PARACHUTIST INFORMATION MANUAL

Part Two C

Advanced Skydiving Skills

May 2004

Draft

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PIM 2 C

ADVANCED SKYDIVING SKILLS

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SECTION 1: PRECISION ACCURACY

PRECISION ACCURACY

The primary purpose of this section is to help you develop your skills at precision accuracy so that you can produce competition scores in the 0 to 16 centimeter range (this far exceeds the CoP requirements). However, a secondary goal relates to increased safety. On each and every jump we must land our canopy and the odds are that in the average skydiving career you will miss the drop zone and have to land in a tight area perhaps behind the trees or close to power lines. The information that is provided in this section would certainly help you in such situations.

The Starting Point

Prior to using these techniques, a jumper should have a B-CoP and be able to:

- Assess winds correctly and select the appropriate set-up point 9 out of 10 times.
- Fly consistent approach patterns.
- Use brakes to maintain angle of approach control.
- Hold to the wind line within plus or minus 1 meter.

Although an A-CoP holder could enter accuracy at Nationals, an athlete without a solid base in the skills listed above will find it rather challenging to apply the following techniques.

Preparation

It is important to be both **physically fit** and **flexible**. These attributes keep you from getting stiff as a result of being cramped in small aircraft and when spending long days packing and jumping. Flexibility also helps to reduce the aches and pains potentially caused by accuracy landings. **Mental preparation** is essential for the accuracy jumper. Every jump should be pre-planned so that only minor adjustments are necessary as the conditions change slightly on the jump. Remember to plan the opening and set up points, assess the winds, gain information by watching other jumpers, etc. In competition an excellent tip is to watch the first few loads.

In-flight

Generally, **spotting** for accuracy is the same as spotting for any low altitude jump. Determine the appropriate spot using wind drifts (paper and human), a rate one turn, and ask the pilot about winds to opening altitude, wind shears etc. You may have a preference for a long or short spot depending upon your canopy type and personal technique. All these factors will be included in your spot selection.

If more than one jumper is exiting per pass, the jumpers will need to stagger their opening altitudes. The canopy with the lowest rate of descent should be last out and the highest opening. Having the faster descending canopy out last will cause traffic problems on approach.

Canopy Control

a) The Set-Up Point

The set up-point is that location in the sky at a certain altitude that is above a chosen spot on the ground from where you will start your final approach to the target. Generally this is the point from which a half-brake approach will land you on the target.

Set-up Point Selection

The ability to select the correct set-up point is gained by experience. It comes from a jump-by-jump assessment of the winds. The two best techniques for assessing the winds involve flying your canopy either "cross wind" or "into the wind". When checking the wind with either of these techniques you should fly at approximately half brakes (the amount that you will use on final approach for angle control) and perform this wind check shortly after opening (approximately 2500 ft). Both techniques described below provide accurate information for that canopy, the observed winds, and that brake setting.

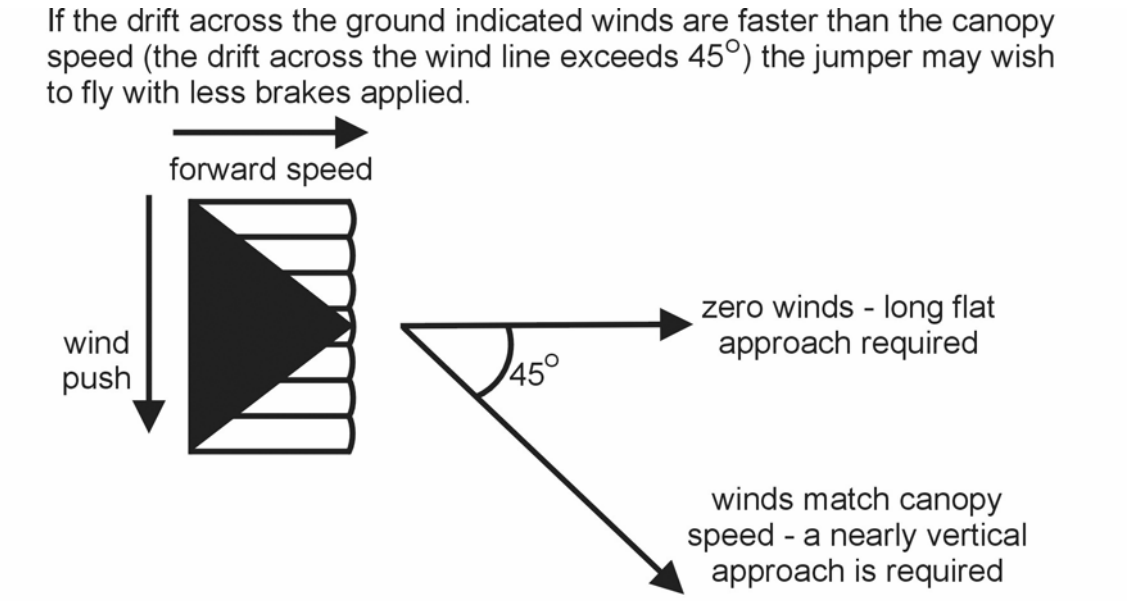
Crosswind

Technique:

- Turn your canopy so that you are 90^0 to the wind line, set 50% brakes, and then observe the drift.

Observation and Analysis:

- The greater the angle off the 90^0 line (the crabbing angle) the stronger the wind.
- If you are flying along the 90^0 line then there are no winds and a long set-up point will be required.
- If your flight angle is at 45^0 then the canopy speed matches the wind speed.
- If the angle is greater than 45^0 it is quite windy and the approach will require less than half brakes.



Benefits	Disadvantages
Provides immediate information	Requires mathematical ability
Re-sampling is easy	If the winds are different at different altitudes, the samples can be misleading

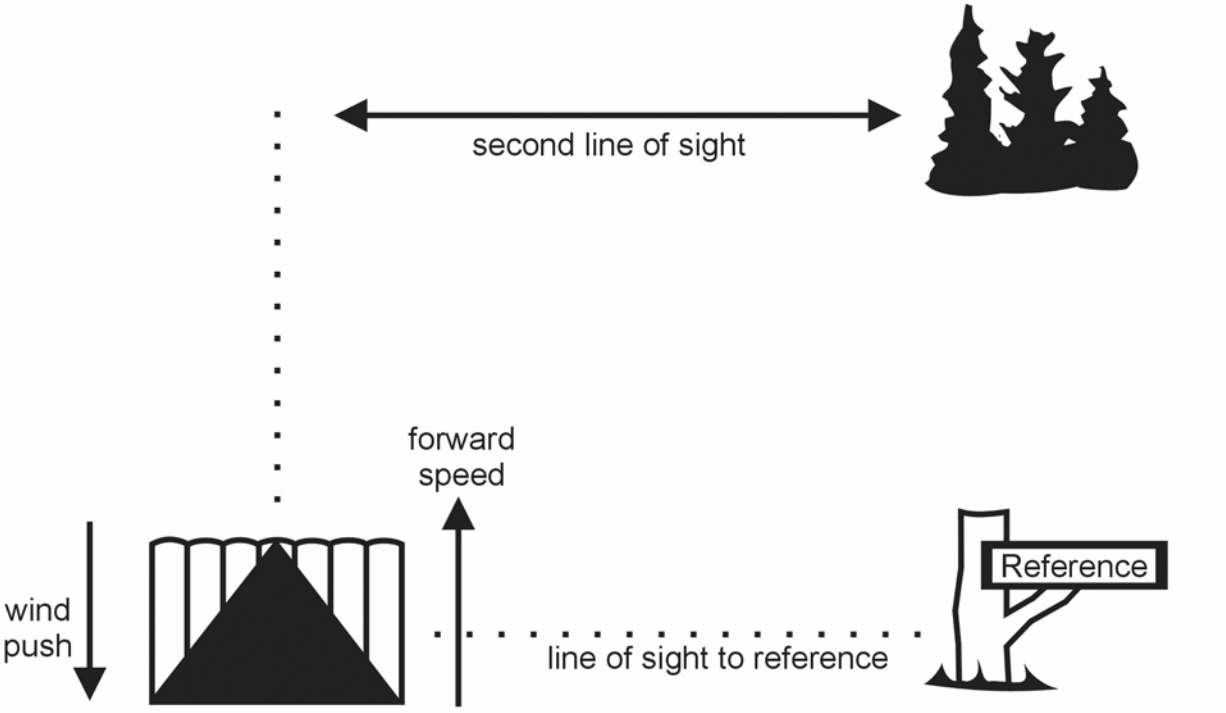
Into the Wind

Technique A:

- Point your canopy into the wind, set 50% brakes, check the altitude, look straight to the side and pick a reference point
- Descend 500 feet (try to gain a feeling for your rate of forward speed during this descent)
- Look straight to the side and note a second reference point

Observation and Analysis:

- Determine the distance traveled between the two reference points
- This distance traveled will equal how far the set up point should be from the target



Benefits	Disadvantages
The sample provides accurate, specific information	The initial sample takes some time (500' of descent)
Re-sampling is easy	If the winds are different at different altitudes, the samples can be misleading

Technique B:

- Point your canopy into the wind, set 75% brakes, look straight down between your legs to the point on the ground directly below you

Observation and Analysis:

- Observe whether you are penetrating the wind, standing still or moving backwards
- If you are penetrating you are in light or medium wind conditions
- If you are holding still or falling back you are in a strong wind condition and caution should be used in not setting up too far behind the target

Benefits	Disadvantages
Gives a quick assessment of conditions with little loss of altitude	Information provided is less specific regarding strengths in medium and light conditions
Can be done close to starting final to better assess lower wind strengths	Requires more practice to assess wind strengths
Re-sampling is easy	Provides less specific information regarding set-up point

Flying to the Set-up Point

This topic is discussed in PIM 2A and B. The basic principle involves flying the "box pattern" to arrive at your set-up point at 500'. If you are above 500 ft when you turn on final, a sashay or an S- turn can be used to lose a little altitude. If you are going to be lower than 500 ft when you turn on final, then 'cutting' the corner will be necessary. You may choose to set-up your final approach at a height lower than 500 feet and will then need to adjust the set-up point proportionately closer to the target.

Summary

Through good wind assessment you will be able to select the ideal set-up point such that you make the turn onto final approach and then have to make minimal corrections to maintain your approach to the bowl.

b) Angle Control On The Glide Slope

Once established at your set-up point, you now need to check the approach continually and make the appropriate minor angle adjustments. Your goal is to maintain a steady or constant angle into the bowl. This angle is referred to as the **glide slope.**

Adjustments to the Glide Slope

Flying the final approach in 50% brakes allows you to compensate for movement off the glide slope. The three scenarios are:

- The disc appears to be moving away from you and the glide slope is becoming shallower. This means that you are going to land "short" i.e. in front of the target because your forward speed is too slow for the chosen angle.
- The disc appears fixed in place with the glide slope remaining constant. Then you will land on the target.

- The disc appears to be moving towards you and the glide slope is becoming steeper. This means that you are going to land "long" i.e. that you will fly over the target and land past it because your forward speed is too fast for the chosen angle.

The obvious solutions to scenarios one and three above are to adjust the brakes appropriately. Use less "brakes" if the disc is moving away and more "brakes" if the disc is moving towards you. You will need to assess the glide slope continuously though you must allow your last input to take affect before you make another change. Rapid changes lead to panic control changes that can be extremely dangerous. In subsequent jumps in the same wind conditions if you find your glide slope is changing in a consistent manner, i.e. it is always becoming either shallower or steeper; you will need to adjust your set up point correspondingly closer or farther away from the target.

Warning - If you apply excessive brakes you will put your canopy into **stall** mode. Prior to stalling a canopy will rock and wobble and it will be difficult to maintain heading control. This is caused by a combination of trapped air underneath the canopy attempting to fill the vacuum above the canopy and decreasing airflow across the top of the canopy. If the pre stall sensations occur momentarily let the steering loops up a few inches. This will smooth out the airflow over the top of the canopy. An excellent score on the pad is not worth it if you cannot walk away from the landing. Stall awareness and recovery should be practiced up high so that you become aware of your canopy's reaction to slow flight and so you will be better able to anticipate these reactions.

Line Control

Although you may be on a perfect glide slope, you may be set up off of the wind line. If this occurs you will notice that you are drifting sideways relative to the wind line. Through minor left or right control inputs re-establish yourself on the wind line. Remember that the glide slope is more important than being slightly off line when close to the target.

Summary

Ideally the final approach should be smooth until landing. You should be continuously reassessing the approach angle, canopy speed, and line control and responding appropriately.

Advanced Techniques

a) Rolling On

This is an advanced accuracy technique that requires that the canopy be flown to a position almost directly above the target at roughly 3 to 10 feet (1 to 3 m). At this point, the forward movement of the canopy has been stopped and it descends virtually straight down in a controlled sink onto the center of the target.

This skill should be developed only after you have mastered the final approach as described above. It is a technique that is suited only to the larger accuracy canopies onto an inflatable pad (tuffet). It is not suitable for either a high aspect-ratio canopy or one that has a relatively small surface area.

The roll-on begins towards the end of the final approach when an altitude of about 50 feet is reached on the glide path. At this point on the glide path (about the last 3 to 5 seconds of the descent), the steering loops are brought slowly down to the 75% brake position. Then, as you come over the lip of the bowl or landing tuffet, the steering loops are moved further down to full brakes, then slightly below that point to achieve a full sink. It is important that the loops are not lowered to the point that the canopy will rock back and stall. When this is done properly the canopy will be seen to slow (without ballooning or flaring) to a point just over the target and then sink down over the dead center.

Keep your feet under you and prepare for a landing on your bum (hence the need for soft pea gravel or a tuffet). Abrupt corrections are not recommended as this can pendulum the body away from the disc.

b) Foot Placement Techniques

When you can fly into the center of the target and land standing with the pad centered just a half-step in front of your feet, it is time to work on your foot placement technique.

The best foot placement is achieved when the heel reaches the target as a result of canopy control and not as a result of a last second torso, leg and foot movements. In other words it is best to fly yourself to the dead center rather than reach for it. The most accurate foot placement is achieved when there is good eye foot coordination. The less one has to move one's torso and legs before contact the greater will be one's ability to accurately aim the heel. The final placement technique involves a movement of approximately 1/2 step ahead and to the center of the body with the heel being rotated slightly inward and the toe raised. Raise the other leg to ensure that your placement foot is the first point of contact. This is the optimal placement technique. The heel can be accurately placed and the landing force can be taken on the buttocks.

The toe can be used when the angle is very steep or you have to reach back to hit the center of the target. The toe is more difficult to aim for an accurate strike. It is important to be wary of large reaches either forward or back as this increases the possibility of injury.

Unusual Situations

a) Thermals

Hot thermally conditions with its rising air and the resulting affect on your descent rate can play havoc with your glide path angle. There is no perfect answer to these challenges. In light wind conditions when an updraft is sensed, consider just flying through it and assessing the affects on your glide path on the other side of the thermal. In stronger thermals apply brakes or consider an "S" turn to maintain your glide angle to the target. In stronger winds and more thermally conditions consider letting up on the steering loops to increase your forward speed, as chances are you will find a downdraft and stronger winds on the other side of the thermal that will reduce your glide path angle. Proper reaction to thermals only comes with experience and then it is coupled with a little luck in choosing the right reaction. The most important thing to remember is that whatever you do you must safeguard yourself against injury on landing. So remember that if your glide path angle is made steeper by the affects of a thermal to the point where you do not have enough time to regain the desired glide path by applying brakes or making 's' turns, simply fly over the target to a safe landing and chalk it up to experience.

b) Cutaways

A cutaway or a minor problem can occur at any time. During a competition, a re-jump will be awarded if a cutaway occurs. If any minor problems occur that do not require a cutaway a re-jump will be granted if you:

- Display a T position; this informs the judges you have a problem. You should occasionally repeat the T position during the descent
- Fly to a safe landing area, or the designated landing area

Key points are to:

- Stay away from the bowl, the judges may score your jump if you land in it.
- Allow the judges the chance to inspect the canopy before fixing the problem.

If a cutaway is necessary:

- Fly to a safe landing area, or the designated landing area
- Do not approach the bowl. The judges may score your jump if you do.
- Allow the judges the chance to inspect the cutaway.

Equipment

a) Harness and Containers

Style and accuracy jumpers often use only one harness and canopy combination for both disciplines. Then you can perform accuracy with your accuracy canopy on every jump.

b) Canopy

The canopy should:

- Provide a slow rate of descent in deep brakes
- Be very stable in all flight modes

- Have a low stall speed

Generally, accuracy canopies have very deep cells (low airspeed high lift airfoils), low aspect ratios, and large stabilizers. The aspect ratio and large stabilizers improve the stability in slow flight (deep brakes). The low speed airfoil allows for extremely slow forward speeds and low rates of descent. This combination of characteristics allows the jumper to approach the target at steep angles and then when nearly over the target apply more brakes (rolling on), and land placing one foot on the "dead" center.

c) Shoes

The accuracy jumper's shoes are an important tool. Shoes with fairly square heels are favored and special shoes are made for the serious accuracy jumper. The shape of the heel allows the jumper to present a small area of contact onto the center of the electronic pad.

Training Program

The following 60-jump program is recommended.

STAGE 1: Wind line control (10 Jumps)

Goals:	• Correctly assess the winds • Perform flat turns to final approach • Remain within 10 degrees of the wind line • Use a braked approach • Be within 2 feet left or right of wind line 4 out of 5 times
Drills:	On 10 jumps • Stall recovery 2-3 times per jump (above 2000 ft) • Simulated setup and final approach from 1300 – 1000 ft
Key Points	• Train both left and right hand patterns • Monitor the consistency of the set up point

STAGE 2: Angle Control (10 Jumps)

Goals:	• Maintain standards from stage one • Use smooth adjustments to stay on wind line and glide slope • Use no flare landing techniques to within a 2 foot radius of the target 4 out of 5 times
Drills:	On 10 jumps • A minimum of one deep braked flight to stall recovery per jump (above 1500 ft) • Simulated setup and final approach from 1500 – 1000 ft • An angle controlled "braked approach" to a landing without stalling
Key Points	• Train both left and right hand patterns • Monitor the consistency of the set-up point selection • You should be selecting set up points for each specific wind condition

STAGE 3: Rolling On (20 Jumps)

Goals:	• Maintain standards of previous stages • Use a braked approach to rolling on from a height of 3- 10 feet • Be 1 foot left or right of the wind line and on the glide slope 4 out of 5 times
Drills:	On 20 jumps • A minimum of one deep braked flight to stall recovery per jump (above 1500 ft) • Simulated setup and final approach from 1500 – 1000 ft • An angle controlled "braked approach" to a landing without stalling
Key Points	• You will need to take the landing force across the buttocks • There are opportunities to work on foot placement • Remember - do not reach for the target (injury prevention)

STAGE 4: Foot placement (20 Jumps)

Goals:	• Maintain standards of previous stages • Use a braked approach to rolling on from a height of 3- 10 feet • Be 1 foot left or right of the wind line and on the glide slope 4 out of 5 times.
Drills:	On 20 jumps • Ground drill – from a chair or hanging harness practice ‘strikes’ on a practice accuracy pad. Use 4 sets of 10 repetitions prior to each jump • A minimum of one deep braked flight to stall recovery per jump (above 1000 ft) • Simulated setup and final approach from 1300 – 1000 ft • A braked approach to land without stalling
Key Points	• You will need to take the landing force across the buttocks • Remember - do not reach for the target (injury prevention)

Summary

Wind line control and angle control will generally chain and /or shape (Coach 2) into each other easily but the effort to refine the separate components will pay big dividends in the long run. As an individual, you will have different needs and goals when training. A coach will help you to set realistic goals and monitor your progress. The higher your performance goal, the more intense and lengthy your program would need to be. Rest assured that you will notice a significant improvement in your skills by applying this program

Paraski - Side Hill and Mountain Accuracy

One of the most exciting accuracy competitions is held as a part of a Paraski competition. Accuracy jumps at these events may be held at the actual ski hill in the mountains. In Paraski you will have to contend with unusual visuals and wind effects.

a) Visual Effects:

In Paraski, your exits may be lower than the mountain peaks. Under canopy the sloped horizon will seriously affect your normal frames of reference influencing your perception of height. Typical scenarios are presented below.

