PARACHUTIST INFORMATION MANUAL

PIM 2A
Basic Skills

The Canadian Sport Parachuting Association
(C.S.P.A.)
300 Forced Road
Russell, Ontario
Canada
K4R 1A1

http://www.cspa.ca/

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FORWARD

This 2009 version of PIM 2A is a re-edit of the 1993 version. It is now in an electronic format that will permit more timely updating, change tracking and distribution on the web. Everyone who reads this manual is asked to please send in suggestions, comments, updates, new ideas and technical advancements that will keep your manuals on the cutting edge and leading the skydiving world. Submission of graphics is encouraged. This is a living document and will only grow with your input.

If you have questions, suggestions, corrections or additional material relevant to this manual, please forward to cwc@cspa.ca so that your ideas can be incorporated.

ABOUT THIS MANUAL

The purpose of this part of the manual is to provide the student and novice skydiver with relevant information for progression through the Basic Skydiving skills grid and in preparation for the A CoP exam, hence the name "Part A - Basic". PIM 2 Part B-Recreational contains relevant information for the B CoP and PIM 2 Part C deals with advanced topics.

The manual is laid out in the order of preparation, equipment, in-flight, freefall, and canopy control skill, and is closely related to the Basic Skydiving Skills Grid. Technical knowledge is provided at the end of the relevant section. In addition, there are sections on self-supervision, emergency procedures, medical aspects of skydiving, and the history of our sport in Canada.

The section on the History of Parachuting has been removed from this manual and is available on the CSPA website at http://www.cspa.ca/en/history.html .

Up-to-date technical information and resources, available on the CSPA Website, http://www.cspa.ca/ , supplement this manual.

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1.1 SKILL AQUISITION MODEL

This manual presents the information to be learned through a standard skills progression to obtain the CSPA A CoP. The skills that you will need in the progression are broken down into the following phases:

- Preparation skills
- Equipment skills
- In-flight skills
- Freefall skills
- Canopy control skills, and
- Technical knowledge.

This model provides guideline to skill development, with each stage building on the skills acquired on previous jumps.

While this manual provides the "how to" information , a Coach's or Instructor's presence is required to facilitate the acquisition of these skills, provide feedback and help you to progress in a safe environment without developing potentially unsafe habits.

1.2 Skills Grids

The Skills Grid represents the progression method from the Student level through to the Solo Certificate and A CoP level to the B CoP. Each section represents the general sequence of progression as has been based on many years of experience. It is recommended that you progress in the order presented. While you may progress more quickly in one phase versus another, you will need to finish each section in order to be fully ready to attain the relevant CoP.