Facing into the hill

- Using the ground straight underneath you as reference can result in a low set up
- Using the mountain in front of you as reference can result in a high set up
- During a good set up, the rising slope will enhance "ground rush". The approach feels like it is being flown too quickly. This can result in high and low approaches and high flares.

Facing down the hill

- The turn onto final approach will feel uncomfortably low, resulting in a high set up. Note: the ground under the jumper is closer than the altimeter set on the bowl indicates
- When flying down the changing slope the ground rush will affect your assessment of the glide slope. Usually you will end up high over the target.

Facing across the hill

- The mountain rising up on one side will feel uncomfortable. You will tend to set up slightly downhill and /or slightly high.

b) Winds

Winds in the mountains are primarily a response of the sun heating the earth. As the air heats up the winds will blow up the mountain. As evening approaches the winds will shift and run down the hill. This sounds strange as we are discussing winter jumps but a few degrees in temperature change will cause this thermal activity. Winds blowing up the hill can slow your canopy's descent. Winds blowing down the hill tend to shorten the descent.

As discussed in PIM 2, **turbulence** can be a problem any time air moves along the ground. The fact that the ground is sloped can have some interesting effects. The shape of the terrain can dramatically affect the winds and hence your canopy.

A bench or plateau can cause a rotor (turbulence) downwind of the obstacle. If the slope is shaped like the inside of a bowl the winds flowing up the slope are channeled and increases the lift/force from the thermal activity. If the bowl is turned over (outside up) the winds hit the slope and tend to be somewhat dissipated. It is strongly suggested that in all accuracy competitions you observe the first few loads to watch for thermals and turbulence. This is particularly important when jumping in the mountains.

Most jumpers will find that landing "across the hill" makes the selection of the set up point and judging the glide slope the easiest. Be wary of the tendency to set up too high or on the down hill side. Visually and mentally isolate a 20 – 30 foot band perpendicular to the slope. As you begin to fly the pattern in for landing, allow your eyes and mind to only accept information from that band. Ignore the visual cues being received in your peripheral vision. If the winds are flowing up the hill set up slightly on the uphill side and fly an approach 10 – 20 degrees across and down the hill. The approach may need to be shortened slightly to allow for the fact that some of the canopies forward speed is being used to crab against the winds.

When landing in snow remember to prepare for a PLF. Crusty snow can present a hazard being either harder than expected or slippery making it a challenge to stand up on it. If the crust breaks, your feet can be trapped resulting in any injury if you fall.

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SECTION 2: SPEED STYLE

SPEED STYLE

The goal of the techniques described in this section is to help you develop your skills at speed style so that you can produce times in the 6 to 10 second range (this far exceeds the CoP requirements). Speed style is a competitive discipline in which the jumper executes a series of turns and back loops in freefall (a style set) as fast as possible. For errors in the performance, the judges add time penalties.

The Starting Point

Prior to using these techniques, a jumper should have a B CoP and be able to:

- Maintain good control of their body position during front loops, back loops, and barrel rolls
- Complete 4 to 6 manoeuvres from 9,000 ft. using smooth transitions.

It should be noted that an athlete with an A CoP could enter the speed style event at the Nationals. An athlete without a solid base in the skills listed above will find the transition to the style tuck challenging.

Note: The term style will be used for speed style from now on.

Preparation Skills

It is important to be both physically fit and flexible. It keeps you from getting stiff from being cramped in small aircraft and tucked into a tight ball in freefall, and when spending long days packing and jumping. Flexibility also helps to reduce the aches and pains from opening shock and precision accuracy - a competitively parallel discipline to style - landings. Mental preparation is also important. To perform the high-speed manoeuvres required in style, you will need to be thoroughly rehearsed and have a relaxed yet alert mental state.

In-flight

a) Downwind Spotting

Style is judged from the ground and a downwind jump run is used. This reduces the effects of forward throw from the aircraft and freefall drift and negates the need for the camera operator to "go over the top" when tracking the jumper on jump run. Additionally you exit facing the target heading and do not have to make an 180^0 turn once out of the plane.

At competitions the judges will provide a briefing about exit signals. This co-ordination helps ensure the jumper is in the best position to be judged. The exit point is approximately 70 degrees from the horizontal as viewed from the target heading.

b) Exits

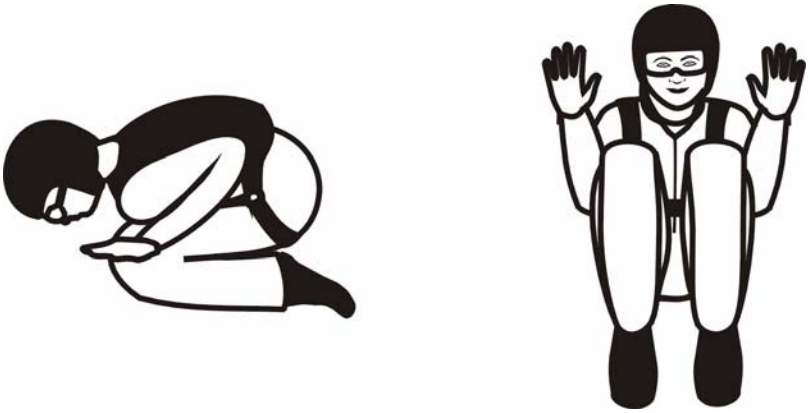
When leaving the plane your exit body position should allow:

- You to maintain visual contact with the target heading
- For a smooth transition into the tuck position i.e. stable and on heading 1-2 seconds after exit
- For minor adaptation for use with various aircraft

Once you can maintain a tight controlled tuck through a full style set, you can add a dive or steep delta prior to tucking. The intent is to carry the extra speed into the style tuck which can be used to generate greater force, higher impulse, and hence larger changes in velocity for the turns and loops.

Free Fall

a) The Fast Fall Tuck Position



The tuck is the set up position for the execution of turns and loops and as such is learned first. It is used for the following reasons:

- In the tuck position you are minimizing your body length and raising your centre of gravity. The principle of stability from Coach 1 tells us that "the lower the centre of gravity and the wider the base of support, … the more stable the athlete". So the style tuck can be seen as a semi-stable position in which it is much easier to initiate and to stop turns and back loops than if you were in the stable spread or a "box" position.
- While in a flat attitude, the tuck creates a small surface area, which allows for a higher downward velocity than that of a stable spread position. The high rate of descent increases the amount of air pressure or force on the control surfaces. Thus at higher speed the same movement generates more force, increases the amount of impulse - change of velocity - available for manoeuvres, and produces faster turns and loops. (Principle of Impulse - Coach 1)
- When you shorten your overall length by tucking up, faster rotations are possible. When a body's total mass is closer to the centre of the rotation the application of torque can overcome the body's inertia much more easily. (Principles of Torque and Angular Momentum - Coach 2)

The combining the higher speed, easier initiation and stopping capabilities with the increase in rotational speed, it becomes obvious why the tuck position is the foundation on which stylists build their sets. The tuck must be maintained not only through each turn and loop, but also during the transitions from one manoeuvre to another.

Note: Learning to maintain the style tuck is the single most important task for you to learn when beginning speed style.

To get an idea of what the tuck feels like, kneel with your shins flat on the floor, bring your chest down to your thighs and try to put your neck between your knees. Your hands will be up by your shoulders with your arms against your sides, there you have it. Shins parallel to the relative wind. Torso parallel to your shins. Toes pointed. Arms and hand close to the body. Chin stuck out. Balanced on the air. It will take some muscle control to attain the position. Once a balanced, tight, tuck is attained the wind force will support the position.

In the air you may feel:

- A higher wind force and sound from the higher airspeed
- That you are slightly head high
- That the wind seems to be only hitting your shins, hands, feet and face.

As your legs are breaking the wind you don't feel it hitting your chest. Your legs are close together, not quite touching but a few inches apart. If your legs are too close together you will feel as if you are tipping over in the air. If they are too far apart then you will actually fall slower than if you were in a stable spread, as your torso will be cupping air and slowing you down. Air speed and pitch vary with the tightness of the tuck. The perfect tuck is a balance between all these factors.

The transition into the tuck must be performed quickly. Key points are:

- keep your arms wide for balance
- snap your legs up towards your chest (identical to a conventional back loop initiation)
- counter the backwards rotation by pushing your chest down
- tuck your elbows against your sides

As experience is gained tucking the elbows against the sides can be performed simultaneously with the leg movement. Going from a dynamic exit immediately into a style tuck is a really fun move. Keep the arms wide to fly the exit.

b) Turns

Notes: The following technique is one approach to causing rotational momentum. Personal refinements and differences due to body size and strength are to be expected. The phrase "Turn Hand" refers to the hand in the direction of the turn while the opposite hand is the "Trailing Hand".

The principle of start - coast - stop applies in high performance turns the same as it does to flat turns. As experience is gained more/longer initiations (impulses) may be applied.

Start:

- To start a turn, your turn hand is moved slightly from the balanced tuck position - only slightly - down and out into the relative wind and away from the body. The palm of your hand remains flat on the relative wind with the fingers spread. Keeping your elbow close to your body, will reduce reaching, and help maintain a tight tuck during the turn. This is the force producing action that causes the rotation.

- As the turn hand moves down and out, the trailing hand follows through into the area of your face. You may notice that your trailing hand wavers a bit. With your legs up under you, your trailing hand will be helping you keep your balance while your turn hand is doing the work
- The shift of the hands will make you feel as if you might go off balance. You might want to spread out to regain your balance. To counteract this, just as you begin to move your hands, try to squeeze your body into an even tighter tuck. Try to get even smaller than you thought possible. Chest down - legs up. Another possibility is that you might 'forget' to control your legs, so focus on the overall position.

Coast

- You do not have to hold the initiation for really any longer than it takes to get the turn going. Once you are a quarter to a third of the way into the turn, you can return to the neutral tuck position and get ready to apply the "brakes".

Stop

- When you are about three-quarters of the way through the turn or just as the target heading is coming into your peripheral vision, squeeze the tuck and start a turn in the other direction. Return your hands to neutral, confirm the heading, and prepare for the next manoeuvre. Timing is important, as you want to stop the turn on the original heading and return to neutral at the same time.

Notes: Variations in air speeds caused by changes in pitch and changing surface area results in inconsistent turns. If your turn speeds are inconsistent confirm the tightness of the tuck. Some jumpers' find that turning the head to look into the turn can cause side-to-side wobbles.

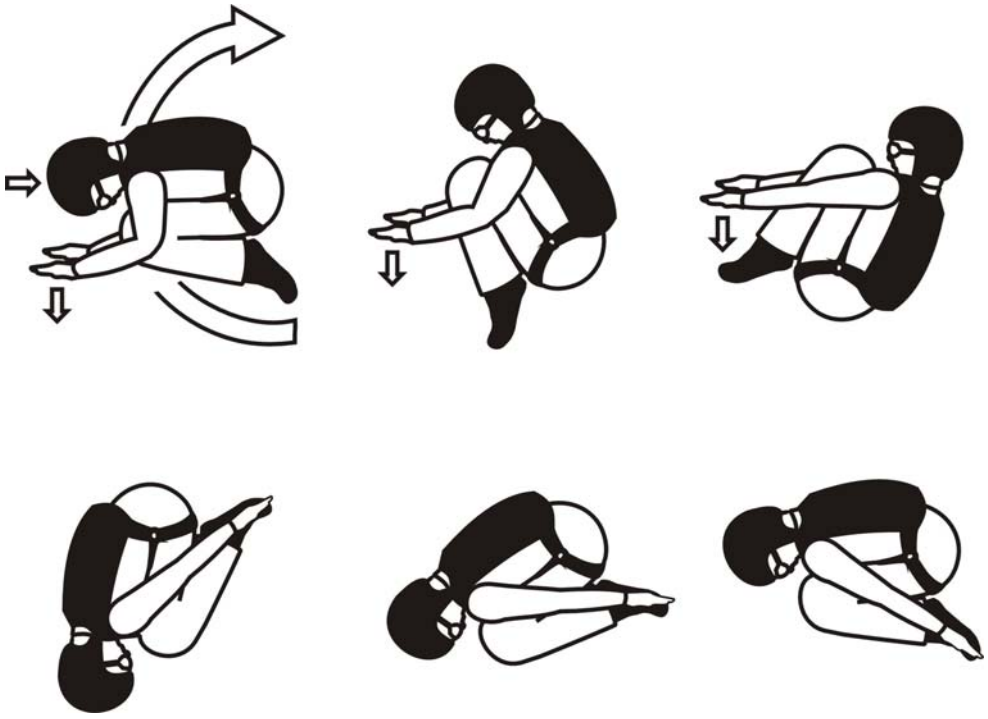
c) Back Loops

Once figure eight's (turns in alternating directions) can be performed smoothly, on heading, while maintaining a good tight tuck you are ready to perform loops. The loops you were taught as a student are similar to the style loop in that you flip over backwards. You don't put your head back and you don't use your legs. You simply fall over backwards.

The back loop, like the turn, is broken down into the three phases start - coast - stop:

Start

- The initiation of a back loop is fairly simple only requiring two movements. Shift your hands from the neutral position to a position much like doing a push-up. Later in training this move is done just as the turn comes to a stop. As you push down with your hands, squeeze the tuck, draw your head in and try to get your face behind your knees. The torque produced by your hands will rotate you backwards.



Coast

- Once the rotation of the loop has started, you will feel as if you are falling over backwards with no effort at all. By continuing to push down and through with your hands more impulse can be applied to the loop. Push with your hands so that the palms stay on the relative wind. As you rotate through the loop, your hands will end up next to your feet.

Stop (a.k.a. the catch)

- Approximately 3/4's of the way through the loop your hands will be next to your feet. As you begin to see the ground again, rotate your wrists outward. The palms of your hands will be once again flat on the relative wind but still next to your feet. This drag / torque

will stop the loop by trying to pitch you forward. As the loop stops, quickly move your hands back into the neutral tuck position.

Canopy Control

Even though you will be exiting the aircraft by yourself, you are seldom really alone. Some key points to remember are

- Obey all the normal canopy landing rules
- Open at your planned altitude
- After opening move to the side of the jump allowing the next person to be seen by the video

Equipment

a) Harness and Container

As most style jumpers are also accuracy jumpers using only one harness and canopy combination is recommended for both style and accuracy. This allows you to practice your accuracy on every jump. The harness and container system should:

- Fit snugly and not shift during free fall
- Not restrict body movements
- Be centred on your axis of rotation
- Be no wider or longer than your back

b) Canopy Characteristics

As most style jumpers are also accuracy jumpers, the characteristics of your style canopy will be dictated by your accuracy requirements. However, as a stylist you may open your canopy at speeds approaching 160 mph. When possible relax the arch, allow time to decelerate, and then open. Packing techniques can be modified for slower openings. Some accuracy canopies are equipped with Pilot chute controlled Reefing System (PRS or spider slider). This system gives very consistent and controlled openings but is extremely bulky, requires high maintenance and also requires having your container modified.

c) Jump suit

A jump suit should:

- Fit snugly and be non-restrictive
- Be a dark colour so that you are easily visible on video

It is not recommended to have a stripe running down your sides or legs as this can give the judges the mistaken idea that you are inclined during a turn.

Training Program

A style coach will help you to establish a training program appropriate to your performance goals. The higher your goals the more intense the program will need to be. The following program is 135 jumps performed from 7200 ft - the exit altitude for competition. After this program you could reasonably expect to perform style sets in the 8 to 10 second range. A medal at the Nationals should also be attainable.

STAGE 1 – Fall Away (20 Jumps)

Goals:	• Smooth transition from the exit to the tuck • Maintain the tuck at full speed for 20+ seconds • Maintain heading plus or minus 5 degrees
Drills:	On the first 10 jumps • Tuck for the whole jump On the next 10 jumps • Tuck - Spread - Tuck
Key Points	• Each time you tuck, do a quick scan to see that everything is in the proper place

STAGE 2 – Turns (20 Jumps)

Goals:	• Maintain a tight body position during the turns • Stop the turns within plus or minus 5 degrees • 360-degree rotations in 2.5 seconds or less
Drills:	On the first 10 jumps • Left turns On the next 10 jumps • Right turns
Key Points	• Start off by trying to do intentionally slow turns to imprint the proper signals and sensations on your subconscious. • Starting with slower turns will allow you time to be precise, get ready for the next move, and 'feel the rhythm' of the set. • Hitting headings not only eliminates penalties; it increases the speed of the set. Do each manoeuvre properly and you won't have to slow down or stop to correct mistakes.

STAGE 3 – Figure Eight's (20 Jumps)

Goals:	• Control of your body position while meeting the previous turn standards • No under shoots: use a combination of the first turns counter and the second turns initiation • A hard stop returning to neutral at end of the set, • Combined times of between 3 and 5 seconds
Drills:	On the first 10 jumps • Left turn - Right turn On the next 10 jumps • Right turn - Left turn
Key Points	• Train both Left turn - Right turn and Right turn - Left turn combinations. Perform all ten jumps then switch. • Monitor the consistency in execution of manoeuvres.

STAGE 4 – Loops (5 Jumps)

Goals:	• Maintain control of your body position • Minimize any “pitch up” or follow through • Monitor your body position at the end of the loop • Rotations in 1-2 seconds.
Drills:	• Stable Loop
Key Points	• Start off by trying to do intentionally slow loops to imprint the proper signals and sensations on your subconscious.

STAGE 5 – Turn / Loop Transitions (20 Jumps)

Goals:	• Transition from the turn to the loop with a minimal pause to check the heading • No deviations or pitch ups during the loop • Return to a neutral body position after completing the loop • 2.5 – 4.5 second “sets”
Drills:	On the first 10 jumps • Left turn - Loop On the next 10 jumps • Right turn - Loop
Key Points	•

STAGE 6 – Turn / Loop / Turn Transitions (20 Jumps)

Goals:	• Smooth transitions • 4-6 second sets
Drills:	• Right turn / loop / left turn, 5 jumps • Left turn / loop / right turn, 5 jumps • Right turn / loop / right turn, 5 jumps • Left turn / loop / left turn, 5 jumps
Key Points	• Monitor the consistency of all the combinations. • You should be equally skilled with all combinations.

STAGE 7 – Turn / Turn / Loop - The Half Set (10 Jumps)

Goals:	• Maintain all standards • 4 to 5 second sets
Drills:	• Left turn / right turn / loop, 5 jumps • Right turn / left turn / loop, 5 jumps
Key Points	• Monitor the consistency of all the combinations. • You should be equally skilled with all combinations.

STAGE 8 – Full Sets (20 Jumps)

Goals:	• Maintain all standards • 8 to 10 second sets
Drills:	• Left cross, 5 jumps • Right cross, 5 jumps • Left series, 5 jumps • Right series, 5 jumps
Key Points	• Monitor the consistency of all the combinations. • You should be equally skilled with all combinations.

Problem Solving

It is imperative to have someone else look at your video. Look for the obvious first and correct the problem not the symptom. As much as you can, keep your training sessions as positive as possible. Remember to reward yourself for progress. Look for achievements, problems and patterns (strongest and weakest sets). Analyse your sets for time and penalties and then look for patterns in the types of penalties received. After identifying any specific skills or transitions that are weak repeat that portion of the training program.

Here are just some of the many things you may experience as you train with the probable cause and possible solutions:

WHAT IS OCCURING	CAUSES	SOLUTIONS
• Pitching up to look for heading	• the chest getting away from legs	• spread the legs for balance
• Loosing balance	• too much trailing hand • pushing too hard / too much movement	• refine placement of the turn hand • do less
• Throwing trailing hand (too wide)	• too physical • elbow getting out	• do less • tuck it in
• Leaning into turns	• shoulder ahead of knees • looking into turn too hard	• pull knees to chest • do less
• Feet washing to side	• low muscle tension in legs	• press heels against bum
• Excessive head movement	• looking in direction of turn / searching for heading	• turn head to a comfortable angle, be patient.
• Head high attitude	• hands too far in front / down	• adjust
• Head low attitude	• legs out behind	• roll stomach muscles tighter
• Rolling loop	• not stopping turn • off balance initiation	• ensure turn stops and returns to neutral. • check arms motion
• Legs not symmetrical	• subconsciously turning / balancing with the legs	• clench tighter
• Arrows	• rushing out of loop • not catching loop	• reassess decision point for catch
• Loosing legs out of loop	• no squeeze into and / or out of loop • using legs to stop loop	• physical rehearsal • clench knees to chest
• Undershoots	• timing • initiating next turn too soon	• reassess decision point for turn • counter / initiate
• Overshoots	• timing	• reassess decision point for turn • counter harder
• Pitch up out of loop / inclining 3rd turn	• catch late • catch weak	• reassess decision point for catch • press harder from shoulders

You may find throughout your training that you will return to practising a simple basic move. This will be necessary if you find a problem or bad habit creeping into your style. Reinforcing basic techniques is never wasting a jump. Too many stylists make the mistake of pushing too hard and trying to go too fast, too soon. As Ralph Waldo Emerson said, "Simplify, Simplify". If you feel as if a set is a struggle and you are so busy doing one manoeuvre that you haven't got time to think of the next, you are doing too much, possibly too fast.

Simply put:

Maximum Technique + Minimum Movement - Problems = Minimum Time

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SECTION 3: INTRODUCTION TO SKYSURFING

INTRODUCTION TO SKYSURFING

The purpose of this section is to help you to develop the skills required to begin skysurfing, which has been recognized as a skydiving discipline since February 1992. The program presented here outlines nine stages that must be accomplished prior to your first skysurfing jump.

The Starting Point

Prior to this training program, a jumper should have a

- "C" CoP
- Minimum of 250 jumps of which 100 are freestyle.

Although a "C" CoP holder, the skysurfer must start anew, effectively taking a trip back to student status, and this deserves the same attention as a FJC. Before jumping a board, it is imperative to master some control techniques, via freestyle. In fact the freestyle basic moves are very similar to skysurfing moves. Freestyle will allow you to acquire power, balance and coordination and it provides a good knowledge of the effects of centrifugal force.

In addition you will need to possess a minimum technical knowledge of this new discipline especially with respect to equipment and safety rules.

Recommended Equipment:

- Webbed gloves
- Sit suit or freestyle suit
- AAD mandatory
- Audible altimeter
- No RSL
- No ultra-high performance canopy (at least for the first few jumps)

Training Program

Each of these stages may require more than one jump. Before progressing to the next stage your performance should be at the 90% level. Each jump should be done from as high as possible

STAGE 1: Sit Flying

Goals:	• Smooth transition to the sit position • Good position (self-awareness) • Clean execution of all maneuvers
In plane:	• Mental review and concentration • Review binding (surf) procedure
Drills:	• Stable position • Move forward and backward • Slow and fast fall
Under canopy:	• Execute a surf cutaway simulation.
Key points:	• Stable Position – arms extended and wide spread (medium fall). The back and legs are vertical • Move Forward – move the feet forward while trying to keep the same fall rate (medium) • Backward – while in the sit position, move the legs backward (from the knee down) • Slow Fall – from the sit position, move legs forward and lower the back on the wind. The moves in slow fall are the same as in medium fall • Fast Fall – unfold the legs at the knee. The back and the lower legs must be vertical in order to move • Regular altitude checks

STAGE 2: Stand Up Flying

Goals:	• Stable exit • Maintain heading • Maintain a stable stand up position without loss of control for at least 15-second stretches
In plane:	• Mental review and concentration • Review of binding procedure
Drills:	• Master a good sit exit, then assume the stand up position and maintain it for at least 15 seconds • Visualize your position • Perform regular altitude checks
Under canopy:	• Perform a surfboard cutaway procedure simulation

Key points:	• Position – upper body in line with hips. Legs are stretched and together. • Control – keep torso straight, keep arms wide apart (cross) and higher than shoulders to balance the body • Keeping the eyes on the horizon will help maintain a straight position and prevent shoulder movement. Be sure to have straight legs, otherwise, you could flip and loose control. • The stand up position is difficult because only one imperfection can affect your balance and provoke a loss of control.

STAGE 3: Back Flying

Goals:	• Lying on your back, lose control and recover stability on your back. (This position is used when loss of control occurs with the board.)
In plane:	• Mental review and concentration • Review of binding procedure
Drills:	• Master a good sit exit • Assume back to earth position • Visualize your position • Regular altitude checks
Under canopy	• Perform a surfboard cutaway procedure simulation
Key points:	• To start the loss of control, move your arms in an asymmetrical position. A high rotation speed will result. Move arms in opposite direction to stop the rotation.

STAGE 4: Sit to Stand Transition

Goals:	• To smoothly alternate between the sit flying and stand up position
In plane:	• Mental review and concentration • Review of binding procedure
Drills:	• Get into a good sit exit • Assume the back to earth position • Visualize the transition between the positions (sit/stand) • Perform regular altitude checks
Under canopy:	• Perform a surfboard cutaway procedure simulation
Key points:	• Assume a good sit position - arms horizontal and stretched. Legs and back vertical. • Push back and de-arch the upper torso and assume the stand up. • Upper body straight with hips and legs straight and together. • Back to sit position. • This is a useful exercise to climb back on the board

STAGE 5: Daffy (lateral spread)

Goals:	• Execute a Daffy and maintain the position for at least 15 seconds
In plane:	• Mental review and concentration • Review of binding procedure
Drills:	• Get into a good sit exit • Stand up and do the Daffy • Visualize the position • Perform regular altitude checks
Under canopy:	• Perform a surfboard cutaway procedure simulation
Key points:	• Legs very straight, one in front of the other in back, with at least 90-degree angle, of course 180 degrees if possible. • Rest on your arms, as in stand up. • Practice the move on the ground. • This position will be helpful to recover after looping with the board.

STAGE 6: Daffy from Back to Earth Position

Goals:	• Do a Daffy from the back to Earth position
In plane:	• Mental review and concentration • Review of binding procedure
Drills:	• Get into a good sit position • Assume back to earth position then go into the Daffy • Visualize the push to come back into the Daffy • Perform regular altitude check
Under canopy:	• Perform a surfboard cutaway procedure simulation
Key points:	• Start from back position • Then push on the air with the arms and use a good back arch, assume the Daffy position. • Return to back to Earth position and repeat the exercise. • This exercise will help you to come forward on top of the surf.

STAGE: 7 Stand Up Flight with Back Layout

Goals:	• Perform the back layout from the stand up position • Repeat the exercise
In plane:	• Mental review and concentration • Review of binding procedure to take it off before exit
Drills:	• Perform a good sit exit • Stand up and do the layouts • Visualize your position during the turns • Regular altitude checks
Under canopy:	• Perform a surfboard cutaway procedure simulation
Key points:	• Position: The torso and legs are very straight for the whole dive. The

	loop starts and comes back in the same position and on heading. • Action: To start the back loop, move the legs slightly forward, push with the arms and kick the head back. Keep a straight position during the loop. The arms push on the air to start the rotation. To stop it, when the legs begin to move down and the head moves up, move the arms back of the hips and push on the air to keep the motion and then stop the body in the desired position. • It is important to maintain the torso as straight as possible when the legs are downward. A bend at the hips will stop you momentarily. Use the arms to keep the axis of rotation during the loop. A light arch of the back makes a nicer figure. • This maneuver is useful to recover to standing up on the board.

STAGE 8: Stand Up Flight with Front Layout

Goals:	• Perform the front layout from the stand up position • Repeat the exercise
In plane:	• Mental review and concentration • Review of binding procedure, then take it off before exit
Drills:	• Perform a good sit exit • Stand up and do the layouts • Visualize your position during the turns • Regular altitude checks
Under canopy:	• Perform a surfboard cutaway procedure simulation
Key points:	• Position: The torso and legs are very straight for the whole dive. The loop starts and comes back in the same position and on heading. • Control: When the torso is vertical and head down the arms are close to the body and with the wind to keep the momentum while the legs start to move down against the wind. The arms keep on moving in a circle, in reverse while pushing the wind towards the hips when the torso is position downward (head down), as to allow the legs to move upward and perform another loop if desired. • The move of the arms is more vigorous than a normal front loop due to the increase in resistance on the stretched legs. It is important to keep the head straight and not lift the shoulders when the torso is moving forward to start the loop. Think to direct the rotation with the heels and follow with the chest to help maintain a straight body. • The front layout is a bit more difficult to do than the back layout because it is more difficult to initiate and follow through

STAGE 9: Stand Up Flight with Back Layout into a Daffy

Goals:	• Execute the move and back into the Daffy position • Repeat the exercise
In plane:	• Mental review and concentration • Review of binding procedure, then take it off before exit
Drills:	• Perform a good sit exit • Stand up and do the back layouts to Daffy • Visualize your position during the turn but most importantly, stop in the Daffy position • Regular altitude checks
Under canopy:	• Perform a surfboard cutaway procedure simulation
Key points:	• To start the back loop, move legs forward (just a bit) then push with the arms and move the head backward (keep straight position). The arms move in a circular motion relative to the body, while pushing to help the rotation. • To stop the rotation when the legs begin to move downward, initiate a split with the legs. While keeping the legs straight, move one forward and the other backward with at least 90 degrees (preferably 180 degrees). You need to push the legs in opposite directions then spread the legs, slow with the arms while pushing downward and back of the hips against the air to maintain the rotation and then stop the body in the desired position. • It is important to maintain the torso as straight as possible while the legs are downward. Bend the hips and stop momentarily. Use the arms to keep a good axis of rotation. A slight arch of the back will do a nicer figure. • This move will help to come back standing up on the board after a backwards loop

Theoretical Preparation

Aerodynamics

A skydiver can be represented (schematically) as two surfaces, front and back. A skysurfer might be represented as four surfaces - front, back for the skydiver, superior and inferior for the board. The aerodynamic equilibrium is obtained when the body has an efficiency equal to the board.

Rotations

A very high speed of rotation can be attained during the layouts. The move is physically bearable if the center of rotation is near the center of gravity (approximately the diver's bellybutton).

Physical Danger
When the skysurfer loses the control of a rotation, the axis of rotation is moving toward the feet. In doing so, the head is now making large circles around the board. The centrifugal force becomes so that the blood flow to the brain can induce loss of consciousness. In the case of a spin, an added weight to the feet (one kilo for one rev/sec) will be felt to the diver. The centrifugal force stretches the legs and prevents precise movements.

Typical Positions

Face to Earth
During the first jumps, the face to earth position, folded legs, with the surf on the butt is felt to be a safe position. It allows for an opening other than standing up, without having to cut away the surf. The augmentation of the board size and the reducing of the suit won't permit safe face to earth openings. Before opening, face to earth, one needs to TPCT to diminish the risk of head down opening.

Sit Position
Real security, stable balance, center of gravity below the center of push; it allows surf control by pitch change and modifies the rotations with leg push.

Stand Up Position
Unstable balance, center of gravity higher than center of push

Track Position
Allows forward move. Bend the chest forwards until parallel to the board, as if in a biplane. In the beginning of skysurfing, while bending the chest the skysurfer will, in order:

- Move backward because of forward push increase
- 'Lift' because of the augmentation of surfaces
- Move forward. The vertical speed varies relative of pitch degree.

In the Plane

The equipment demands more effort than in a surf-less jump. Shortness of breath and sickness can happen rapidly, especially at 13,500 ft. of altitude. The lack of space in the aircraft to put the equipment on and the positions in freefall means that the knees are stressed more than usual. The risk of knee problems or ligament problems is augmented by the lack of flexibility of the bindings.

Openings

With the use of a smaller board at the beginning, the opening shock might be stronger, mainly due to the higher falling speed.

The Cutaway

In the case of a surfboard cutaway, in freefall, you must beware of the risk of collision with the board and protect your head. In every case, a safety device is mandatory; there is no special case. The bindings do not give way when over stressed or in a torsion situation like they do on in skis, therefore, there is more risk in freefall and when landing. As a new skysurfer you should test your mobility on the ground, study your moves and the restraints before the jump, find your limits and not neglect physical preparation, warm up and stretching.

Line Twists

One cannot run or move your legs with a board. First, cutaway the board b efore getting involved with severe line twists that would also require a canopy cutaway. The more experienced skysurfer will disengage the back foot first and will work on the twists with the surf hooked to one foot.

The Jump

Goals:	• To open in a stable position • Have minimum instability time • Learn the basic surf position
On the ground	• Exercise with the equipment and practice surfboard control, do repetition both at the mock-up and at the plane • Power and balance exercises - jump in place with the board • Flexibility testing - be aware of the weight of the board • Opening training, standing or face down • Surf cutaway and main canopy training • Always inform the pilot of the skysurfer's presence and needs • Adjust audible altimeter to 5,000 ft.
In plane:	• Concentration and mental review • Keep your energy for the surf binding • Determine the time needed to put the surf on • Get ready early so as to catch your breath before exit • Beware of knee and ankle torsion
Drills:	• Play with your position
Under canopy:	• First, cutaway the board • Put the cable in your pants or suit • Take off webbed gloves • Loosen the bindings at 1,000 ft.
Key points:	• Open face to earth, bending forward will reduce opening shock. Otherwise, open standing up • On landing - get rid of the board in the last 50 meters • No severe turns on final

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SECTION 4: CAMERA FLYING

CAMERA FLYING

Camera flying (still and / or video) can be a very rewarding experience. It gives you a chance to document the performances of others, provide lasting memories for all levels of jumpers, and when filming tandems and PFFs it can supplement your skydiving income. Video flyers are now part of any competitive team. Even though you may not receive money from the team, your slot is covered and you are certainly an integral member of the team. If you like to travel, camera flying can help you introduce yourself to others and provide some income on the road.

However, Camera flying is not for everyone. Regular skydiving has its inherent risks. Adding several pounds of weight to your head, a suit with wings, a sight that may interfere with your vision, filming other skydivers who may forget that you are there on opening, and personally losing track of time when filming are some of the added risks that have to be taken into account. Before strapping a camera to your head you really must be a proficient skydiver, adept with your emergency procedures and able to fly with others both in freefall and under canopy.

The Starting Point

Prior to filming a skydive, a jumper should have:

- a “C” CoP
- very good relative work skills
- good diving and floater tracking skills
- good canopy skills

This high experience level is recommended to both increase the chances of success and minimize the risks involved.

Preparation

Before your first camera jump you should

- Find an experienced camera flyer (200+ video jumps) to mentor you in the basics of camera flying. Have the experienced camera flyer look over your complete set-up. This should include: camera helmet set-up, snag points, camera suit, special emergency procedures and camera controls.
- Read as many articles as you can on the art of camera flying. You will find these in skydiving publications such as Canpara, Parachutist, and Skydiving.
- If using a new winged camera suit, make several jumps in the suit without wearing a camera on your head. Do several practice pulls to familiarize yourself with any differences the suit will make.

For all camera jumps you should

- Ensure that you have thoroughly stretched. The importance of stretching prior to jumping with a video camera cannot be stressed enough. Even without a camera helmet, the opening shock of the parachute can cause damage to the structure of your neck. With the added weight of a camera helmet, a snappy opening can cause injuries. Stretch the entire neck, back and shoulders during your warm up routine.
- Choose a type of canopy that opens softly. This will help to protect your neck and back during openings. Use a canopy that you can land conservatively. A small error in landing could result in damage to your neck, as well as damage to your expensive camera equipment.

Setting up the camera

- There is a slight difference between what the flyer sees and the camera views. This difference is called parallax. The sight path of the eye and the sight path of the camera need to be aligned to provide an accurate aiming point. Aiming the sight to match the camera at a specific distance does this. Everything past the aiming point will be slightly low in the picture frame. Everything closer than that point will be slightly high in the picture frame. A suggestion to reduce parallax is to select an aiming point 3-4 meters (10-12 feet) away, zoom the lens in slightly and align the sight so that your target is centred. Return the zoom to its normal setting. Sighting the camera will require the help of a friend and adjustments gained through experience.

In-flight & Exit

On the climb to altitude perform all your normal in-flight checks and mental rehearsal. Several minutes before exit confirm that the video is ready to record and that the still camera is set and ready. At this time you should put your helmet on and prepare for the door to open. Once the door has opened be ready to start recording. One way to check if your camera is on and recording is to install a record indicator. These relatively inexpensive devices will save tape, hassle and aggravation.

Exits: Cessna

There are several exit positions for the camera flyer from a Cessna aircraft. On all the following remember:

- That timing is as important as maintaining eye/video contact with the formation.
- During climb out, keep your head low to reduce the chance of hitting the camera on the door or wing.
- If flying a winged suit keep your arms close to your body to prevent the wind from catching the wings and pulling you off the plane.
- Above all, spend lots of time practicing on the ground with all your equipment on so that the climb-out becomes second nature.

Rear – Have both hands on the back of the doorframe keeping one foot against the wheel strut and the other splayed across the fuselage for support. Aim at the centre of the group and release on set or the ‘g’ of go. If your release is slightly early, use a floater track to get into position. This exit produces a nice shot of the aircraft and of the formation presenting itself to the air.

Dive Out – Set up in the door and leave on ‘go’. It is often difficult to maintain contact as you dive out. There is little chance of collision on exit and this exit quickly puts the camera in position to video from above.

Hanging Exit – Climb out and hang from the strut looking back into the plane. Try to keep one foot on the wheel or step. Remind the pilot to brake the wheel. Varying the exit timing will produce different results. This position is very useful with free flyers as you are on level with the jumpers right from the exit.

Exits: Larger planes

In planes such as Twin Otters, there is usually a step and handle specifically for the camera person. Place your left foot in the corner of the door and have your left hand gripping the floater bar, swing your body outwards and reach for the camera handle and step. Once you have got a firm grip bring your other hand and foot out onto the handle and step. From this position you can use either foot on the step and either hand on the handle for your exit position. For the best results, your timing for this exit should be slightly early or slightly late.

Freefall

Filming Positions.

There are 3 basic video / camera positions.

Above – The camera flyer assumes a position above the formation at a comfortable distance and an angle of about seventy degrees. This angle allows a good view of all parts of the formation. The distance away from the group can be tightened up as you gain experience. This position is used primarily to film formation skydiving. Remember that you should not be directly above any jumper in case of a premature activation or that you enter the burble and drop on the formation.

Level – Here the camera person hovers level to the formation or solo jumper. This position is great for recording freestyle moves or getting a close up shot of someone’s face. This position is used mainly by freeflyers and on tandem jumps. The tandem position should be slightly below the tandem (1-3 feet) to better facilitate a shot of the paying customer, hopefully with the sun on their face.

Below – This position produces a great novelty shot. It requires the camera flyer to have good freestyle skill to get a prolonged shot. You will be either on your back, in the sit

position, or sitting on your feet looking up. These positions should only be performed when your skill level is sufficient so that you will not cork.

Expectations

Whether filming novices, free flying or relative workers the camera flyer must be prepared for the subject to move all over the sky. Sometimes teams turning pieces move away from each other. The team will expect you to keep both pieces in the frame so that they can be judged. Free flyers may expect the camera to be totally interactive and that you will keep them centred while moving around the sky. The novice will be happy if they get a close up shot to show their friends. As a camera flyer it is important to know beforehand what the expectations of your client are so that you can do your best to fulfil them.

Break Off

Camera flyers are expected to maintain contact with the jumpers for as long as possible. Generally the cameraperson will deploy their parachute the moment the group begins break off. Key points include

- No matter what, you must be prepared to avoid any intentional or unintentional deployment by a jumper so set up your filming position accordingly.
- You should also deploy immediately if you feel the group has lost altitude awareness - an audible altimeter is a must for camera flyers.
- Formation skydivers will generally leave the centre of the formation for the camera flyer.
- Novice jumpers should be instructed to give a clear wave off and deploy higher than usual – you may need to track off in this situation.