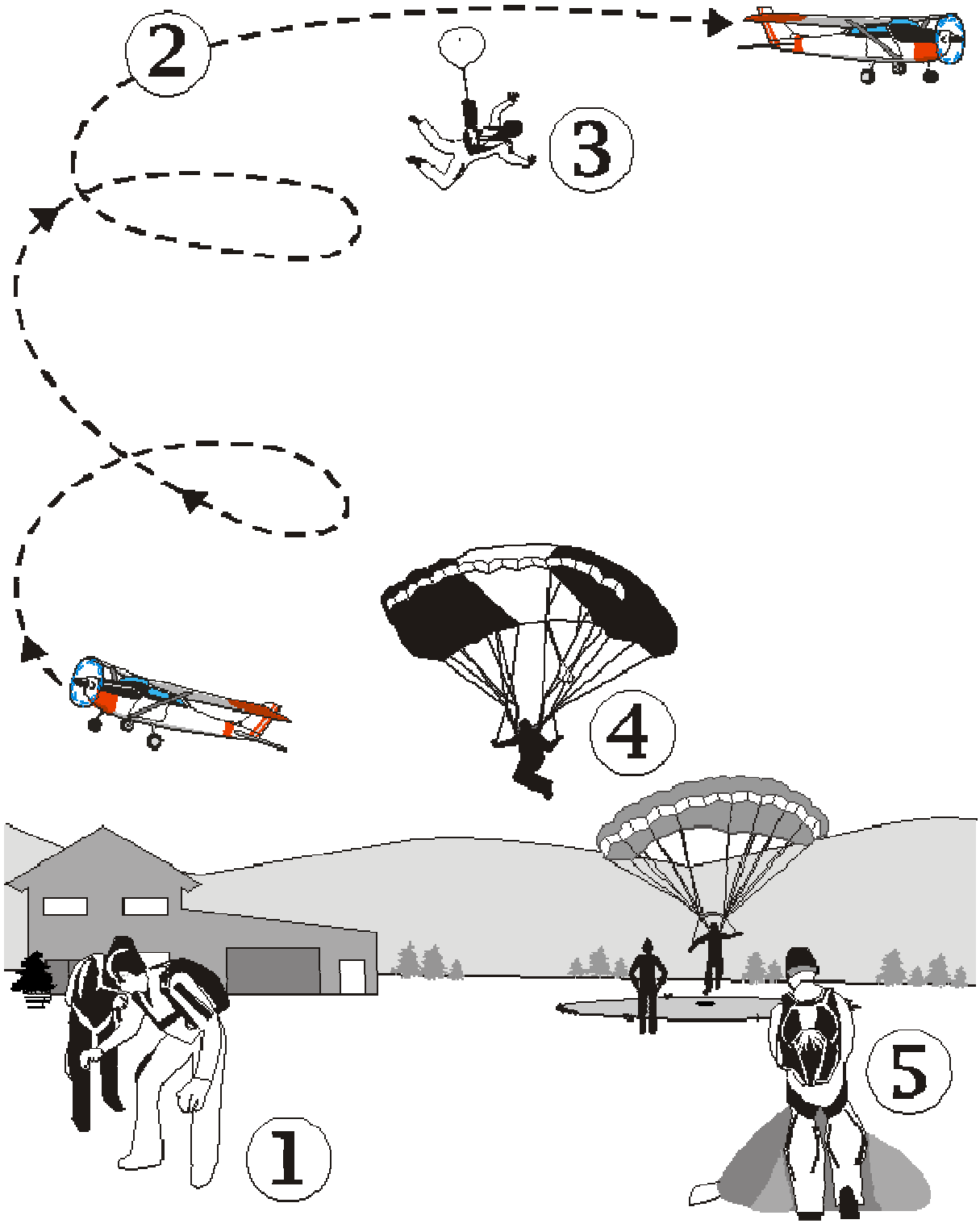
The Skills Grid is arranged in the order of tasks for each phase or column. Once you identify which level you are at, continue down the grid to find the next skill that you should be working on.

When using the grid, it is worth noting that:

- The grid is set out vertically, from simple to more complex
- When using the grid it is not necessary to be at the same level in all skill areas (or phases) – there is no need for horizontal parity
- The information that you require in order to do the skill is presented in PIM 2A.

- As you progress through the skills grid, some of the tasks will be repeated. As you gain experience, you must improve the quality of your performance of a task and refine the details of the skill once the fundamentals have been mastered.
- Skills presented later in the progression usually require that you have achieved some competence with the preceding skills in the grid.

The sixth phase of the grid that you should know as you gain experience is Technical Knowledge. Included are subjects such as why certain actions have a certain result and the recommended procedures when faced with unusual circumstances in the aircraft, in freefall, under canopy, or while preparing for a jump.



CSPA Skills Progression Grid					
Progression of each of the 6 areas are independent of each other, however all stages must be completed prior to receiving your CoP.					
PREPARATION Section 2	**EQUIPMENT Section 3**	**IN-FLIGHT Section 4**	**FREEFALL Section 5**	**CANOPY CONTROL Section 6**	**TECHNICAL KNOWLEDGE Sections 2 - 6**
PRE-LEVEL.....First Jump Introduction.....SSI					
Physical rehearsal	Components and function Activation of reserve *<Emergency procedures Endorsement>*	Seating and movement Assisted exit	Wide spread arch	Canopy identification Flight control check Guidance response Observation of surface winds Landing techniques Ground Control Assisted	Unusual situations: in-flight under canopy on ground
Student Progression to Solo.....Jump Master or PFFI					
Relaxation Mental Rehearsal Recall and Awareness Self-evaluation Self directed instruction	Altimeter setting and mounting Gearing-up procedures and adjustments Setting audible altimeter Setting AAD Full Gear Checks Packing: introduction	Pre-exit handles check Verbal Review Ground Orientation Spotting - Observed Spotting - assisted Pilot briefing Spotting unassisted	Box position Observation circle Altimeter use Activation Heading control Arm exercise Leg exercise 90/180 Turn left/right (Vertical axis rotational control) 360 Turn left/right (Vertical axis rotational control)	Spiral Turns (Full glide turns) above 2000' Ground Control - Partial Assistance Observation of drift Ground Control – Unassisted Stall practice & Recovery (above 2000') Rear riser turns Basic Landing pattern Flat Turn Turbulence	Box position Unusual situations in freefall Theory models: spotting freefall control freefall math canopy flight (straight, turns, stalls) freefall control 360° turns
SOLO Check-out … Jump Master, PFFI					
Goal Setting	*Component Identification*	*Ride the Slide*	*Solo Check-out Jump*	*Basic Landing pattern*	*<Solo Emergency Procedures Review>*
SOLO CERTIFIED					