Opening Time

During the actual opening shock of the canopy you need to look at the horizon and keep your neck tensed. The goal is to reduce strain on the neck and avoid riser strikes to the helmet/camera. Your left hand (or both hands) can hold your helmet during pilot chute extraction to help stabilize your head during opening. Only look up to check your canopy after opening shock. With your experience level you should have a feel for how the canopy reacts during opening and this non-visual information will help you decide if there was a problem.

Canopy Control

After opening many camera flyers turn off their video cameras. This will help save several minutes of tape on every jump. However, there are also times when you may want to shoot while under canopy so be prepared to turn your camera back on. If filming another canopy in the air or your landing, turn the camera on well in advance. As this is a normal skydive, remember to keep your hands in your toggles at all times.

Equipment

Equipment for flying video can be very expensive. Several manufacturers produce commercial camera helmets and the range of possible still and video cameras is extensive. You should certainly price shop to find the best deal for yourself and consult with experienced camera flyers that may have recommendations about specific pieces of equipment.

Camera Platforms

There are 2 basic places to mount cameras on a helmet.

The Top Mount – This places the camera on top of the head. This location is best for large or heavy cameras and it also offers good balance. It is also used when mounting double video cameras or a video and a still.

The Side Mount - Smaller cameras are often mounted on an 'L' shaped platform that is attached to the side of the helmet. Several models offer a fully enclosed box to help protect the camera. The downside to the side mount is that during opening the risers have been known to hit the camera.

Video Formats

Traditionally Hi8 has been used to provide a high quality image but it has been superseded by the Mini DV. A less expensive option uses a Digital8 format. This format allows recording in DV format on Hi8 tapes. It also allows the playback of Hi8 tapes.

Lens Selection

Most experienced videographers will suggest a good wide-angle lens. Lenses most commonly used are 0.6 (great for tandems and RW formations), 0.5 (tandems, free flying and RW formations) and 0.42 (free flying and large RW formations). Fish eye lenses (0.35 & 0.28) are sometimes used for free flying, very large formations and novelty jumps.

Depth of Focus - It is a good idea to manually focus the camera just back from infinity. Sometimes auto focus will 'search' for the depth of focus and this may put your subject out of focus. By setting the focus just back from infinity all depths of field will be in focus except for very close objects.

Jump Suits

Any suit can be used to fly camera. Your choice will depend on the discipline you are filming. Some points to consider are

- The basic camera suit with wings is great for filming formation skydiving, tandems and solos. The size of the wing is determined by your exit weight and your subject matter. Basically the smaller you are, the smaller the wing. It is best to confer with a suit dealer and an experienced camera flyer when setting up a suit.
- Freefly suits can be used to film free flying, tandems and solos. If you are a heavier jumper using a freefly suit to film tandems, the addition and use of swoop cords is a good idea.

Audible Altimeters

There are several good audible altimeters and using at least one is highly recommended for camera flying. It is very easy to become so focused on filming that you may lose altitude awareness. You also do not want to check your visual altimeter, as this will take the camera focus off of your subject. The best type of audible altimeter would be one that has adjustable settings. If filming free flying manoeuvres it may be a good idea to use 2 audio altimeters.

Sights

There are two basic types of sights: prismatic and dot sights.

Prismatic - An example of the prismatic sight is the Newton Ring Sight. When viewing through this sight a person sees a series of concentric rings or arrows. As you move your eye in any direction the sight will continue to show where the camera is aiming. So, if the helmet shifts in freefall the sight will still show the aim point.

Dot sights - These consist of a plastic disc with a dot in the middle. This type of sight relies on the helmet staying exactly lined up in front of the jumper's eye to be aimed accurately. If a helmet with a dot sight is knocked or put on crooked, the sight will not be necessarily accurate.

Recording Indicators

Several manufacturers offer record indicator lights that will inform you of when you are recording. They can be mounted on your sight and will all need a power supply, either by plugging into the camera or using an external battery. Most have a device that will light up when your record light on your video camera is lit. Others will plug into your camera and may provide more options.

Editing Equipment

To make a copy of your skydiving footage you will need some type of editing equipment. Still, the most popular format for viewing is VHS. There are two ways to edit video: linear and non-linear.

Linear Editing – This involves the use of a television and VHS recorder. The TV should have a display of at least 13". The VCR should have 4 heads plus a feature called a "flying erase head" to produce seamless edits. Additional components could include a CD player, a selection of music, an audio mixer and an effects generator to create transitions and editing effects.

Non-linear Editing – Here you would use a computer for your editing. You will still need a VCR if you are going to output to tape. Other output options include DVD and video CD's. The specifications for a PC editing computer change daily, speak to a computer pro. It must include a very fast processor, a capture card and editing software. Apple's Macintosh computers also produce excellent editing results.

Accessories

It is a good idea to have a kit made up of accessories you may need. Typical items include:

- Spare batteries. Keep one spare for the video camera, another for your still camera and a few for any remotes you may use.
- A roll of gaffers tape.
- Items that allow you to perform field repairs to your helmet and equipment - spare screws and bolts, allen keys, pliers, lens cleaner and cloth, small adjustable wrench, knife, anti-fog, screwdriver with multiple tips, etc.
- Several blank tapes for your camera and VCR.
- Spare rolls of film when jumping with a still camera.

A large pocket on your jumpsuit can be used to carry a couple of spare items such as a spare battery for your cameras, a spare roll of film and extra gaffers tape.

Tips & Tricks, Do's & Don'ts

Some tips that will help you when filming are

- Remind all jumpers on your load that you are flying video and that they must track away to provide you with the centre of the formation.
- For the best light when filming, keep your back to the sun.
- Never get over a formation. There is a burble there and you may drop onto a jumper in the formation. Also a premature opening could be extremely dangerous
- Fill in or cover areas on your helmet where a line may snag.
- If you are under a malfunctioning canopy, look down and cutaway your main, then open your reserve. Do not try to film it.
- Pack for a slower opening.
- Place any swoop cords over gloves. Remove swoop cords after opening to facilitate your reach.
- Film the paying customer, not the instructor.
- Expect the unexpected.
- Jumping wings will change your normal deployment procedures. Both must be collapsed to prevent instability at pull time

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SECTION 5: INTRODUCTION TO FREEFLYING - SIT FLYING

INTRODUCTION TO FREE FLYING - SIT FLYING

The sport of skydiving is constantly evolving. Skydivers now enjoy relative work when belly flying, sit flying, and when head down. This section provides athletes with an outline of the basic skills required for free style vertical skydiving or free flying. The suggested progression uses the sit position as the base of free flying and a program is outlined in which controlled manoeuvres about all the axes are developed. The skills and techniques required for head down free flying is discussed in a separate section of this manual.

The Starting Point

The recommendations prior to initiating free flying are:

- B CoP
- minimum of 75 freefalls
- be able to maintain control of your body position during front loops, back loops, and barrel rolls
- be able to perform a stand up and hold it for 5 seconds.

Although an athlete with an A CoP could start free flying, without a solid base in the skills listed above they will find the manoeuvres challenging.

It is also recommended that athletes wishing to concentrate on free flying purchase an audible altimeter as a secondary backup to a wrist altimeter.

Preparation Skills

Similar to belly flyers, free flyers must use mental imagery and relaxation techniques. In free fall you must be alert yet relaxed and ensure that you maintain altitude awareness. It is important to be both physically strong and flexible. Strength is required because effective body positions and flying attitudes must be maintained at a rapid fall rate. Flexibility maximizes stability and increases the range of movement.

In-flight

a) Exit Order

The exit order must allow for adequate horizontal separation between groups. Free flyers have a significantly higher fall rate and are affected differently by forward throw from the aircraft. The general rule is that free flyers exit following the belly flyers and larger groups exit before smaller groups.

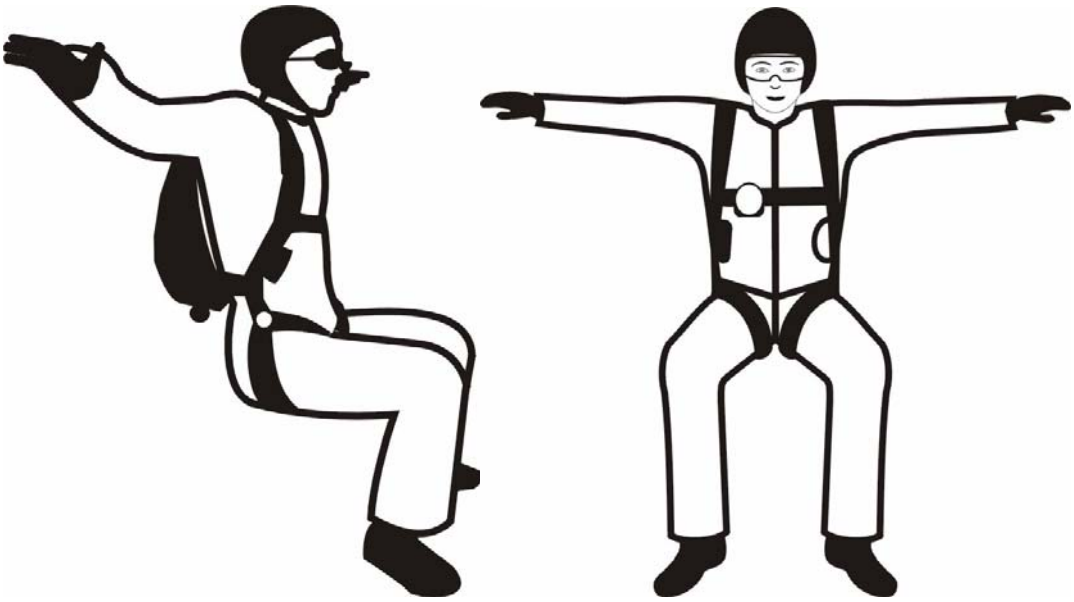
b) The Sit Exit Position
To exit a Cessna aircraft, crouch on the step or wheel facing the tail of the aircraft. You should lean slightly forward, position your back to the relative wind (facing away from the line of flight) with your hips locked in the sitting position, arms out to the side, right hand balancing on the doorframe, and left hand on the strut. Your knees should be approximately shoulder width apart and your legs bent. This exit position allows rapid transition into the vertical sit position.

Free Fall

a) Sit Position and Heading Control
The sit position is the basis for free flying because it is natural, allows for maximum visibility, while fall rate and directional movements are controllable. In fact: **learning to maintain the stable sit position with a constant fall rate is the most important task when learning to free fly.**

The sit position illustrated below is basically the same for everyone with only minor variations due to body shape, size, and distribution of mass.

Side View Front View



To get an idea of the basic sit position, sit in an erect armchair and then lift your arms (palms down) 90-degrees from your sides and hold them straight out like a 'T'.

Heading Control
New sit fliers should remember to choose a heading perpendicular (at 90°) to the line of flight. This is to avoid movement that may put you into contact with other jumpers on the same pass.

Transition to the Sit Position:
The transition into the sit position can be effectively achieved from the back (inverted flight). To transition from the back to the sit, spread your arms wide with palms down, position your legs at 90-degrees about shoulder-width apart (similar to sitting in a chair laying on its back). In one rapid motion, push your legs down as if getting up out of a chair, while bending forward at the waist. Pull your arms into your body and in one sweeping motion thrust your arms forward (hands open and palms facing out) away from your chest and pull air towards the body. If unstable, simply return to the back, relax and check your altimeter and try again if altitude permits.

Observations/sensations from the sit position:

- Compared to belly flying, there is a higher wind force and sound from the higher airspeed
- You will find that there is little wind hitting your torso or face

When performing a stable sit, you should keep your shoulders square and level and have a balanced body position. This will best help you to remain on heading and prevent orbiting.

Additional points to maximize stability include:

- A wider leg position provides more stability
- Heading can be maintained by keeping your arms and legs symmetrical and balanced
- Your arms should be directly extended from the torso with your hands open and facing down
- Your feet should be flat and into the relative wind
- Maintain a flexible 90-degree angle between your feet, calves, thighs, and torso
- Do not arch. Maintain a straight back with your head up, looking straight at the horizon

In sit flying there is a tendency to backslide. It is important for you to develop a sense for airflow on the back instead of the chest. It is especially important when practicing RW sit flying as the tendency to reach for a grip will cause the opposite of the desired effect resulting in increased separation from the target.

The sit position is the primary set up for the execution of turns and loops and this position must be mastered prior to progressing to turns. When in the sit position, always assess your heading control and perform frequent and quick altimeter checks by turning the head slightly towards the altimeter with minimal body adjustments or this can drastically affect the fall rate.

b) Turns

While learning to effectively sit fly, jumpers should experiment with various turning techniques and observe the resulting affect on stability, airflow, and speed of rotation. Suggested turning techniques with resulting motions include:

- Extend a leg – you will turn backwards around the other leg
- Pull in a leg – you will turn forward around that leg
- Extend an arm – you will turn backwards around your feet towards the other arm
- Pull in an arm – you will turn around your feet towards that arm

On each jump use the same technique to turn more than once before moving on to other methods. Focus on learning how to do each type of turn before attempting combinations. You should remember to use a consistent fall rate while performing turns and figure eight's smoothly.

c) Back Loops

- Starting from the sit position, straighten your legs and lean backwards.
- Once upside down (inverted or head to earth), pull your knees to the chest to reduce the resistance to the airflow. To maintain directional stability it helps to hold a square body position with your arms wide and hands open. Execute the leg movement as rapidly as possible.
- About three quarters of the way through the loop, spread out into the sit position

**The key to a successful loop is to make the entire motion as rapid as possible so that you do not dramatically slow down your fall rate.*

d) Front loops

- Starting with the sit position, extend your legs down, as if to stand, and bend forward at the waist.
- To maintain directional stability, hold a square body position with your arms wide and hands open. Execute the leg movement as rapidly as possible.
- Approximately three quarters of the way through the loop, spread out into the sit position

Forward and Backward Movement

The execution of controlled forward and backward movement while maintaining a level and consistent fall rate in the sit position are key skills for effective free fly RW. After mastering turns and loops, you should seek out a coach who is proficient in sit flying to work on relative sit flying skills. Start with 1:1 jumps before moving on to group sit flying. Proficient sit flying is defined as the ability to maintain position and perform all basic skills including: turns, loops, docking, levels and transitions. Working with a coach is the best way to assess your range of motion and relativity. You should speak with the Drop Zone Safety Officer to suggest a coach with sufficient skills.

Note: As a general rule, when working on 1:1 relative skills as a sit flyer, utilize proximity and break off procedures as outlined in the PIM 2B (p. 29-30). Set up approximately 6 m, at the same level and directly in front of the coach, prior to initiating any movement. To start, you should aim at staying about 2-3 m in front of the coach (the approach zone) until proficient and comfortable with the countering motion. Actual docking in the sitting position should not be attempted until you are proficient at controlled forward and backward motion, while maintaining heading and relativity.

e) Forward Movement

The principle of start - coast - stop can be applied to forward and backward movement. Apply the initiation action (Start). Once the manoeuvre is initiated move to a neutral position (Coast) and then perform the counter manoeuvre (Stop).

Start:

- Initiate forward movement from the sit position by extending your legs slightly forward below the knees (As you progress and gain experience, various positions of knee width and hip position can be attempted for stability, effect and range). With your legs extending forward, lean back at the waist with your arms back slightly (palms down) to maintain balance. Maintain an upright head position and eye contact with the target. (Hint: while sit flying it is important to keep in mind that to move closer to a target, you must lean away, as if reclining a chair, as this creates airflow on your back that pushes you forwards.)

Coast:

- Upon reaching the proximity zone, level and approximately 2 m away from the target (the edge of the approach zone), return to the sit or neutral position. Forward momentum will keep you moving forward.

Stop:

- Stopping or countering the forward motion can be achieved by leaning forward slightly while moving the feet back under the body (again utilizing the opposite motion to move in the intended direction).

f) Backward Movement

Start:

- To initiate backward movement, set-up approximately 6m from the target and from the sit position lean forward. Keep your arms level or slightly forward (palms down) to maintain balance. Keep an upright head position and maintain eye contact with the target. Move the legs under the body to roughly a 45° angle.

Coast:

- Upon reaching approximately 8-10 m away from the target, return to the sit or neutral position. Backward momentum will keep you moving slowly away.

Stop:

- Stopping or countering the backward motion can be achieved by leaning backward slightly while moving your feet away from your body.

g) Level Control

With the high rate of fall attained during free flying, even slight differences in fall rate can cause significant vertical separation. Developing the ability to rapidly control level (vertical separation) is a key free fly RW skill.

Increasing Vertical fall rate

There are two different methods to increase the fall rate so that you can close a vertical gap. The positions are the stand-up and a compressed sitting position. Both involve streamlining the body or presenting a smaller surface to the relative wind thereby increasing the fall rate. Because of the high speed, the stand-up is used to cover large vertical separation. The compressed position is most effective for closing smaller vertical separation. When free flying, it is very important to be aware of other jumpers both above and below you. You should develop the normal habit of scanning 360° below you before increasing the fall rate.

Stand-up

- From the sit position, keep your back straight, arms out (palms down) and look at the target. For maximum stability feet should be about shoulder width apart and flat.
- Maintain an erect body position until 2-3 m above and in front of the target.
- To counter the stand-up, you need to increase the amount of surface presented to the relative wind. In one motion, while maintaining stability, bend the waist and bring your knees back into the sit position. Keep in mind that the knees must be spread out approximately shoulder width and the arms slightly backwards.

Compressed Sitting Position

- To compress the sit to generate a small increase in fall rate, you will pull your feet in under your body while leaning slightly forward. Your head should remain upright while maintaining eye contact with the target. The arms can be pulled towards the body and adjusted backwards to maintain a vertical falling angle.
- Maintain the compressed body position until you have almost closed the desired distance to the target.
- To stop return to the basic sit position.

Decreasing Fall Rate

In the event of falling low on the target, you will need to learn to slow your rate of fall while in the sit position. A general rule of thumb during all group free flying is to use the low person in the group as the base. It is important that if you decide to reduce the rate of fall, you should not be directly under another jumper. Rapidly decreasing the rate of fall is called “corking” and is highly dangerous. You should develop the habit of scanning 360° above before decreasing your fall rate.

- To slow down the fall rate you will need to achieve a reverse arch. In one motion, retaining as much balance as possible, you should lift your hips, kick the legs out evenly, and lean backwards. The arms should remain out with palms down. Remember to maintain eye contact with the intended target.
- To stop, return to the basic sit position.

h) Angular & Diagonal Movement
While practising RW sit flying, you will need to complete a dock by moving forward or backward on an angle (diagonal movement).

- To initiate diagonal movement from the sit position, maintain the position of the upper body (straight back, head up and arms out), and drop the leg in the direction of the intended target. For example, to move to the right (45°), you should drop the right leg lower than the left leg and slightly raise the hips. You need to practice the finesse of this manoeuvre by experimenting with different leg positions. If you wish to move down and to the right, then a deeper drop of the right leg is required.
- To stop, return to the basic sit position.

i) Cart Wheels/Transitions
Executing a flawless cartwheel is a key step before transitioning to the advanced free fly skill of head down. To maintain a balanced body position during a transition, the manoeuvre must be completed as rapidly as possible. At all times the jumper needs to maintain a consistent fall rate and remain in position and on heading. As previously stated, corking while close to another skydiver is extremely dangerous.

- In one rapid motion, pull in the right side of the body tightly against the torso. The right arm should be aggressively bent and pushed down to the right side of the torso and the right leg bent at the knee with the right foot tucked up as high as it will go. The left arm should be raised to catch air while the left leg remains in the standard sit fly position.
- If performing a complete 360° transition back to a sit, you should remain in the tuck until ½ to ¾ through the rotation. The rotation is extremely rapid and momentum should carry you back to the sit. It is critical to maintain a stable head position and balanced shoulders (no dipping forward or leaning back) or the rotation will move forward or backwards.
- To stop, return to a balanced sit position.

j) Docking
It is very important to maintain a consistent rate of fall while executing docking manoeuvres. As previously mentioned it is especially critical to avoid corking while flying close to other skydivers. You should be extra cautious to avoid reaching, leaning or stretching to complete any docking manoeuvre as the change in airflow can have a drastic effect on the fall rate creating a dangerous situation. Only minor adjustments should be attempted when flying in close proximity to other jumpers. Docking can be performed in any combination with feet or hands.

Canopy Control

Due to the excessive speed of free fly manoeuvres, free flyers normally break off at 4500 ft AGL. To deploy, return to the stable belly to earth body position, ensure adequate separation, quickly scan for other jumpers, wave off, and deploy.

Equipment

a) Sit Suits
Special sit suits are available which have "pockets" on the arms. These pockets provide increased drag allowing you to more easily maintain a head high attitude. When using these suits, remember that prior to deployment you may feel a little head high in the face to earth position. To counter, extend your legs.

Shorts and a long sleeve shirt are sufficient for sit flying. As your skills advance, a proper free fly suit should be acquired. Experimenting with different clothing and drag will enhance your performance.

b) Harness and Container
In free flying an unexpected deployment could be disastrous due to your body attitude and the high air speed.

To reduce the possibility of accidental deployments or malfunctions, the:

- Container must have full riser covers
- Deployment system must be a **BOC** or **Positive Pullout.** Be certain that no bridle is exposed.
- Main and reserve flaps must stay closed
- The closing loop must pull the container tightly closed. This increases the tension on the pin and reduces the chance of the wind opening the container.
- The loop should be in perfect condition.
- On the BOC system a portion of the pilot chute bridle is tucked under the main flap as it is routed to the BOC. It is recommended that more bridle than usual be placed under the flap and that it be tucked a little deeper than normal. This anchors the bridle reducing the chance of it being extracted into the wind and possibly pulling the pin.

You can also tie a pull up cord around the back of the leg straps to prevent movement or shifting

c) Audible altimeters
Audible altimeters and hard shell helmets are a must for this style of jumping, particularly when the transition is made to group jumps.
Training Program

The key to effective progress is to maintain high standards for your base skills. Problems at higher skill levels are usually caused because the lower level skills were not mastered. Start off slow, focus on technique and imprint the proper signals and sensations on the subconscious. Advanced skills can be developed as your experience and comfort level increases. You should reasonably expect to be able to perform 10 + moves on a 9000 ft. jump after this training program.

The following program consists of approximately 80 jumps and assumes that all jumps are done from 9000 ft.

STAGE 1 – Sit Position and Heading Control (10 Jumps)

Goals:	• Smooth transition to the sit position • Maintain heading control • Maintain the sit at full speed for 10+ seconds • Be able to go unstable and return to the sit a minimum of 6 times per jump
Drills:	• Sit for the entire jump - 5 jumps • Go unstable – sit, go unstable – sit, etc. - 5 jumps

STAGE 2 – Turns (5 Jumps)

Goals:	• Maintain good body position during turns • Stop turns on heading and pause (plus or minus 5 degrees) • Complete 360 degree rotations in 3 seconds or less • Minimum of 5 turns per jump
Drills:	• Alternate left and right turns

STAGE 3 – Figure Eight's (5 Jumps)

Goals:	• Maintain good body position during turns • Stop turns on heading and pause (plus or minus 5 degrees) • Use correct counter to first turn and correct initiation for the second turn • Minimum of 4 sets • Make sure the turn is on axis
Drills:	• Left turn, Right turn - 5 jumps
Key Points	• Train both patterns • Monitor the consistency in the execution of manoeuvres

STAGE 4 – Loops (10 Jumps)

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Goals:	• Maintain a good body position during loops • No pitching up on follow through • Minimum of 6 loops per jump.
Drills:	• Stable, Front Loop, Stable - 5 jumps • Stable, Back Loop, Stable - 5 jumps

STAGE 5 – Cartwheels (10 Jumps)

Goals:	• Cartwheel on axis • Rotations in 1-2 seconds • Minimum of 6 cartwheels per jump
Drills:	• Left Cartwheel - 5 jumps • Right Cartwheel - 5 jumps

STAGE 6 – Combinations - Turns and Loops (4 Jumps)

Goals:	• Fast and smooth transitions • Combinations in 8 seconds • 2 combinations per jump
Drills:	• Right or left turn / front loop - 2 jumps • Right or left turn / back loop - 2 jumps
Key Points	• Be equally skilled with all combinations • Monitor the consistency of all the combinations

STAGE 7 – Combinations - Turns and Cartwheels (8 Jumps)

Goals:	• Fast and smooth transitions • Complete the combinations in less than 4 seconds • Minimum of 4 combinations per jump
Drills:	• Right turn / right cartwheel - 2 jumps • Left turn / right cartwheel - 2 jumps • Right turn / left cartwheel - 2 jumps • Left turn / left cartwheel - 2 jumps
Key Points	• Be equally skilled with all combinations • Monitor the consistency of all the combinations

STAGE 8 – Combinations - Loops and Cartwheels (-4 Jumps)

Goals:	• Fast and smooth transitions • Complete the combinations in less than 8 seconds • Minimum of 2 combinations per jump
Drills:	• Front or back loop / left cartwheel - 2 jumps • Front or back loop / right cartwheel - 2 jumps
Key Points	• Be equally skilled with all combinations • Monitor the consistency of all the combinations

Problem Solving

You should try to have as many jumps as possible on video. Look for the obvious and correct the problem not the symptom. Remember to apply the theory of freefall control from PIM 2A and the principles of biomechanics when looking at the moves. Keep training sessions as positive as possible. Look for achievements, problems and patterns (strongest and weakest moves and combinations). After identifying any specific moves and combinations that are weak, repeat that portion of the training program.

And of course, have fun.

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SECTION 6: CANOPY RELATIVE WORK

CANOPY RELATIVE WORK

Introduction

The purpose of this section is to help you in safely learning the basic skills associated with Canopy Relative Work (CRW).

Prerequisites

See PIM 1, Advanced Recommendations, Canopy Relative Work

Equipment

Canopy

You will need a CRW parachute to learn CRW safely. The time to learn CRW is not after completing a freefall skydive, or when using a freefall-skydiving parachute.

Consistent on-heading openings are very important when doing CRW. Because you will be opening very near your partner, an off-heading opening may result in a wrap or entanglement. The best canopy for CRW is a seven-cell rectangular canopy, rather than a nine-cell or elliptical canopy.

Your canopy should be equipped with a retractable pilot chute. This is not to be confused with a collapsible pilot chute. The bridle of a retractable pilot chute is typically made from 900 lb Dacron suspension line, and passes through several metal rings on the top skin of the canopy. As the canopy inflates, the distance between the rings increases, and the pilot chute is pulled against the top skin of the canopy, where it is less likely to entangle with the equipment of your partner. Using a non-retractable pilot chute, the danger of entanglement is increased considerably in certain formations. In addition to the danger of entangling with a trailing jumper or canopy, the pilot chute may entangle with a jumper docked on the nose of the parachute, as it bounces around in the jumper's burble.

Your canopy should have Dacron suspension lines, rather than the thinner Spectra suspension lines commonly found on skydiving parachutes. It is not uncommon in the event of an entanglement or wrap to have a suspension line wrapped around an arm, leg, or your neck. With your partner's weight suspended from that line, a Dacron line will likely cause a burn or bruise. A Spectra suspension line can cut through skin and muscle when similarly loaded.

Your canopy should be fitted with un-cascaded centre and outer a-lines. This facilitates movement up and down the lines. The lines may also be red so they are easily identified when taking a grip. Some CRW canopies are equipped with "target panels" on the front of the centre and end cells, which also help identify those cells.

Your canopy may be equipped with a mesh slider or spider slider. This will help the canopy open more quickly at sub-terminal speeds.

Because you will be using your front and rear risers at least as much as you will be using your toggles, front risers should be equipped with dive loops or dive blocks, which will make it easier to keep a positive grip on the riser. Dive blocks are preferred, since it is easier to grab and release them without looking. Toggles should be easy to get into and out of, and should not snag easily on a docking canopy's nose or lines.

You should make sure your canopy is compatible with the canopies you intend to do CRW with. The canopies should be of similar construction. If possible, the canopies with which you first learn CRW should be the same model. It is challenging enough to learn the basics of CRW without also having to compensate for incompatible canopies.

The jumpers/canopies should have the same wing loading. As a rule of thumb, canopies that are the same model and with the same wing loading will descend at similar rates. Mismatches in wing loading will be immediately noticeable because one jumper will consistently "sink out" on the other. Weights can be worn to even out the wing loading between two jumpers. The weight used will sometimes be much higher than what is used for freefall jumps (it is not uncommon for a light CRW jumper to wear 20-30 lb), and it may be necessary to use a SCUBA weight belt instead of, or in addition to, a weight vest. Weights should be worn under a jumpsuit in order to minimize their snag potential.

Canopies of the same model and similar wing loading, but of differing size, will not fly exactly alike. It may be possible to match sink rates, but one canopy may consistently out-drive the other. Such mismatches are unavoidable for the recreational jumper, but if you decide you would like to focus on CRW, it will be worthwhile to purchase canopies which are exactly the same size and model.

Container

It is very important to have an easily accessible hook knife. Some containers are shipped with a small plastic hook knife. This knife is not intended for CRW use, and should not be used. Purchase a metal hook knife built specifically for CRW. The knife should be mounted on your chest strap, and not on your arms or legs – where it will often come into contact with (and eventually will snag) someone else's canopy or lines.

The container itself should present as few snag points as possible. A container with an external reserve pilot chute is not recommended. Some containers are equipped with a reserve flap that is tucked in at the bottom to eliminate a snag point.

Reserve handles should be of the "D" or trapezoidal style. Martin Baker and cloverleaf reserve handles can snag on lines in the event of a wrap, causing your reserve to be deployed into the wrap.

Automatic activation devices (AAD's) with external components (for example the FXC 12000 or Astra) should not be used when doing CRW, since they add a potential snag point to the container. Mechanical AAD's such as the FXC 12000 are prone to misfiring, and also should not be used when doing CRW. An AAD misfire could be fatal, for example, if it misfires when you are in the middle of a stack, launching your reserve pilot chute straight through another jumper's lines. The Cypres AAD has been proven much more reliable than older mechanical AAD's, although it has also been known to misfire. Jumpers should make an educated decision as to whether or not they will do CRW with a Cypres – or do CRW with others who are wearing a Cypres.

Your reserve static line (RSL) should be disconnected before doing CRW. In the event of a wrap, it may be necessary to gain some separation from the formation before deploying your reserve. For the same reason, single-handle (SOS) reserve systems are not compatible with CRW and should never be used.

A positive pull-out system is preferable to a throw-out main deployment. In sub-terminal air, a throw-out pilot chute can tow behind the jumper for a short time and creates some uncertainty about opening altitude. For recreational CRW, however, a throw-out system is acceptable.

Clothing, helmets, and altimeters

Jumpers should wear thin leather gloves, shoes, socks, and long pants or a jumpsuit. The jumper will be in constant contact with canopy fabric and lines, and clothing that covers the arms and legs will prevent burns. Shoes should have no hooks, which could snag lines. Shoes should be tied tightly enough that they will stay on, but not so tightly that they can't be removed if a canopy wraps around the shoe – it is not uncommon for a canopy that is wrapped around the leg to slide down and become hung up on the top of a running shoe.

Jumpers should wear a helmet that does not restrict hearing.

Chest-mount altimeters should be worn when doing CRW. The use of a wrist-mounted altimeter is discouraged, since it provides an additional point for lines to snag on. If a line becomes snagged on a wrist-mounted altimeter, it will immobilize that arm and make it much more difficult to deal with the situation.

Unusual situations

You should review your Emergency Procedures, Section 7 of PIM 2A. Although many unusual situations are unique to CRW, the techniques used to assess your situation and to activate your reserve are very similar.

Unusual situations in CRW can be divided into two categories: entanglements and wraps. An entanglement occurs when two or more canopies become entangled with each other. A wrap occurs when a canopy becomes wrapped around another jumper's body. In spite of precautions taken to avoid them, wraps and entanglements do sometimes occur.

The first step toward surviving an emergency situation is to have a plan, prior to the onset of the emergency. Your plan should take into account the experience of those who have come before you, as well as careful analysis of errors committed by others, and by yourself. You should not, however, limit yourself to one course of action.

For example: You are wrapped! The canopy is wrapped around your head, and the lines are wrapped around your neck, cutting off the supply of blood to your brain. You are unable to communicate with the jumper below you, and your consciousness is fading. You cross your legs to signal the jumper below to cut away. Unknown to you, the jumper below has also become wrapped, and is unable to cut away. Realizing that your partner is not responding, and desperate to relieve tension on his lines, you take hold of as much as possible of the canopy wrapped around you, reach for your hook knife, and cut the lines wrapped around your neck, thereby restoring the supply of blood to your brain and saving your own life.

A primary plan is necessary, but don't limit yourself to a single emergency procedure and convince yourself that it is going to work every time.

The second step toward surviving an emergency situation is to practice your emergency procedures. You should go over your plan until it becomes second nature to you. Review your emergency procedures before each skydive.

The third step is to do it. When you become involved in a rapidly deteriorating situation, you should quickly review your emergency procedures. Remain calm, maintain altitude awareness, and deal with the situation one step at a time.

You should initiate your cutaway no lower than 1,000 feet. A cutaway below 500 feet has almost no chance of being successful.

Wraps

A wrap can be compared in severity to a low-speed malfunction. With sufficient altitude, there will be time to consider the situation and deal with it one step at a time. The canopy of the top jumper should remain inflated, giving you substantially more time to deal with the situation than you would have in a high-speed malfunction.

The most important rule in dealing with a wrap is that the bottom jumper must cut away first, and must cut away only when instructed to do so by the wrapped jumper. It is very important that the bottom jumper not cut away without specific instruction from the wrapped jumper. The cut-away canopy may behave unpredictably, and can make a tricky situation much worse.

Usually, the wrapped jumper can extricate himself from the wrapped canopy by sliding it down his body. If he is unable to do this, it may be necessary for the bottom jumper to cut away in order to release tension on the canopy. This decision belongs to the wrapped jumper, and as usual the bottom jumper should not cut away without clear instructions from the wrapped jumper.

Always maintain altitude awareness in an emergency situation. Just like a low-speed malfunction, there is a limited amount of time to deal with a wrap.

If the wrapped jumper cannot completely extricate himself, and if altitude is running out, he may simply control the fabric of the wrapped canopy as best as possible, and then give the command for the lower jumper to cut away. The wrapped jumper may land with the wrapped canopy tucked between his legs.

If you are in a larger formation and the jumper below you gets wrapped, hold onto his canopy until he is able to sort things out. This gives the wrapped jumper more time, and also keeps his canopy on heading.

Entanglements

An entanglement usually results from one jumper passing through the lines of another jumper’s canopy, or from a part of one jumper’s gear becoming entangled on another jumper’s gear. This causes the two canopies to become entangled, with the jumpers dangling beneath the partially inflated or completely collapsed canopies.

In an entanglement, the two jumpers will usually orbit around the entangled canopies. The rotation may be very rapid, and the jumpers may tumble violently as the canopies fight for control.

Entanglements will often clear themselves. Altitude permitting, jumpers should take a moment to determine if the canopies will disentangle on their own.

The general rule with entanglements is that the top jumper should cut away first. If the bottom jumper cuts away first, his risers and lines may recoil into the top jumper, which could make the situation much worse.

In dealing with an entanglement, it is important to maintain altitude awareness and communicate with other jumpers involved in the entanglement.

Communication

The first thing to do when you become involved in a wrap or entanglement is to communicate. You need to communicate the altitude, the problem, and the plan.

The bottom jumper in a wrap should call out the altitude at regular intervals, since the wrapped jumper may not be able to see his altimeter, or may have lost track of altitude in dealing with the situation. In addition, it can be very comforting for the wrapped jumper to know if he has a good canopy over his head.

In some cases, a wrapped jumper may be unable to communicate verbally. Non-verbal signals should be arranged beforehand. A common non-verbal signal is for the wrapped jumper to cross his legs if he is being choked by lines or fabric. The bottom jumper should cut away immediately if he sees this.

If you become wrapped in another person's canopy, you should let the other jumper know what you are doing, if you can. This information should be communicated at regular intervals, so that the bottom jumper is constantly informed of the situation.

Clear verbal signals such as "Cut Away!" or "Hold!" should be used. Avoid using signals that could be misinterpreted if one or two words are misheard – for example, a signal such as "Don't Cut Away!" should be replaced with something less ambiguous, such as "Hold!" Certain signals should be agreed upon beforehand, so that everyone knows what to listen for.

Avoiding wraps and entanglements

A bad dock is most often the cause of a wrap or entanglement. Three factors contribute to the problem: speed, angle, and distance from centre.

If you have too much speed, your canopy and body will continue to move forward after the dock has been taken. The point where a grip is taken will remain stationary, but the rest of the canopy will engulf that point. The best way to avoid this situation is to practice no-momentum docks – the target jumper should be able to reach down and pick up your canopy.

Every dock should be made with the aggressing canopy moving on the same heading as the target canopy. Often you will approach your target from an angle other than straight

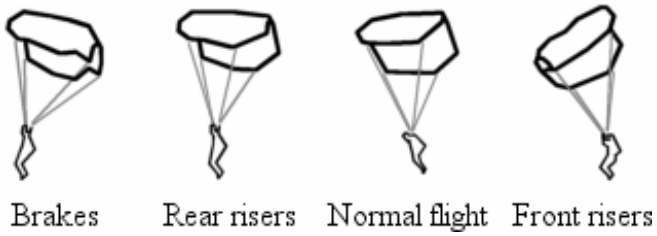
behind, but you need to turn your canopy to match the target's heading before you make the dock.

Rising docks should also be avoided. In a rising dock, the aggressing canopy approaches from below using brakes. When the target takes a grip on the rising canopy, it collapses against him because it is in a low-pressure, braked configuration. To avoid this problem, all docks should be made from above and behind the target.

Finally, docking unintentionally with an end cell is much more likely to cause a wrap than docking with your centre cell. If you are the target jumper, you can choose not to take any dock that comes in too hot, from the wrong angle, or in the wrong position.

Basic canopy control

It is highly recommended that you review the Canopy Control sections of PIM 2A and PIM 2B before learning CRW.



Front risers

Pulling on the front risers has an effect similar to increasing the angle of attack of the canopy. This increases forward speed, and increases downward speed. Relative to a canopy at full flight, a canopy with front riser input will move downward and forward.

Rear risers

Pulling on the rear risers has an effect similar to decreasing the angle of attack of the canopy. Gentle pressure on the rear risers will increase forward speed and decrease downward speed, causing the canopy to skate forward and up relative to a canopy at full flight.

By applying greater pressure to the rear risers, the canopy eventually reaches a point where it is no longer able to produce lift. Eventually, the canopy will stall. It may become hard to control, and will certainly sink downward and backward with respect to canopies in full flight.

Brakes

Pulling on the brakes cups the tail of the canopy, causing it to produce more lift, but also slowing its forward flight. Relative to a canopy at full flight, a braked canopy will float up and backward.

Body movement

By shifting your weight left or right in the harness, you can cause the canopy to turn left or right, respectively. You will sometimes use these effects to your advantage, but if you are careless they can work to great disadvantage.

For example: Your partner is coming in for a dock. He's close, but not quite there. You reach back with you right hand to snag the canopy. Suddenly, your canopy turns to the right. With your partner's canopy gripped firmly in your right hand, you spin around into a wrap or entanglement.

It is important not only that you are mindful of your ability to turn the canopy by shifting your weight, but also that you use discipline, keeping your body square in the harness when it is not your intention to turn.

The burble

The burble

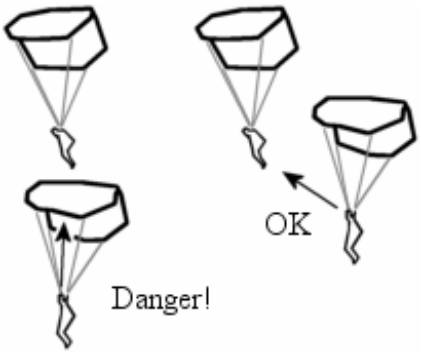
Much like a boat in the water, any object moving through the air creates a turbulent wake behind it called the burble.