PREPARATION	EQUIPMENT	IN-FLIGHT	FREEFALL	CANOPY CONTROL	TECHNICAL KNOWLEDGE
Novice Progression -The Basics.....Coach 1					
Warm-up & Stretching	Packing: assisted	Exits (e.g. dive, rear float)	Back loop(360° lateral axis rotation)	Rear riser spirals (above 2000')	Theory models:
Concentration	Packing: unassisted (observed)	Exits (e.g. poised, front float)	Front loop (360° lateral axis rotation)	Line of Flight Approach	freefall control-back loops
Anticipation	Packing: clearing entanglements	Intentional unstable exit	Barrel Rolls R/L (360° longitudinal rotation)	Set-up assessment	line of flight approach
Solo dirt dive (Sequence preparation)	Equipment Inspection while packing	WDI, Meteorological Report	Delta, Delta Dive	Front riser turns	freefall control-front loops
				Flat turns	freefall control-rolls
				Set-up assessment with line of flight	<Night Endorsement> [optional training]
Novice Progression - Advanced.....Coach 2					
Fitness	<Packing Endorsement>	Dive to delta exit	Basic Solo Free Style, Artistic and Inverted Flight E.g. French roll, stag, T, daffy, sit, stand-up	Stall turns	<water endorsement> [optional]
Dive planning	Deployment control techniques	Floater track exit	Combined manoeuvres	Angle control on approach	
Relaxation - advanced	Accessory equipment	Rate one turn	Style and manoeuvre series	Assessing/critiquing a canopy approach	Model for accuracy approach
Mental training techniques	Jumpsuit selection	Downwind spotting	1:1 Formation Skydiving	Riser manoeuvres	Advanced FS body position (mantis)
	Use of weights	Spotting for FS	Pin practice with proximity	Front Riser Spirals	*<Sport Canopy Review A>*
		1:1 tight exits	Break off procedures	Rear Riser Flare/Stalls (above 2000 feet)	*<Emergency Procedures Review A>*
		Rehearsal with relaxation	Level control Docking procedures	Avoidance techniques	
A - CoP completed					

PREPARATION	EQUIPMENT	IN-FLIGHT	FREEFALL	CANOPY CONTROL	TECHNICAL KNOWLEDGE
Intermediate Skydiver Progression.....Coach 2 / Coach 2DS					
Memorization	Variations to packing techniques	1:1 tight exits	Freefall grips	Rear Riser flared landing	Model for three turn types
Group Dirt diving			Turn and dock	Assessing weather	Model for group freefall
Dive planning (review)	Routine maintenance		Side slide and dock	Assessing terrain	Model for group exits
Stress control	Storage practices	Exit order	Diagonal dock	FS approach/rules, group approach	FS rules and courtesies in freefall
Self-directed skill development	Equipment seminar	Small group exit, no grips	Super positioning	S-turn	Equipment servicing
Dirt diving - review		Small group exit, with grips	Relativity control	Sashay	Maintaining the fall rate
Goal setting techniques review: SMART, short, long term goals		First formation exits	Flying base	Parallel canopy flight	Safety for Group FS
		Large aircraft loading and spotting	Partner sequential	Large group pattern approach	Equipment characteristics and selection
			Advanced solo skills		*<Sport Canopy Review B>*
			E.g. Sit/Inverted 360 degrees		*<Emergency Procedures Review B>*
			Flat track Group FS Long swoop Floater tracking Recovery *<Group Endorsement>*		
B-CoP completed					

SECTION 2 PREPARATION: Mental and Physical

Previous: Section 1 - Introduction .....Next: Section 3 - Equipment

2.1 INTRODUCTION

What should you do in order to prepare for your next jump? Basic preparation skills involve activities that should become habits for you at an early point in your jumping career as they build the foundation for successful skydiving.