Flying through another jumper's body-burble may simply cause your canopy to perform poorly. If you are trying to close the last few inches to make a dock, it could take a very long time if one of your canopy's cells is behind the other jumper's body – your canopy is effectively flying on 6 cells instead of 7. Flying through another jumper's canopy-burble could cause your canopy to turn unexpectedly if you are flying in partial brakes or rear risers. When doing CRW, you must be aware of the burble behind other canopies and pilots in the formation.

Rules of flight

The following three rules of flight should be taken very seriously. There is no excuse for violating them, since each represents a completely preventable, but very dangerous, error.

Keep sight of the target



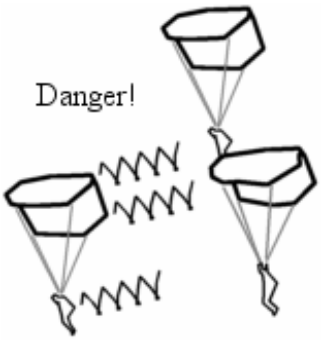
If you've lost sight of your target, you no longer know where you are relative to it. In particular, if you fly under another jumper and touch your brakes, you may wrap him from the bottom up. Therefore, losing sight of another jumper should be considered an extremely dangerous situation.

The situation needs to be recognized before it develops. If you think you are in danger of passing under the formation, simply stop your forward motion using a quick stab of the rear risers before you pass under the formation, and reset the dive.

Stay in your quadrant

Generally, your quadrant will be the left or right side of the jumper you are docking on. Even if you are centre-docking the jumper, you should choose which side you will approach from, and stay on that side. The reason for this is that there may be another canopy approaching on the other side of the centre line. Even if you are doing a 2-way jump, it is very important to develop the habit of staying to one side.

Keep out from in front of the formation



By flying in front of the formation, or in front of any other canopy, you are putting that canopy inside your burble. If you pass in front of a formation, it is likely to cause some instability in the formation, which could result in an entanglement or wrap. If you pass in front of another jumper, that person's canopy will behave erratically, and may be turned

in an unexpected direction. The jumper may also have to perform evasive manoeuvres to avoid colliding with you.

Preparation

Review Section 2, Preparation Skills, in PIM 2A.

Off-dropzone landings are common when doing CRW. It is important that you are familiar with terrain assessment (PIM 2B, Section 5.9) and observation of surface winds (PIM 2A, Section 5.9). You will sometimes need to land in unfamiliar terrain, and without the aid of a windsock to determine wind direction. Even if you are landing on the dropzone, you should take a moment to practice other methods of determining wind direction, so that these skills are refined when you need to use them.

Canopy Relative Work is very three-dimensional. For this reason, it is important to dirt-dive each jump. Find a large open space, and walk through the jump with realistic separation between jumpers. Call out any verbal signals (“Go”, “Incoming”, etc.) that you plan to use in the air. When there are more than two jumpers involved, make sure everyone knows what side of their target they will be approaching from, and resolve any potential traffic problems.

Notify manifest, and the pilot, that you will be doing CRW. Let the pilot know as early as possible where you will be exiting, so that he can plan his flight accordingly.

In-flight

Review Section 3, In-flight Skills, in PIM 2A. In particular, the spotting skills and exits used for CRW will be very similar for those used in freefall skydiving.

Handles check and pin check

As on any skydive, it is important to check your cutaway and reserve handles before you exit. In addition, it is important to make sure the handle for your pilot chute or pull-out is in place before exit.

It is especially important when doing CRW to give each other careful pin checks before exiting the aircraft. Check both main and reserve pins.

Spotting

You will typically use a downwind jump run for CRW. This keeps you oriented toward the dropzone, and in competition allows the judges a clear view of the front of your formation throughout the dive.

When doing CRW, it is particularly important to understand that there may be several layers of wind between you and the ground. Whereas a freefall jumper will plummet

through all but the lowest of these layers, a CRW jumper will spend a much longer time exposed to the changing winds.

Use a rate-one turn to determine the upper winds. As a general rule of thumb, you should spot the load a mile away from the dropzone for every quarter-mile covered in the rate-one turn.

Plan your spot so you will pass over the dropzone at no higher than 2,000 feet AGL, so that you don't interfere with freefall canopies opening at that altitude. If necessary, turn back into the wind short of the dropzone, continue the dive until break-off altitude, and return to the dropzone. On subsequent jumps, the spot can be adjusted so that this is not necessary.

Exits

In general, when doing CRW, you will make jumps from about 7,000 feet. This gives you enough time to go through several repetitions of the dive, and by the time you reach the ground you will be ready to debrief your jump, discuss how to improve the next time, and do it again. Although it's possible to do CRW from 9,000 feet AGL or higher, you will probably find that you are tired or even hypoxic before the end of the dive, and no longer learning at your full potential.

Although you will usually be exiting before freefall jumpers, you may occasionally find yourself in a situation where you are exiting at the same altitude as freefall jumpers. In this case, the freefall jumpers should get out first so that they are safely below the CRW jumpers throughout the dive.

On most aircraft, it is possible to get three jumpers comfortably outside the door. On small aircraft, jumpers should line up so that the first jumper is furthest from the door. On larger aircraft, jumpers should line up so that the first jumper is at the rear of the door. A fourth jumper can remain inside the aircraft, and jump after the other three have left.

Exit timing will depend on the experience level of the participants. Beginners should leave about 3 to 5 seconds between jumpers. This gives added time to deal with an off-heading opening, and will also provide a good set-up to practice closing large distances.

Delays from one to three seconds are common. A delay of less than one second should not be used. A parachute deployed in the prop wash of the aircraft will open uncomfortably fast. In addition, it is possible for an over-zealous jumper to toss his pilot chute over the tail of the aircraft.

With specialized CRW canopies, a delay longer than 3 seconds may result in an uncomfortably fast opening, injury, or damage to the canopy itself. Each jumper should consider what he would do in the case of an unintentionally unstable exit, where a long delay may be unavoidable. Going straight to reserve instead of deploying the main may be an option in cases where the main would open quickly enough to injure the jumper.

During the jump

Communication

Clear, concise communication is important when doing CRW. The following signals should become habitual:

“Incoming” – shouted by anyone who is a second or two away from docking on another jumper. This alerts the jumper so he is ready to accept the dock.

“Complete” – shouted by the person taking the final dock in a formation, this signals that the point has been built.

“Go” – shouted by the pilot (usually in response to his having heard the “complete” call) to signal everyone to begin building the next point.

“Reset” – shouted by the pilot to signal that he is going to put himself in position to begin a re-build of the current point.

“Break” – shouted by the pilot at break-off altitude.

Break-off

Most unusual situations occur either when docking, or when breaking off. Break-off altitude should be no lower than 2,000 feet, to give you time to assess the situation and perform emergency procedures if necessary.

The jumps

Review the training recommendations for CRW in PIM 1, Section 3.18. The following progression of 2-way jumps will get you started. Repeat each jump 3 to 5 times, or until you feel comfortable with the skills introduced in that jump. Later jumps build on earlier skills, so it will be a great advantage to be comfortable with one jump before moving on to the next.

End cell bumps

Both jumpers should be outside the aircraft in preparation for the exit. On a Cessna 182, the first jumper may be hanging, and the second poised. On larger aircraft, jumpers should line up in the door with the first jumper at the rear, and the last jumper toward the front of the plane. The first jumper should be the more experienced of the two jumpers.

The first jumper should take a 2- or 3-second delay before pulling. The second jumper should exit about 5 seconds after the first, and pull after a 1-second delay. This will put the second jumper approximately 500 feet in front of the first, and approximately 100 feet

higher. In CRW, this is known as a position of advantage. It is fairly easy to come down or back to someone else, but it is very difficult and time consuming to move forward or upward relative to another jumper.

After completing a visual check of his own canopy, “Base” releases his toggles and sits in half-brakes. This will allow “Pin” to move slower or faster than Base by applying more or less brake, respectively. Base should choose some landmark against which to judge his heading, and should make appropriate corrections to stay pointed toward that landmark.

Pin is going to fly a pattern that puts him in a position to bump Base’s end cell. He will have the option of using his toggles, front risers, or rear risers to make each turn. This decision should be made based on the amount of altitude remaining between Pin and Base. If there is little altitude remaining, gentle rear riser turns can be used to conserve altitude. Toggles can be used with a moderate amount of altitude, and front risers can be used to close a large difference in altitude. Be aware of the side-effects of using each control – front risers, for example, will also increase your forward speed. When you are practicing this drill initially, be conservative with your choices, and try to maintain a position of advantage.

Pin’s flight pattern is as follows:

First, turn 90 degrees right or left.
Hold that heading for about 2 seconds, and then turn another 90 degrees in the same direction.
When the angle between your heading and that of Base is approximately 45 degrees, turn in toward Base.
As you approach, turn to face the same heading as Base.

Pin’s goal is to arrive next to Base in exactly the right spot to bump end cells. Initially, you may need to perform some corrections to get there.

A sashay can be used to bleed off some altitude, and at the same time move slightly backward. Information on performing sashays can be found in PIM 2B, Section 5.12.

To close distance when he is quite far in front of Base, and there is sufficient vertical separation, Pin can perform a 360-degree turn in a direction away from Base. It is

important always to keep an eye on the target, and to be prepared to abort the turn if you have misjudged the distance. To close the distance with less altitude loss, Pin can perform a gentle 45-degree turn away from Base, hold for several seconds, and turn 90 degrees back toward Base.

These manoeuvres are time-consuming, so of course the goal in this exercise is to wind up in the right place the first time.

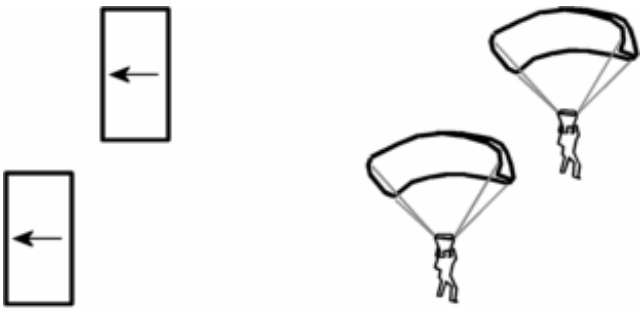
To reset the exercise, either Base or Pin (depending who needs more practice) can turn 180 degrees in a direction away from the other, hold that heading for several seconds to build horizontal separation, and then turn 180 degrees to return to the original heading. These turns can be made with toggles or risers, to vary the exercise. Try to set things up a little differently each time by varying the horizontal or vertical distance that Pin needs to close.

It is very important in CRW to learn to close large distances accurately, and to be able to judge horizontal and vertical separation. Although it is tempting to perform them from close proximity, any of the following exercises can be modified by introducing a large horizontal or vertical separation.

Centre docks

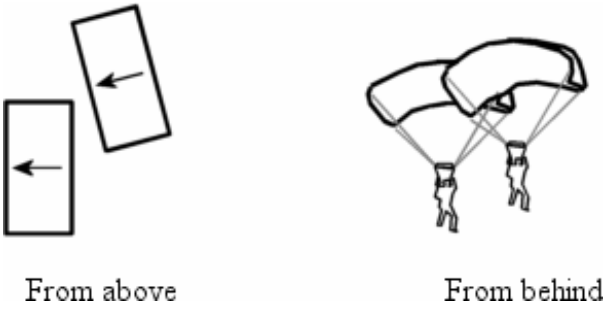
Use the same exit as for end cell bumps. Pin will first close the horizontal and vertical distance to get to a position beside Base. Base sits in half-brakes.

By applying three-quarters brakes abruptly, and holding them for about one second, Pin will move up and behind Base, into what is called the set-up point.



From above From behind

From the set-up point, Pin has the advantage. Using his inside front riser, he turns toward Base. His canopy should pass under Base's burble, through clean air.



From above From behind

Using the opposite front riser, Pin aims his centre cell at Base's lower back while bringing his heading back around to match Base's. When Pin is one or two seconds from completing the dock, he should yell, "Incoming!" to alert Base.

From above From behind

Base should stay in one-quarter to half brakes throughout this manoeuvre. When Pin is very near completing the dock, Base lets up gently on the brakes and removes his hands from the toggles in preparation. Base should be careful to maintain a consistent heading, but should also keep an eye on where Pin is.

When looking to see where Pin is, it is very important that Base look only left, right, or down under his arm. By looking up toward the tail of his canopy, Base exposes his chin and neck as a potential snag point for Pin's canopy, and risks a broken neck.

When Pin's canopy touches Base's back, he can reach down with his hands and grab the top skin. By passing his feet inside Pin's centre a-lines and hooking his toes around the outside of the lines, Base takes a grip.

To reset the exercise, Base kicks out of Pin's lines and releases any grip he may have with his hands. Either Base or Pin can turn to set up the next go-around. Base can use a smooth application of his brakes to pass up and over Pin's canopy before turning to reset. Pin can use his brakes to put a short distance between his canopy and Base's back before turning if he is going to act as Base on the next go-around.

Monkey crawl

The goal of this exercise is to prepare for wing docks. When Base takes a grip on Pin's end cell in a wing dock, it has the effect of slowing down that side of the canopy, and reducing the lift it produces. The opposite side of Pin's canopy has a tendency to overtake and lift with respect to Base's side, which can cause a wrap. In order to prevent this, Pin must apply front riser pressure on the side opposite Base. This has the effect of keeping that side down, and also hampers the performance of that side somewhat, so that it does not overtake Base's side.

Use the same exit as for end cell bumps. Pin will first close the horizontal and vertical distance to get to a position beside Base. Base sits in half-brakes.

Pin moves back and up to the set-up point, and completes a centre dock. Base needs only take hand grips this time. Once he has a grip, he calls out to Pin, "Crawling Right!" and begins to shuffle his hands along Pin's top skin, behind his back, toward the right side of Pin's canopy. Pin applies increasing pressure on the left front riser to compensate. If the left side of the canopy seems to be lifting or overtaking Base, greater pressure is required.

Because Base is still piloting the formation, it is very important that he maintain heading, and keep his weight distributed evenly in his harness, throughout this exercise. It helps to keep looking forward while edging along Pin's canopy.

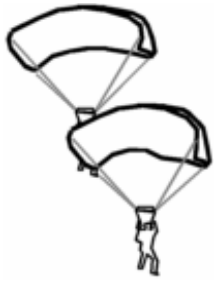
When Base reaches the right side of Pin's canopy, he calls out, "Crawling Centre!" and crawls toward the centre. Pin slowly lets up on the front riser pressure until, when Base is in the middle of his canopy, he is no longer applying any pressure. Base then repeats the exercise for the left side of Pin's canopy, with Pin applying pressure to the right front riser.

If altitude permits, Base can yell, "Reset!" and the exercise can be reset in the usual way so jumpers can switch roles.

Wing docks

Use the same exit as for centre docks. Pin will first close the horizontal and vertical distance to get to a position beside Base. Base sits in half-brakes, and Pin moves into the set-up point.

The wing dock is similar to a centre dock, except that Pin aims to place the outside edge of his end cell against Base's lower back.



Although a centre dock can be completed safely with quite a high closing speed, a wing dock must be placed with little or no horizontal or vertical momentum, in order to avoid a wrap or entanglement.

Base must be very disciplined in not accepting any dock that comes in too fast – if the dock is not accepted, Pin will simply pass by Base, and the exercise can be reset.

Base must also be very disciplined with heading control. Especially with wing docks, it can be very tempting to reach back and help Pin close the last few inches. Base's primary concern should be keeping a consistent heading so that Pin has a stationary target to hit, and in order to avoid entanglements and wraps that could result from Base turning toward Pin's canopy.

As soon as Pin's canopy comes into contact with Base's body, he should take a hand grip. At this point, Pin should apply opposite front riser to compensate. Base can take a leg grip once Pin has applied front riser. Base should fly the formation for a few seconds to get a feel for it, and then the exercise can be reset as usual.

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SECTION 7: DEMONSTRATION JUMPS AND THE EXHIBITION JUMP RATING

Demonstration Jumps and the Exhibition Jump Rating.

One of the most rewarding and ambassadorial aspects of skydiving is the 'demo' or exhibition jump. For the jumpers it is an opportunity to share their colorful and exciting sport with the mainstream public, and perhaps, even receive compensation! Demo jumps also serve to bring modern knowledge of our sport to the public, providing the opportunity to educate, entertain, and reinforce a positive image of skydiving.

Of course, with this increased reward, there is an increase in risk. It is common knowledge in the entertainment industry that the performance is different from the rehearsal; this is equally true in exhibition jumping. Although you have jumped hundreds or even thousands of times at several different drop zones you will still find that performance anxiety increases when jumping before live audiences and/or television cameras. Even if the proposed landing zone is completely free of obstacles and larger than the drop zone you normally use, jumping before the public is NOT just another skydive! Mess up a landing at the drop zone, it costs maybe a case of beer. Mess up at a demo, and you will be vulnerable to everything from the ridicule of your peers to litigation.

The goals of this section of PIM2C are to help you prepare for and perform a safe and entertaining demonstration jump.

The Exhibition Jump Rating

There are minimum qualifications and regulatory approvals required to conduct a "*parachute descent over a built-up area or assembly of persons*" as Transport Canada has defined demonstration jumps.

Transport Canada requires that only jumpers who have proven their competence may participate in demonstration jumps. CSPA is empowered to certify those jumpers through the Exhibition Jump Rating (EJR). The following are the minimum requirements for the EJR:

a) Prerequisites:

- Current CSPA membership
- Class C Certificate of Proficiency
- Minimum 400 ram-air parachute jumps
- Minimum 50 parachute jumps in the previous 12 months

b) Requirements

- Score 80% or more on the EJR written exam, and;
- Perform 10 consecutive pre-planned stand-up accuracy jumps landing within 5 meters of target center, witnessed by an EJR examiner.
- A pre-planned jump witness must have one of these ratings:
    - Instructor B
    - Course Conductor
    - Coach 2
    - Logbook Examiner
    - CSPA Judge
    - Application Fee $30

c) Annual Currency Requirements

- Current CSPA membership
- 50 jumps in the previous 12 months, 10 of which must have been within 5 meters of target center, not necessarily consecutive, using a parachute which meets the wing loading and performance characteristics of the main parachute intended for use on exhibition jumps,
- Verification by an EJR examiner.

Notes:

1. A declared jump means that you must tell the examiner before the jump.
2. The "consecutive" portion does not mean ten jumps in a row i.e. 141, 142, 143, 144, 145…. A jumper can decide which jumps they declare e.g. 142, 156, 197, etc.
3. If a candidate misses on any of the ten designated jumps, then they must re-start the series at jump number one.
4. The EJR must be renewed every year, the EJR renewal form is attached to the annual membership renewal application.

Candidates can easily enhance their performance on the designated jumps by:

- Spotting the load,
- Prior to their jump, watching other jumpers for freefall drift and canopy penetration
- Performing the jumps within the wind limits for demo jumps -18 mph at canopy height
- Performing the jumps from similar altitudes to those found on demos (normally 5000 ft or less)
- Not performing any radical landing maneuvers
- Remembering that stress is perceived
- Using appropriate techniques

The Demonstration Jump

Whether it is an international event in front of 100,000 screaming fans that is being televised around the world or a little league game in the middle of the country, your preparations for the jump should be the same. The success of a jump will certainly enhance the event you are jumping into and promote our sport. Failure to perform well can be embarrassing, even tragic. Here is a recommended process to assist you in performing a successful exhibition jump.

a) Preparation

1. Special Flight Operation Certificates (SFOC)

For new exhibition jumpers this will be the first time they have applied for a Special Flight Operation Certificates or SFOC. An SFOC is the way that Transport Canada approves jumping activities at a given location at a given time. The jumper who is coordinating the demo should submit the application a minimum of ten working days before the event and sooner will always be better. The application for an SFOC can be as informal as a letter with the following information:

- The date and the time window in which the jump will occur
  > e.g. May 2 between 1730h and 1800h (local time)
- The exact location of the jump described in latitude and longitude
  > e.g. 49°15'00"N x 123°15'00"W
- Exit altitude (Above Ground Level & Above Sea Level)
  > e.g. 5,000 A.G.L. / 5,050 A.S.L.