There are two basic types of preparation skills – physical preparation and mental preparation. Physical preparation includes stretching and warming up, dive planning and rehearsing the manoeuvres you are going to do in the sky on the ground (this is commonly referred to as “dirt diving”). Mental preparation includes learning to relax, visualizing or mentally rehearsing the skydive and developing concentration and anticipation skills.

2.2 PHYSICAL PREPARATION

2.2.1 Physical Rehearsal – the Dirt Dive

A walk-through of each phase of a jump is called a physical rehearsal, or more commonly, a dirt dive – simulating your in-air activities while on the ground. The dirt dive can begin with aircraft seating arrangement planning, climb-out practice and exit practice, freefall manoeuvres and canopy drills. Initially the rehearsal is done without gear but jump suits might be worn for visual recognition. The emphasis is on physical movements and your points of view for orientation and decision-making.

Final rehearsal prior to any jump should be done with full equipment at least once prior to boarding the plane. The final rehearsals are performed at real speed, in real time and with no prompting or correction. The way you practice on the ground is, generally, what will happen in the air during the actual skydive.

2.2.2 Warm Up and Stretching

A warm-up before each jump day, and every jump, is a good idea. There are many exercise programs available, and some individuals will have received training in how to stretch through involvement in another sport. The skydivers' benefit from a warm up includes:

- improved flexibility and agility
- the possibility of reduced injury
- increased energy/arousal

An example of a sequence for a warm-up begins with some light jogging or other activity that raises the body temperature. Once the muscles are warm, begin stretching at the extremities (fingers, toes) and work to the center, working joint by joint and stretching the

major muscles along each limb. When stretching, remember to start slowly; to stretch and hold each movement (10 seconds for small muscle groups, 30 seconds for large muscle groups), and to work through a full range of motion at each joint. Avoid bouncing to force the range of motion and avoid stretching when your body is cold. If sharp pain occurs - STOP. Wear clothing that keeps you warm and comfortable and that allows a full range of motion.

Following are some general comments pertaining to the warm-up and stretching programs:

- warm-up with a light jogging activity or skipping and wear appropriate clothing
- the sequence for the stretches is to start at the extremities, and work to the centre, working joint to joint inward along each limb
- start slowly; stretch and hold each movement, 10-30 seconds depending on muscle size
- work through the full range of motion for each joint
- make it a habit; stretch every day, and before each jump
- stretching without bouncing, as this can tear the muscle
- if it causes pain, stop!
- allow time after a meal before warming up.

Power activities such as sit-ups and push-ups should appear near the end of the warm-up and stretching. These activities tighten the muscles and are best performed after some degree of warmth has been achieved throughout the muscular system.

2.2.3 Fitness

Increased balance, flexibility, agility and strength can make a significant difference to our overall skydiving. A full day of skydiving can tax a person's strength and endurance. Some key things to note are:

1. Stretching prior to jumping allows you to retain more mobility after sitting in the aircraft and can reduce the chances of injury after a bad landing.
2. Food and water are required to get through the day.
3. Our bodies use micronutrients/vitamins in the production of adrenaline.

4. Self-induced stress, such as lack of sleep, can greatly affect the quality and safety of the skydive.

2.2.4 Dive Planning

Properly planning your next skydive is a very important step to the quality of your jump. Proper planning allows you to stay on track with your set goals, keeps your jumps measurable, keeps your jumps safe and more importantly, fun.

It does not matter if you are jumping by yourself or with a group of 20. Each skydive has to begin with a plan.

Step One: Decide What You Are Going To Do On Your Skydive

The first step is to decide what you are going to do on this jump. Are you going to do a solo dive and practice front loops? Are you going to do a 2-way with a Coach 2?

Step Two: Determine the Details

The second step is to plan your skydive in a more detailed way. During this step, you should determine:

- The spot (or, where you are going to leave the aircraft);
- The amount of time required between exits;
- How you are going to exit the aircraft;
- The sequence of manoeuvres in freefall and under canopy;
- The points in the sequence of manoeuvres where you will check your altimeter;
- The break-off procedures (including break-off altitude, general tracking direction and canopy deployment altitude);
- Your intended landing area, and the flight path you will need to get there;
- Who you need to watch your skydive (for example, you may need a videographer to capture your free fall manoeuvres or a Coach to watch your landing); and,
- How you will measure success and identify areas for improvement.

Step Three: Equip Yourself

The third step is to make sure you have all of your equipment needed for a successful skydive in one place. Decide which jumpsuit and rig you will use. Ensure that your visible altimeter is zeroed and that your audible altimeter is set for the desired altitude. Turn on your Automatic Activation Device. Gather any “extras” you may need for the jump, such as weights.

Now that the equipment and preparation is done, it is time for rehearsal, including exit, freefall break off and canopy control.

2.3 MENTAL PREPARATION

2.3.1 Relaxation - Basic

Skydiving can certainly feel unnatural when you first start in the sport. It is common to be nervous on the climb to altitude, when the door opens and when the people in front of you fall away. There are a few techniques you can use to help you relax which will help you to focus on the technical aspects of the jump. Here are two exercises that may help you relax:

1. Take three deep, controlled breaths. Slowly inhale fully, pause for a second or two, then exhale slowly; repeat three times. As you exhale, think "relax..." The result should be a noticeable reduction in both respiration and heart rate. This technique should be introduced and practiced initially in relatively quiet surroundings. This takes time and practice to learn to control effectively!
2. Picture a very relaxing scene (e.g. Relaxing on the beach) while taking deep breaths.

These techniques should be introduced and practiced, initially, in relatively quiet surroundings. Do not expect instant success, but takes practice, just like everything else. In time, one will be able to invoke this relaxation response even in a noisy environment, such as on the airplane.

2.3.2 MENTAL REHEARSAL

Mental preparation is about training the mind to work *with* the body in a variety of sport situations, and training it not to work against it. Mental Rehearsal should augment the physical practice of the skydive (e.g. dirt dive). By visualizing yourself properly executing the various stages of the skydive or the emergency procedures, you greatly improve the likelihood that the skydive will be successful or that you will respond correctly in the event of an emergency. It helps you remember the sequence of events in your next skydive as well as the physical movements required for each manoeuvre.

While mentally rehearsing, you should review the major events or manoeuvres within the jump in the planned sequence. You should focus on instances when there is increased stress or limited time, such as:

- Exit, including set up position, how you will stay with the airplane until the launch, and how you will launch;
- Freefall skills, including the sequence of manoeuvres you will perform and their initiation moves;
- Break-off and deployment, including break-off altitude, direction of tracking, and deployment altitude;
- Emergency procedures, including procedures for handling total and partial malfunctions;
- Canopy drills, including the altitude at which you will cease these activities; and,
- Your planned flight path back to the drop zone, including wind checks and your planned landing direction.

You should mentally rehearse:

- After a skill instruction
- After gearing-up
- During the climb to altitude, at pre-determined altitudes

When you mentally rehearse, you should:

- Recall events in proper sequence: close your eyes and visualize yourself in the dive. You may want to do this from the first person and the third person perspective. Visualize yourself performing the manoeuvres successfully;
- Rehearse the skydive in its entirety, from climb-out to landing;
- Imagine the event at the approximate rate of the real-life performance, then faster and slower; and,
- Imagine the sensations of each action.

2.3.3 Recall and Awareness -- Self Evaluation

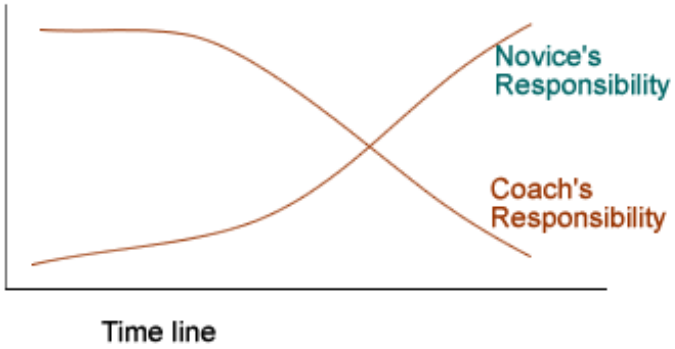
Recall is an important skydiving skill because it helps you to analyse what you did, which will help you find areas for improvement. From your very first jump, you are encouraged by your Instructor to develop the ability to recall the events of the exit, freefall and canopy descent after the jump is completed. A few tips will contribute to success:

1. After you complete your jump, sit quietly for a few minutes, reflecting upon the events of the jump, making written notes as needed. This will increase the level of detail remembered.
2. Break down the sequence of events in your head, or on paper. Think about the exit, freefall and canopy stages of the skydive.
3. Talk to your coach. They can assist by asking questions, adding their feedback, and clarifying the events of the jump as they actually happened.
4. Finally, relax and let your mind wander between concentration periods. Once you have been distracted for a period, try review the dive again.