- A map of the proposed landing area clearly showing the distances to obstacles and alternate landing areas
- A description of the crowd control measures that will be in place
- The jumpers' names and their CSPA membership numbers and expiry dates
- The name of the on-site ground supervisor - must have a "B" CoP minimum
- The aircraft type & call sign to be used.
- Attach the **written permission** from the property owner, event sponsor and the municipal authority, often the municipal engineer's department or the office of the risk manager.

The local representative of Transport Canada will respond with the Special Flight Operation Certificate. It will list the terms and conditions under which the jump must comply:

- The time, date, altitude, jumpers' names, and aircraft will be acknowledged
- The wind speeds and minimum opening altitudes will be confirmed
- The need for any night or water jump equipment will be specified
- There will be a specified minimum altitude (or separation) to maintain over the crowd. You will need to include any suspended flags or banners in this altitude
- The times to contact and phone number of the local control tower so that they can issue the NOTAM to local air traffic
- The radio frequency for the pilot to contact the control tower during the flight and an outline of the expected procedures will be given
- Individuals required to have copies of the paperwork will be specified

2. Additional requirements:

- The aircraft must have a Mode C (altitude encoding) transponder
- Square reserves and AAD's will be required
- VHF radio for the aircraft. It is advisable to have radio communication between the plane and the ground control

Remember to read the complete SFOC document carefully and confirm that all the information is as you would expect.

3. Key points to remember are:

1. The Ministry will check that all jumpers listed are on CSPA's EJR list and hold back permission for the jump if an individual is not on the list. Make sure they have the rating before you submit the names. If you are uncertain of a jumper's EJR status contact the CSPA head office.
2. The Ministry does not wish to limit jump activities by committing the jump to one aircraft. Aircraft substitutions are OK providing the aircraft has a VHF radio; a Mode C transponder, and all radio procedures are performed.
3. Perceptive event hosts will require proof of insurance for the event. Typically, $1,000,000 of coverage will be required. CSPA offers a $2,000,000 policy at a modest price. This must be applied for, from the CSPA office, well in advance (minimum of 14 days) or a surcharge for coverage will apply. If you apply too close to the jump, coverage may not be possible.
4. On the day of the event, copies of all paperwork MUST be in the possession of the pilot and the ground controller. It may be appropriate to provide a copy to the event host as well.

4. Site Reconnaissance

Prior to the jump, the jumpers should

- Look at the site careful and specify the locations that they would like wind socks and streamers
- Assess the location for turbulence and plan the landing pattern

5. Mental Preparation

As mentioned earlier, there are psychological aspects of exhibition jumping that are not present during normal skydives on the drop zone. The pre-planned accuracy component of the EJR qualifications are intended to duplicate, to some degree, the added performance anxiety present on a demo jump. Experience suggests that attention to mental preparation significantly improves the performance, and enjoyment, of the exhibition jumper. Before you begin your mental preparation ensure that all your equipment is prepared as discussed in the next section. It is recommended that all equipment should be tested and items on your checklist completed and confirmed at least 15 minutes prior to aircraft loading.

If you use the 15 minutes in the following manner, you should enjoy a calmer more controlled demo experience. Take the

- First five minutes to go off by yourself and simply review the entire dive from take-off to packing. Visualized the entire process twice
- Next 5 minutes and review your gearing up procedure, with detailed emphasis on any special equipment you may be using.
- Final five minutes for the real gear up.

Although it may seem simplistic, this process serves to calm and focus the mind, reinforce confidence, and place you fully in the moment.

Once completely geared up and ready for departure, and AFTER you've had someone do a complete gear check while it is on you, review the emergency procedures. You should not just do this on your own, as you will no doubt need to discuss certain potential emergencies with the other jumpers and the pilot. Reviewing emergency procedures with the rest of the group helps to build a "team concept" that is beneficial in the event of a real emergency.

b) In-flight

During the flight:

- Perform the standard handle checks remembering to also check and confirm any special equipment you are using.
- All jumpers should verbally confirm that they know: the plan, break off heights, deployment altitudes, who is landing first, etc.

Exit Order:

- Solo exits may be appropriate even if there is time for a little relative work.
- Staggering the opening altitude should be used to stack up the canopies and provide spacing. As a rule of thumb, have the jumpers with the fastest descending canopies deploy lowest. This may mean that the 'flashiest' jumper will land first; it is no time for heroes.
- Jumpers using flags will want to be open higher to allow time to deploy the flag.

c) Free Fall

- It is suggested that jumpers exit from lower altitudes than at the drop zone for several reasons:
- It provides improved visibility for the spectators of the free fall portion of the jump. Every jumper can agree that it is very difficult for the public to find free falling skydivers. Most demos consist of 3-4 skydivers / performers and even when connected together, it will be difficult for a spectator to identify the formation.
- Spotting the aircraft is easier
- It improves the odds of getting clearance from Nav. Canada when in controlled airspace

- Utilizing smoke or flour can make it easier for the spectators to identify the aircraft on jump run and the skydivers in free fall.

d) Canopy Control

- Once the jumpers have opened each should confirm the spot and the location of the other canopies. The jumpers will need to ensure the separation and spacing between themselves.
- Jumpers with flags need to confirm their heading and clearance before deploying the flag.
- Fly the agreed upon pattern for landing. Check the wind socks. Ensure that you DO NOT fly over the crowd. Keep all suspended flags clear of the obstacles.

e) Landing

- Upon landing gather the jumper's together, wave to the crowd, enjoy the moment, and then clear the field.
- If circumstances permit, hang around the field, pack the parachute, and talk to the spectators. In general, present a proud, professional face to our sport.

Ground Crews

As mentioned in the paper work section, one individual must be named as the ground crew coordinator. This person must be at minimum a "B" CoP holder. This person has several responsibilities:

- They should ensure that
- they have a copy of all the paper work
- copies of all paper work are in the hands of the pilot
- there is a VHF radio to communicate with the aircraft
- the event occurs on time and in safe conditions
- a radio or a cell phone is available to the ground crew
- all personnel are on site ahead of time to confirm their jobs.
- On big demos, for example a professional football game, the jumper may have to hit a narrow window in time. Communication between the ground coordinator and the aircraft is essential. Confirm details of the schedule beforehand and establish specific time references.

a) Other aspects to consider include

- A trained medical person should be on hand
- There should be a chase person and vehicle for each jumper in the air - for off target landings. They can also confirm openings and watch where cutaway canopies land
- Provide a script for the announcer (names, number of jumps, claims to fame, canopy colors etc.) who would be preferably an eloquent jumper
- Have a crowd control plan - Individuals from the host group can be utilized for this
- Demonstration jumps require cool heads and the ability to make good decisions under pressure. "*The show must go on!*" is a dangerous attitude for an Exhibition Jumper. Do NOT base go / no-go decisions upon bravado.

Special Equipment Preparation

The Event host will often ask if the skydivers can jump with flags, smoke, or costumes. The jumpers will need to weigh the request from the host against their abilities and experience level and the complexity of the task requested.

A key point to note here are that prior to any demo jump you must **practice with any special equipment**. For example, the demo jump is not the time to find out that the glide angle of your canopy has altered considerably due to the drag from a flag.

Flags

There are at least two simple ways to store and display flags for demo jumps. The method generally relates to the size of flag:

a) Regulation and smaller flags

- These can be stowed and deployed from inside the jumper's suit and flown beside the jumper while under canopy.
- At the bottom leading edge of the flag, attach sufficient elastic bands to form a stirrup to go around your foot. At the top leading edge of the flag, attach sufficient elastic bands to comfortably slip over your hand and, with minimal force, create tension along the leading edge of the flag between your foot and your hand when flying the canopy in full flight mode. If you would prefer not to hold the top of the flag in your hand, attach a karabiner to the elastic at the top leading edge of the flag.
- Once you have donned your gear and checked it, s-fold the flag into the front of your suit, starting with the trailing edge and finishing with the leading edge. Place the leading edge near the top of your jumpsuit zipper so that it will be easily accessed under canopy.
- When you have completed your canopy check, you can take the foot loop and hook it around your foot, then put on the hand loop (or snap the karabiner to your riser).
- Once you have secured these loops, pull the rest of the flag out and let it stream behind you. This operation should only take thirty seconds or so, nevertheless pay very close attention to where you are relative to the landing zone!
- One advantage to this procedure is that on landing the jumper can keep the flag off the ground. This is good etiquette, especially when carrying national flags.

b) Weighted large flags

The second technique works for large flags that require weight to be suspended below the jumper.

- Obtain a large fanny pack, or have a rigger custom build one for you.
- The waistband and container of the pack must be able to support the flag and weight through canopy deployment.
- The pack also needs attachment points on the bottom to anchor the pack to your leg straps to keep it stable during free fall.
- The flag and weights must be properly attached to the rope. Again, consult a rigger.
- Have a large pouch firmly attached to the bottom of the rope capable of containing the weights.
- On the other end of the rope, attach a y-shaped piece of webbing. A single three-ring riser works well here. (The three ring attached to the top of the flag and the connecter link ends attach to removable d-rings.)
- Sew the flag to the bottom portion of the rope.
- You should have removable D-rings attached to your main lift webbing.
- Use a quick release snap to attach each end of the Y-webbing to the D-rings.

One more time, consult a rigger or someone who has experience in this type of jump.

To pack the flag into the pouch:

- Lay the flag out in its fully deployed configuration.
- Using s-folds the width of the pack, start at the trailing edge and s-fold to the rope (or 'spine') of the flag
- Fold the rope in half.
- Starting at the end farthest from weight, s-fold the rope and flag into the pouch. After it is in the pouch lay the weight and then the y-webbing on the top and seal the pack.

To deploy the flag:

- Open the pouch enough to pull out the y-webbing and attach it to the D-rings
- Next, pull the weight out of the pouch and lower it and the flag. Caution, if you drop the weight, you may burn your hands on the rope
- Once the flag is deployed, observe how well the flag is flying below you. If the flag is extremely distorted or bowed, you need a heavier weight.

c) Key points to remember when using a flag are:

- In the SFOC there will be a minimum altitude that you can fly over the crowd. This required separation from the crowd applies to the lowest part of the jumper, which may be the flag or the weights.
- A catcher should be used to preserve the dignity and integrity of the flag.
- A flag with weights will pendulum around dramatically affecting the parachute's ability to turn. The forward speed is also reduced, resulting in a steeper glide angle.
- The flag MUST be safely stowed for free fall.
- When using a flag there must be an easy release system in case the flag hangs up on an obstacle.
- The use of a flag requires practice jumps.

Smoke Bomb

Smoke bombs greatly enhance the visibility of the aircraft on jump run and the free fall portion of a demo jump. Smoke canisters are available from Paragear. Key points when using smoke are:

- A quick release metal foot bracket to hold the smoke canister MUST be used.
- The canister must be worn on the foot opposite the deployment side (usually on the left foot) to reduce the chance of entanglement during deployment.
- The foot bracket must provide good protection from the HEAT of the canister.
- Most smoke bombs last roughly one minute and the smoke itself can stain your equipment.
- If using the bomb to 'mark' the jump run pop the canister and quickly put your foot outside the door.
- Solo exits are recommended to avoid contact with the smoke bomb.
- If using the canister to highlight the canopy flight several smoke bombs can suspended below the canopy using a technique similar to that described for large flags.
- Remember don't hit the crowd with the smoke canisters.
- **Under no circumstances should a person use a canister labeled WP. This stands for white phosphorous, a non-metallic substance that burns white hot when exposed to oxygen.**

Flour Streamer
Flour streamers are simple, easy, and inexpensive. Take one or two 5 lbs. bags of flour in the aircraft. On jump run, liberally shake the bags of flour outside the door. The streamer will be visible from the ground. If well coordinated with the ground crew, it can be used for a count down to exit.

Final Comments
Typical of any public performance the degree to which preparation is addressed directly affects the perception and enjoyment of the performance by audience and performer alike. Some things are difficult to duplicate in any other situation, like the first time you recognize that the roaring noise that you are hearing under canopy isn't the wind; it's the audience roaring their approval. Can't you just feel the hair on the back of your neck standing up? Enjoy it, but don't let it distract you. They will cheer even louder after your tippy-toe landing awes them with the display of your mastery of skydiving skills. Good luck, and please assume responsibility for the image you project, as it affects the public's perception of our sport. As an integral member of aviation we seek acceptance and not alienation by our fellow aviation enthusiasts. Blue skies!

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SECTION 8: INTRODUCTION TO FREE FLYING - HEAD DOWN

INTRODUCTION TO FREE FLYING: HEAD DOWN

Flying head down is simply breathtaking. It offers you a completely new perspective on skydiving. Once mastered, you will find it is the most comfortable, natural position for your body in the air. You will find you have an unparalleled amount of control of your body's flight in the sky. Due to the speeds possible in this position, it is also one of the most dangerous body positions, especially when learning. High-speed collisions and corking could be deadly.

Therefore, this introductory section will only deal with basic head down control: flying straight down, turns and transitions. Later on, once you have learned head down control, you will learn the head down exit and VRW (vertical relative work)– flying relative to other free flyers while head down.

Basic head down control requires a high level of awareness in both body and mind, and is therefore not something you should rush into. If you have taken the time to properly develop your awareness and overall skills in the sit position, you are now ready to try flying head down.

Note: The suggested progression uses the sit position as the foundation of head down safety and fall rate maintenance.

The Starting Point

The recommendations prior to initiating head down flying are:

- B CoP
- 175 jumps
- Proficient overall sit flying skills.

Although an athlete with an A CoP could start head down flying, without a solid base in sit flying and good awareness in the sky, head down flying could be deadly.

Athletes wishing to concentrate on head down flying MUST have an audible altimeter or two since it is very easy to lose altitude awareness. Use them only as a secondary backup to a wrist altimeter; high speeds can make them impossible to hear. In the event that you did lose altitude awareness, an AAD can give you a last chance. Additional equipment considerations are discussed in the equipment section.

Preparation Skills

a) Awareness

Body Awareness

Flying stable head down requires that the body be symmetrical, coordinated and balanced. To do this properly, you will have to develop your body awareness. You will

train your body to have certain body parts flexed, while others are kept neutral. You will need to find a balance between being too floppy and too tense.

By developing muscle memory of the correct head down neutral position, practicing body coordination and balance, you will quickly be able to sense where the air is hitting your body and be able to make subtle corrections. It is highly recommended that you use a mirror for repeated feedback to ensure muscle memory of what is the symmetrical body position.

Practicing upper and lower body movements separately, then simultaneously will enhance your body's innate coordination when flying. Using balance beams and learning to perform headstands and handstands while being conscious of the head down neutral position will improve functional balance and thus your performance in the air.

Flexibility and strength training will increase your range of control for both fall rate and movement.

Mental Awareness

A good sense of relaxed situational awareness is a key to flying naturally, fluidly and above all, safely. Excessive stress levels will affect your ability to perform the neutral position properly. Breathing normally will help with stress management and a CSPA Coach will be able to assist you with other relaxation techniques.

b) Safety

Note: Your number one priority is to be ALTITUDE AWARE

Until you become stable when head down, you may move across large horizontal distances. There is therefore the danger that you will invade the airspace of groups exiting before or after you. To help guard against this:

- Exit in the sit position, and turn to hold a heading that is 90 degrees from the direction of the jump run
- Only hold a head down position for up to 8 seconds, then transition back to a sit position. You can count to 8, or simply run through a mental check of your neutral position, making corrections as you go. Head / shoulders, arms / chest, and hips / legs. By the time you go through the list, it should be around 8 seconds. Flip over back into a sit.
- Check your altimeter
- Again, ensure that you are pointed on a heading 90 degrees from the direction of jump run in your sit position
- Then transition back into head down (altitude permitting)

In-flight

Exit Order
Exit order must allow for adequate horizontal separation between groups. Head down flyers have a significantly higher fall rate than belly flyers and even sit flyers. Free flyers falling straight down will drift less than belly flyers in upper winds due to less exposure time. The general rule for exit order is:

- Large to small belly groups, large to small free fly, students, high pullers and tandems.

Free Fall

a) Transitioning from the Sit Position to the Neutral Head Down Position

Half Cartwheel:
This transition is recommended, since, when done properly, you will keep the horizon and/or your coach in sight.

Start

- Right: Keeping your eyes on the horizon, throw your hips to the left, while keeping your back straight (See Head Down Neutral Position section on lower body: Pelvis/ hips) and head centred on your shoulders. Pull your feet toward your buttocks, and lift your thighs up slightly more than 90 degrees. Bring your arms in a bit toward your body.
- Left: Keeping your eyes on the horizon, throw your hips to the right, while keeping your back straight and head centred on your shoulders. Pull your feet toward your buttocks, and lift your thighs up slightly more than 90 degrees. Bring your arms in a bit toward your body.

Coast

- As soon as you start rotating, get ready to enter the neutral position. The horizon should always be in sight, with the sky rotating to be below you.

Stop

- At 1/2 to 3/4 of the way through the 180 degree turn, spread your legs and open your body out into the head down neutral position. To help prevent over-rotation, lock your eyes onto the horizon and initiate the stop so that you will see the horizon straight across, and then try to keep it that way.

b) Instability Recovery

If you become unstable, return to the sit position.

c) Head Down Neutral Position

Your first goal when learning to fly head down will be to fly straight down, on heading. This is commonly referred to as “going down the tube”. It requires you to coordinate some muscles so that they are actively flexed, while holding others in place without excess tension or floppiness. To do this, you will need to learn the head down neutral position. The head down neutral position is designed to make your body as symmetrical as possible to maximize your stability. It is also designed to help counteract any muscular tension of which you are not aware that might affect your performance. Once achieved, the neutral position forms the foundation from which all elements of head down flying will stem.

PICS OF NEUTRAL POSITION HERE

Front **Side**

The neutral position can be broken down into two parts: the upper body and the lower body.

Upper Body
The upper body includes your head, neck, shoulders, arms and hands. A symmetrical upper body posture (all axes) is important for initial head down stability. Symmetry translates into efficiency, meaning that it will enable you to fly straight down with the least amount of effort. Symmetry will improve your body's aerodynamic profile and your ability to balance upside down. Flying efficiently, you will be more relaxed, aware, and it will make progression more successful. It is worth noting that it is common for new head down flyers to arch and / or to look for the ground, which both cause horizontal movement.

The neutral position requires correct coordination of many of your body parts. To improve your body's coordination you will have to practice, either on the ground or in the air. Practice each part separately until you master it. Then, work to put the parts together as a whole for an overall symmetrical body position. Your goal will ultimately be to transform your awareness of your many parts into one overall feeling of correct body posture.

Points for correct upper body neutral position:
Head

- Your head should be straight on the spine with the chin tucked in a bit. The straight head position is held in place without tension; relaxed but not floppy. Use mirrors to find this position and train your muscle memory to remember it.
- Your eyes are on the horizon, keeping it level in your field of view: ground above, sky below. This may help keep you in the head down orientation. Note that with your head straight on your shoulders, you may not have a good view of the ground. This may cause you to search for the ground in the air, causing asymmetry and movement.

Shoulders

- The shoulders should be centred. To find the optimal shoulder position, pull your shoulders back, pull them forward, shrug without clenching your neck, and then completely relax your shoulders. This is the desired shoulder position, even if your arms are extended to the sides. It may feel a bit like slouching or as if you are doing very little with them. This is correct. Make sure to isolate your shoulders during this exercise.

Chest

- The chest should be centred on your front-to-back axis, held in place without tension. To find the correct chest position, puff your chest (solar plexus) out and forward like a peacock, then pull it back, slouching as if you were tracking. These are the extremes of movement of your chest. The correct position is right in the middle of these extremes.

Note: Make sure your gear fits properly. If your container is tight around the shoulders, it may cause you to tense up and arch at the chest to relieve the tightness, thereby causing movement.