Focus on what was done correctly. Keep it positive!

2.3.4 Self-Directed Skill Development

By the time you achieve your Solo CoP, you will have a firm grasp of the basics of skydiving and must be capable of functioning on your own, hence the responsibility of progression switches more to yourself. However, you need to be aware of your limitations. You should know how to get assistance from qualified Coaches, and how to make use of the PIM's. As you progress beyond the Solo CoP, you will gradually be taking more responsibility for your own acquisition of skills and skydiving information.



It becomes your increasing responsibility to arrange for coaching prior to manifesting for your next jump. An Instructor will initially supervise your jumps and progression to the Solo CoP. A Coach 1 will help you to acquire basic skydiving skills. A Coach 2 will teach you how to fly relative to other people and to better control your canopy. All Coaches help recreational skydivers improve their skills by helping to set goals for performance.

How will you know what needs to be done next? Ask yourself the following questions:

- Who can coach me? Who on the DZ has the appropriate rating to help?
- Who is available today? Find what staff are available by asking the manifestor.
- What is the next step? Look at the Skills Grid. Where are you now in your progression?
- Is there a supplemental training guide? Does your DZ have a written program for progression?
- Where can I get a copy of the PIM's, etc.? http://www.cspa.ca/

Coach 1 (CAC Instruction Beginner): The Coach 1 assists Solo and higher Certificate of Proficiency (CoP) holders to acquire basic skills for individual skydiving on a daily basis. The Coach 1 has the most up to date information on "how" to coach, making them a strong initial resource.

Coach 2 (CAC Instruction Intermediate): The Coach 2 assists experienced novices working toward their A CoP and recreational skydivers working toward their B CoP achieve an advanced level of overall skill development by setting goals for performance.

This type of coach helps participants refine basic skills, and introduces a variety of more complex techniques to individuals who already have some experience in the sport and who already exhibit a fair degree of proficiency in the activity. The coach provides more "customized" instruction based on the individual performance characteristics of each participant.

Coach 2DS – Discipline Specific: The Coach 2DS will be introduced in 2009. They are specialized experts in a specific area of the sport, such as:

- Formation Skydiving (4 way, 8 way)
- Artistic Events such as free flying and free style
- Canopy Formation (aka CRW)
- Style and Accuracy

2.3.5 Goal Setting

As you probably already know, there are many different skydiving disciplines. In order to become proficient in any skydiving discipline, you must set long-term and short-term goals. Once you determine a long-term goal a Coach will be able to help you determine short-term goals for the weekend, the month, and the season. Consulting with your Coach and setting goals will provide direction and help keep you motivated in the sport.

As an athlete, you will be better able to describe your goals when you ask yourself, and answer, the following questions:

- What is it I really would like to achieve?
- How can I achieve it?
- When would I like to achieve it?

At the beginning of your skydiving progression, your coaches and instructors had set goals that you achieved before moving on. As you take on more responsibility for your own progression, you will start to recognize where your skills are now (your starting point) and to establish the long-term goal(s) you want to attain. These could be seasonal goals, competition goals, or pretty much anything that you see yourself doing with your skydiving.

Your long-term goals will determine your short-term goals. For example, if you want to do a 4-way, you will have to be proficient at flying “relative” to others. Depending on your level of proficiency, your short-term goals for your first weekend might focus on falling at the same rate as another jumper and making small movements forward, backward and sideways in a controlled manner.

Once you have identified what your long term goals are, talk to a Coach. The Coach will assist by providing a frank assessment of your starting point and suggesting short-term goals. The Coach will balance your “wants” against the skills “needed” to attain those goals.

Athletes Who Use Goal Setting Effectively Tend To:
• suffer less from anxiety and stress • concentrate better on the task • show higher levels of self-belief and self-confidence • show greater control over the performance process • be happier with their performance results

Concentration is defined as exclusive attention to one object. In skydiving, concentration before and during a jump can help you make the most of the precious time you spend in the air. Concentration and focus can be enhanced with practice. These tips will help you maximize your concentration:

Prepare your mind by getting enough sleep. Concentration is easier when you are well rested:

- Shift focus occasionally between the entire skydive (the big picture) and key details (the smaller picture);
- Avoid focusing on mistakes or anything else that does not contribute to success; and,
- Establish self-reminders about safety - this is particularly important for the few seconds prior to landing the canopy.

2.3.7 Anticipation

ANTICIPATION means "keeping pace with the action during the jump", and, “keeping one step ahead of the game”. This skill is being ready to act when the moment arrives. When you dirt dive a jump you see how a jump sequence is going to build. By knowing what is going to happen, in advance, you can ensure that you are in the right place at the right time to initiate a move or present a grip rather then playing catch up all the time. Your anticipatory skills can be improved if you learn and practice skydiving skills in the sequence in which they occur, and mentally and physically rehearse the skydive and your emergency procedures. As you develop more independence in your progression, you should begin practicing these techniques without being prompted or encouraged by your coach prior to the jump.

2.4 MENTAL TRAINING TECHNIQUES

2.4.1 Stress:

This results from an individual's perception of, and reaction to, a situation. Since stress is based on the view of an individual, the stress level for two persons in the same situation can be significantly different. Some factors that create or increase a person's stress level are:

- new, unknown experiences and activities, uncertainty
- a threat to personal safety
- the need to perform or to excel
- self-doubt
- a shortness or inadequacy of time to perform

The physical environment may add to an individual's level of stress. Things in the environment that can do this are found in everyday life, and in skydiving. Examples of these are:

- loud noise
- cold temperature
- strong wind
- time delays (waiting)

You cannot always change or control the physical environment, but you can help to change your perceptions of the situation.

This is, of course, a high-adrenalin sport, and particularly with students and junior jumpers, the arousal level is quite high. Some arousal is good to "keep one on their toes." Too much arousal or adrenalin can have negative consequences.

When does this adrenalin present itself? In situations where we feel we are not in total control; where we perceive the risk is greater than our perceived personal ability.

There are three inherent and genetic responses to such an adrenalin rush:

1. Attack, Fight
2. Retreat, Flight
3. Freezing up, the "deer in the headlights" effect

It is a combination of adrenalin and human/animal evolution. Instructors will encounter a catatonic student during a student training skydive – the one who will not move their arms – they are locked in tight and stiff, will not turn their head, do not respond to visual or physical commands, and the eyes are wide open but no body is home. It is a rather common occurrence.

Often, first jump students are filled with negative thoughts, e.g. "What if my parachute doesn't open?", or "What if the radio fails?" This is perfectly normal. But, by the end of the

first jump course, most of theses “what if?” questions should be answered satisfactorily. They now have some solutions to perceived problems. However, what about the person who dwells on the negative thoughts? It is the fear that can build up because of these negative thoughts that are counterproductive and can result in “overload”.

The Instructor or Coach can help to alleviate most fears by explaining what happens, why it happens, and how to correct problems. When learning, ask questions, ask the “what if” questions. Shift from the idea, “oh, that is going to be scary!” to “Wow, that sounds like it will be a Blast!” Learn to replace negative thoughts with positive ones.

It has been described that if you focus on the single tree beside the landing area when coming in for landing, then you WILL hit the tree. Why? Because the mind was focused on the tree, and so the body follows the mind. Instead, allow yourself to let go of that thought, just say, “oh, there’s a tree…I think I’ll steer over here to where it is clear.” Focus on what you want to DO. Make your mind lead you where you want to go!

Roman Philosopher Marcus Aurelius
“Our life is what our thoughts make it”
“Our thoughts have the power to change our lives”

2.4.2 Stress Control

It is known that high levels of stress diminish an individual's ability to perform. The same is true of very low levels of stress. Someone who is very relaxed might also be said to be performing at less than their potential. Therefore, there must be a range or level of stress that is optimal for you to perform at your best.

Your experience as a skydiver might lead you to form the opinion that the majority of individuals who participate in the sport at the novice level have a higher-than-optimum level of stress. Available research supports this opinion. For this reason, the emphasis will be on techniques to lower the stress level. These are called Relaxation Techniques. You may encounter material about the Arousal Techniques, those that help a person to increase the stress level on purpose.