Arms

- Your arms should be out to the sides at around a 45 degree angle. Shoulder muscles flexed only outward, arms straight or slightly bent, angled downwards like the wings of a jet. Your arms should be held firm against the relative wind, without excess tension or floppiness.
- To find the correct arm position on the ground, start by completely relaxing only your arms. Your hands should be lightly touching the fronts of your thighs. (If your hands naturally seem to rest on the sides of your legs, you may be arching at the chest). Bring your arms out to the sides from this position. Use a broomstick to verify that your arms are on the same plane when extended as they were when relaxed, and check that they are not angling behind you. Use a mirror to check this.

Hands

- The hands are held lightly in their natural position as an extension of your arm. Air should slip through your fingers from the back of your hands around the vertex of the thumb and first finger. This may feel odd, as you are likely used to feeling the air on your palms. This is normal. Getting used to flying with your hands in this natural, efficient position will make some more advanced techniques easier later in your progression. It is ok to turn your palms into the relative wind if you have the coordination. Be aware, however, that this twisting motion of the forearm can lead to more general upper body asymmetry.
- Your hands should be visible in your peripheral vision. Holding your arms out to the sides with centred shoulders and chest will make the arms seem to go forward slightly. This is correct.

Note: Be aware that your much-practiced everyday posture (i.e. slouching, head forward, etc) can have an effect on your ability to perform the neutral position correctly. For instance, when you assume a relaxed posture, it may not be symmetrical. Or when you think you are making your back straight, you may be pulling back your shoulders or arching at the chest. You may need to retrain your everyday posture habits on the ground in order to attain the neutral position correctly in the air.

Lower Body

The lower body includes the pelvis/ hips, legs and feet. With a symmetrical upper body to work with, your lower body is used to help balance and stabilize your upper body on top of the relative wind by “tapping on the walls of the tube”. To understand this better, think about doing a headstand with a wall behind or in front of you. If you lost balance and began to fall toward the wall, you could use the wall to regain stability by pushing off it with your legs.

Points for correct lower body neutral position:
Pelvis/ Hips

- You will need to roll your pelvis forward using buttock muscles and lower abdominals. This is to help straighten your spine to aid upper body symmetry. Your body should be a symmetrical unit from shoulders to the hip joints. With the pelvis rolled forward, the chest can not arch. Note the difference between only rolling the pelvis forward and pushing the hips forward in the arch position.
- Your buttocks and sides of your hips are actively flexed to hold your legs out sideways for drag. This helps to keep you in the head down position by actively pressing against the relative wind.

Legs/Knees/Ankles/Feet

- The legs are out to the sides with no excess leg tension in the quadriceps. The knees are slightly bent; ankles pressing out to the sides. Your feet point forward with your heels pressing out to the sides.
- Knee, ankle and foot positions should be maintained without excess tension.
- In the air, it may help to think "heels out" instead of "legs".
- Experiment with the width of your legs. Wider is slower, narrower is faster.

When you are correctly in the neutral position flying straight down, you will feel a light pressure on the top of your head, pressure on your shoulders and along your arms. The horizon will be level in your field of view. The wind will be slipping through your fingers. There will be air pressure along the outsides of your legs and ankles. You should feel balanced and yet you will need to make constant small corrections with your body to keep this balance. If you feel wind on the front or back of your legs or feet, you may be moving forward or backward.

d) Forward and Backward Movement

Your legs will be your primary means for moving forward and backward in the head down position, especially when flying close to others. As you will discover, your upper body can be used to initiate and stop large forward and backward movement and understanding how the upper body affects your movement is the first step toward controlling it. Once you have your upper body under control and neutral, you can then move on to using your legs, which, again, will be your primary tools for movement as a novice head down flyer.

Use only small, slow movements so you can learn to fine-tune your balance. Aggressive movements can cause sudden instability, corking and extreme horizontal movement. The principle of start –coast – stop should be applied to forward and backward movement.

Using Upper Body

- Backward: pull your shoulders back slightly and / or slowly push your chest forward slightly while keeping eyes on the horizon, then resume the neutral shoulders and chest position.
- Forward: push the shoulders forward slightly, keeping eyes on the horizon, and then resume the neutral shoulders position.
- Moving the head forward or back slightly can also cause forward and backward movement.

Tip: Backward movement caused by shoulder or chest arching will cause air pressure on: the face, shoulders, chest and the front of the thighs. Forward movement caused by de-arching too much or leaning will cause air pressure on the back of your head, your upper back and calves. When learning to fly straight down, use your upper body to move *slowly* TOWARD the air pressure you feel. If this is done correctly, you will find an angle where there is no pressure. There will be a smooth layer of air in front and behind you. The sound will become smooth and high pitched. This is the "tube".

Using Lower Body

- Forward: From the neutral position, slowly bend both legs backward at the knee until you feel a light push from the relative wind on your calves and heels. Use only your legs – keep your pelvis in the neutral position and upper body symmetrical.
- Backward: From neutral position with a straight upper body, slowly push both legs forward simultaneously, just until you feel a light push from the relative wind on your shins and thighs. Use only your legs – keep your pelvis as in the neutral position and your upper body symmetrical.

Note: When you have found your upper body balance and are using your legs correctly to move, your upper body should remain straight and symmetrical into the relative wind, causing no air pressure on your back or front.

e) Turns

Turns can be initiated with elements of the entire body, including the shoulders, arms, hands and legs. Experiment with using various parts of your body to turn in different combinations around different axes. For the purpose of achieving stable, controlled, stationary turns about your centre of gravity (hips), it is best to use the legs.

Leg turns:

PIC OF LEGS FROM ABOVE

Start

- Left: From the neutral position, keeping your hips square with your torso, bring the left leg forward, while bringing the right leg backward. Only use your legs.
- Right: From the neutral position, keeping your hips square with your torso, bring your right leg forward, while bringing the right leg backward. Only use your legs.

Coast

- Hold the start position for about 1/3 of the turn then return your legs to the neutral position and get ready to "apply the brakes".

Stop

- At 1/2 to 3/4 of the way through the turn, counter the rotation by initiating a leg turn in the other direction.

f) Fall Rate Control

Stable head down fall rate control is achieved by varying the amount of surface area you present into the relative wind with your legs and arms. Use both arms and legs for fall rate control. However, focusing on legs-dominant fall rate control will help future development of fall rate control while docking.

Note: When learning, your fall rate will likely be fast. When you become able to slow your fall rate, you may notice that the air may seem to become more "bouncy" and less immediately responsive than fast air. You will quickly get used to this. Target fall rate speed for head down flight is 150-170 mph.

The principle of start –coast – stop should be applied to fall rate control.

Using Upper body

Fast

- Starting from the head down neutral position, bring your arms in to your sides. Remember, if your hands naturally seem to rest on the outsides of your legs when you do this, you are likely arching at the chest or shoulders. Hold this position to go faster.

Slow

- Starting from the head down neutral position, widen your arms and press forcefully into the relative wind with the sides of your biceps, the tops of your forearms and your hands. Maximum arm input is straight out to the sides at shoulder level, parallel to the horizon. Hold this position to go slower.

Using Lower body:

Fast

- Narrow your legs, reducing drag. Hold this position to go faster.

Slow

- Widen your legs to the sides as much as possible, pressing forcefully with your ankles against the relative wind. Grab more air by hooking your feet into the wind. Hold this position to slow down.

The Head Down Daffy Position

Using the daffy position, you can comfortably achieve maximum fall rate control range while head down. However, it is not a very efficient position for moving forward and backward quickly since one leg is already forward or back.

PIC OF DAFFY POSITION FROM TOP

Upper body:

- The upper body position is the same as for the neutral position previously described. For maximum drag, widen your arms as much as possible at shoulder level and press forcefully into the relative wind. Hold this position to go slower.

Lower body:

- One leg is put forward from the body, while one leg is put back.
- To get an idea of a basic position for the legs, keep your torso straight as in the neutral position and get down on one knee. The thigh of your front leg will be parallel to the floor, knee bent at 90 degrees, foot flat on the floor. The thigh of your other leg will be perpendicular to the floor, knee bent touching the floor, calf parallel to the floor, heel pointing toward the ceiling.
- Now, support yourself with your arms on a table or chair and bring the back knee off the floor, making all the bent angles of both legs 90 degrees. Only the toes of your back foot should be resting on the floor.
- Tuck in your pelvis as in the neutral position.
- To decrease fall rate, symmetrically straighten your legs forward and back. To maximize use of surface area along the sides of the legs, widen your legs while straightening them. This will cause your front leg to be forward and 45 degrees to the side, while the back leg will be back and to the other side at 45 degrees. It will take practice to not induce a turn. Flexibility training will help attain this position properly.

g) Transitions

Front Loop

Start

- From the head down neutral position, bring in your arms and legs to shoulder width for half a second to increase speed before throwing your head forward and down. Simultaneously de-arch at the chest, bending at the waist while retracting the legs, bending the calves back under the knees. Bring your head down to almost touch your knees. Your body will be in a tuck position. Initiation should be done rapidly to maximize the momentum of the rotation.

Coast

- Hold your body in the tuck and anticipate the feeling of resumed air pressure on your head and shoulders from above. Anticipate the horizon coming back into view. For side-to-side stability during the rotation, keep your arms out to the sides. Get ready to open up into the neutral position.

Stop

- At about 2/3 of the 360 degrees through the loop, when you start seeing the horizon, lock onto the horizon with your eyes while unfurling your lower body and straightening into the neutral position. If you had too much initiation or held the tuck too long, you may over rotate onto your back and cork. You may have to experiment with the timing of when to open up.

Back Loop

Start

- From the head down neutral position, bring in your arms and legs to shoulder width for half a second to increase speed before throwing your head backward. Simultaneously arch at the chest, while retracting the legs, bending the calves back under the knees. Keep your arms to your sides for stability. Your body will be in a tuck position. Initiation should be done rapidly to maximize the momentum of the rotation.

Coast

- Hold your body in the tuck and anticipate the feeling of resumed air pressure on your head and shoulders from above. With your head back, you can more easily anticipate the horizon coming back into view. Get ready to open up into the neutral position.

Stop

- At about 2/3 of the 360 degrees through the loop, when you start seeing the horizon, lock onto the horizon with your eyes while unfurling your lower body and straightening into the neutral position. If you had too much initiation or held the tuck too long, you may over rotate onto your front and cork. You may have to experiment with the timing of when to open up.

Cartwheel:

Start

- Right: keeping your eyes on the horizon, throw your hips to the left, keeping your back straight, and head centred on your shoulders. Pull your feet toward your buttocks, and your thighs up slightly more than 90 degrees. Bring your arms in a bit toward your body.
- Left: keeping your eyes on the horizon, throw your hips to the right, keeping your back straight, and head centred on your shoulders. Pull your feet toward your buttocks, and your thighs up slightly more than 90 degrees. Bring your arms in a bit toward your body.

Coast

- Hold the semi-tucked position. You will see the horizon flip end over end. If you do not see the horizon, you may have initiated the rotation off the axis of your centre of gravity.

Stop

- At about 2/3 of the 360 degrees through the cartwheel, lock onto the horizon with your eyes and open up again into the neutral position. Anticipation of the correct moment will help.

Note: When doing transitions at very high speeds (170-200mph) fall rate changes may become more pronounced. It is recommended that transitions be done at speeds within the “normal” range.

h) 2 way Break-Off (with a coach)
When flying with a coach, you will need to execute proper break off procedures for VRW in small groups. Break off procedures for head down flying are normally done between 5500 and 4500 feet due to the need to slow down before deployment and achieve adequate horizontal separation. Make sure to track 90 degrees off the line of flight. At the beginning, there may be a larger vertical separation than when belly flying. Be aware of where your partner is in the sky.

- Return to the sit fly position, drive away from your coach for a moment and

Either

- Execute a cartwheel, to a steep delta dive away, to a gradual flat track

Or

- Drive away slowly, turn 180 and use your upper body to move you gradually forward onto your back, then flip over onto your belly and track away.

Break-off must be done smoothly to make sure fall rate slows down smoothly and to prevent high-speed collisions.

Canopy Control
After slowing down your fall rate, deploy your parachute in the stable belly to earth body position. Failing to slow down may result in extremely hard openings or a blown up parachute.

Equipment

a) Jumpsuit
A free fly jumpsuit will give you a good amount of all around drag. A jumpsuit that is baggier will provide more drag for fall rate control, according to your body type. However, it is not recommended that you rely on a jumpsuit to help you fly.

Wearing comfortable pants and a tee shirt is sufficient for flying head down. Make sure you tuck in the shirt tightly so it does not ride up and cover your handles.

b) Harness and Container
To ensure safety and guard against unexpected and potentially fatal high-speed deployments your free fly safe gear must have:

- Full riser covers. If Velcro, make sure it is in great shape.
- BOC or Positive Pullout deployment system with bridle cover. Tuck more bridle than usual under the main flap to anchor it in place.
- Main and Reserve flaps that stay closed.
- A tight closing loop in perfect condition.
- A reserve rated for your weight or higher.

c) Audible Altimeter

Audible altimeters, (one or more) must be worn on head down jumps to help ensure altitude awareness. They should only be used as a secondary backup to your wrist or chest mount altimeter. They can be mounted inside a protective hard shell helmet, which is also highly recommended.

Training Program

The key to effective progress is setting small, achievable goals and working your way systematically toward achieving larger goals. Concentrate on performing each technique correctly. Dirt dive often and practice mental imagery. Try to stay positive in your progression. If you get discouraged, get a coach to help guide and motivate you. Above all, be patient and have fun. Every jump you make is a useful experience in learning to fly head down.

The following program consists of 65 jumps and assumes that all jumps are made from 10,500ft. The exact number of jumps it takes you to master each skill may vary, depending on your level of skill, concentration and awareness. Once you are able to perform a stage at 90%, move on to the next stage.

Stage 1 - Transitions from Sit to Head down and Recovery from instability (5 jumps)

Goals:	• Gain body awareness • Practice transitioning to head down • Practice recovering from head down instability using the sit position. • 2 head down attempts per jump.
Drill:	• Sit exit. Turn off the line of flight. 1/2 cartwheel to head down, hold up to 8 sec. Check neutral position. Return to sit, check altitude and heading, repeat.

Stage 2 - Neutral Position: Upper and Lower body Awareness. (8 jumps)

Goals:	• Gain awareness of effect of upper and lower body movement on flight. • Hold the head down position for up to 8 seconds. • 2 head down attempts per jump.
Drills:	Upper Body: • Sit exit. Turn off the line of flight. Transition to head down, hold for up to 8 sec. **Slow, small and deliberate** chest de-arch and arch movement. Return to sit, check altitude and heading, repeat - 2 jumps • Sit exit. Turn off the line of flight. Transition to head down, hold up to 8 sec. **Slow, small and deliberate** shoulder de-arch and arch movement. Return to sit, check altitude and heading, repeat - 2 jumps Lower Body. • Sit exit. Turn off the line of flight. Transition to head down, hold up to 8 sec. **Slow and deliberate** lower legs forward and backward movement. Return to sit, check altitude and heading, repeat - 2 jumps • Sit exit. Turn off the line of flight. Transition to head down, hold for up to 8 sec. **Slow and deliberate** whole leg forward and backward movement. Return to sit, check altitude and heading, repeat - 2 jumps

Stage 3 - Neutral Position: Flying down the tube. (10 jumps)

IMPORTANT: Before holding the head down position for any time over 8 seconds, you must have, while in the head down orientation, awareness of both the altitude and that you are keeping a heading 90 degrees off the line of flight. The best way to verify this is with a coach.

Goals:	• Gain awareness of "the tube" • Hold stable head down position for 15 seconds.
Drills:	• Sit exit. Turn off the line of flight. Transition to the neutral position for 10 seconds. Return to the sit position, check heading, repeat if time available - 5 jumps. • Sit exit. Turn off the line of flight. Transition to the neutral position, hold for 15 seconds. Return to the sit position, check altitude and heading, repeat - 5 jumps.

Stage 4 - Fall Rate Control (6 jumps)

Goals:	• Hold stable head down position for entire dive. • Learn fall rate control with upper and lower body. • Start learning the daffy position.
Drills:	• Sit exit. Turn off the line of flight. Transition to head down. Bring arms close to body. Hold for 4 seconds. Widen arms as far as possible and hold for 4 seconds. Return to the neutral position and check altitude. Repeat - 2 jumps. • Sit exit. Turn off the line of flight. Transition to head down. Bring legs to shoulder width. Hold for 4 seconds. Widen legs as far as possible and hold for 4 seconds. Return to the neutral position and check altitude. Repeat - 2 jumps. • Sit exit. Turn off the line of flight. Transition to head down. Attempt the daffy position with left leg forward, right leg back. Hold for 8 seconds. Return to the neutral position and check altitude. Repeat with right leg forward, left leg back - 2 jumps.

Stage 5 - Heading Control: Turns (4 jumps)

Goals:	• Controlled centre turns using legs and arms/hands. • Turns return to original heading. • 2 controlled turns per jump.
Drills:	Legs: • Sit exit. Turn off the line of flight. Transition to head down. Maintain stability. Leg centre turn left (right leg pushes back, left pushes forward.) Check altitude. Repeat - 2 jumps. • Sit exit. Turn off the line of flight. Transition to head down. Maintain stability. Leg centre turn right (left leg pushes back, right pushes forward.) Check altitude. Repeat - 2 jumps.

Stage 6a - Transitions: Loops (4 Jumps)

Goals:	• Controlled on-heading loops • Fall rate maintained throughout loop • 3 loops per jump
Drills:	• Sit exit. Turn off the line of flight. Transition to head down. Maintain stability. Front loop back to neutral position. Check altitude. Repeat - 2 jumps. • Sit exit. Turn off line of flight. Transition to head down. Maintain stability. Back loop to neutral position. Check altitude. Repeat - 2 jumps.

Stage 6b - Transitions: Cartwheels (6 Jumps)

Goals:	• On-heading cartwheels • Fall rate maintained throughout cartwheel. • 3 cartwheels per jump.
Drills:	• Sit exit. Turn off the line of flight. Transition to head down. Maintain stability. Left cartwheel back to neutral position. Check altitude. Repeat - 3 jumps • Sit exit. Turn off the line of flight. Transition to head down. Maintain stability. Right cartwheel back to neutral position. Check altitude. Repeat - 3 jumps

Stage 7a - Combinations: Turns and Loops (6 Jumps)

Goals:	• On-heading transitions. • Fall rate maintained throughout transitions. • 2 combinations per jump, checking altitude in between.
Drills:	• Right or left turn / front loop - 3 jumps • Right or left turn / back loop - 3 jumps

Stage 7b - Combinations: Turns and Cartwheels (8 Jumps)

Goals:	• Controlled on-heading transitions. • Fall rate maintained throughout transitions. • 2 combinations per jump, checking altitude in between.
Drills:	• Right turn / left cartwheel - 2 jumps • Left turn / right cartwheel - 2 jumps • Right turn / right cartwheel - 2 jumps • Left turn / left cartwheel - 2 jumps

Stage 7c - Combinations: Loops and Cartwheels (8 Jumps)

Goals:	• Controlled on-heading transitions. • Fall rate maintained throughout transitions. • 2 combinations per jump, checking altitude in between.
Drills:	• Front or back loop / left cartwheel– 2 jumps • Left turn / right cartwheel– 2 jumps • Right turn / right cartwheel– 2 jumps • Left turn / left cartwheel– 2 jumps

Problem Solving

Be patient and positive when progressing in head down flying. Stability requires symmetry, coordination and balance. If you get frustrated, take a break from your progression and do something else. You may find that skills learned on your dives may start to become more automatic if you leave them alone for a while.

As an individual, your innate level of physical and mental awareness will differ from other jumpers. Awareness training including coordination and balance training will benefit jumpers of all abilities. For instance, use a mirror to train your body's muscle memory of a symmetrical position. Use a pool or trampoline to help with balanced execution of loops, turns and cartwheels. Enhance your dirt diving through the practice of visualization.

Use a coach and get your jumps on video. Coaches can spot problem areas and help prevent bad habits so get coaching from the pro's whenever possible. Once again, remember altitude awareness!

Be safe and have fun.