Some skydiving specific techniques for stress control are given below:

- characterize the jump as a controlled situations, emphasizing all of the safety precautions that are in place
- highlight your ability to control the situation and your degree of autonomy
- speak about your concerns with your Coach or Instructor – they are there to listen and to help
- maintain a steady flow of activities, minimize delays and avoid rushing
- make the stresses of the environment more positive or attractive (e.g. think of playing with the wind, rather than it being windy).

2.4.3 Imagery

Imagery refers to the skill of systematically creating positive, vivid mental images, to using the senses to create or recreate pictures or feelings within the brain. The brain cannot distinguish between the actual performance of a skydiving skill and vividly imagining the same skill. In skydiving, the term mental rehearsal is used to describe this activity.

This is an important skill for a novice skydiver to develop. Time in freefall is short; practicing freefall skills only in freefall is very expensive. The same is true of exit skills, and those for a final approach to the centre of the target. Each lasts a very few seconds and occurs only once each jump. It is to the benefit of the individual to be able to practice these skills at other times. Your will want to be ready to execute the skill correctly when the opportunity arrives. The probability of success is much greater if you use the technique of imagery to develop the skill.

To develop this skill a quiet, relaxed setting is required. Imagery requires one to clear the minds of thoughts and then to imagine the skill being performed. It is important that you understand the correct method and sequence (through coaching, use of video, or demonstration, etc) before imagery is used, because the outcome of the actual jump will depend on your mental picture of how it is supposed to look. Note that this mental skill does not require any actual physical movement.

2.4.4 Relaxation Response – Advanced

The human mind and body have many capabilities 'hardwired'. A first jump student moves towards the door, for a moment, they wrestle with the urge to descend with the aircraft. They control their fear, climb out and jump. During this moment, the student is dealing with the instinctual "fight or flight response": palms are sweating, the breathing is faster, and adrenaline is flowing through the blood stream, the eyes are WIDE open.

To combat this stress, picture a nice, sunny day on the beach; take a deep breath and smell the salty ocean air; relax your shoulders; think of the smell of fresh-baked bread. The heart rate slows.

People can learn to invoke their relaxation response. Initially it may take much effort and long procedures to do this on a consistent basis. Eventually a person will be able to bring up the response by invoking images or sensations that "trigger" the response. At that point the Relaxation Response is "automated" and can be used anywhere, even just before exit. Coaches would suggest that a large part of our "pre-game" strategies focus on controlling our arousal.

2.5 LOGGING

Logging your jumps is important for a number of reasons. Having a record will allow you to prove your ability by showing your accomplishments. This will be important to you as you progress through your CoP's. A continuous record will help you plan your progression, spot trends in your jumping, and help you set new goals. It is also fun, for sentimental reasons, to have a diary of your accomplishments, and to remember times with old friends..

The information in the logbook contains a description of the particulars of the jump, and must be filled in for every jump. The description is the plan of the skydive and what actually happened. The signature is of utmost importance so that each jump is validated. With many people using electronic logbooks these days, the description and signature validation are often missing. If you are working toward a specific goal, such as a CoP or a particular rating, is it still important that you maintain a written log of the skydive and canopy manoeuvres.

This is a sample logbook sheet, with the suggested minimum entries:

Date	Aircraft
Drop Zone	Canopy/Equipment
Jump #	Exit Altitude
Freefall Delay (hh:mm:ss)	Total Freefall time (hh:mm:ss)
Distance from Target (Accuracy)	Wind speed
Jump Type (solo, FS, CFS, VFS, Wing suit, style, accuracy, etc.)	
Description • manoeuvres or points planned • number (and names) of people • number of successful manoeuvres, or manoeuvre times/scores • Canopy skills performed • elements of the jump that went well • elements to improve on • possible goals or progression for next jump	
X - Witness signature and CoP# (and Rating if required)	

SECTION 3 EQUIPMENT

Previous section 2 – Preparation ..... Next Section 4 – In-flight

3.1 INTRODUCTION

In this section, you will look at the skills and knowledge involved in preparing and using parachute equipment, including the harness and container, accessories, and packing procedures.

3.2 EQUIPMENT COMPONENTS AND FUNCTION

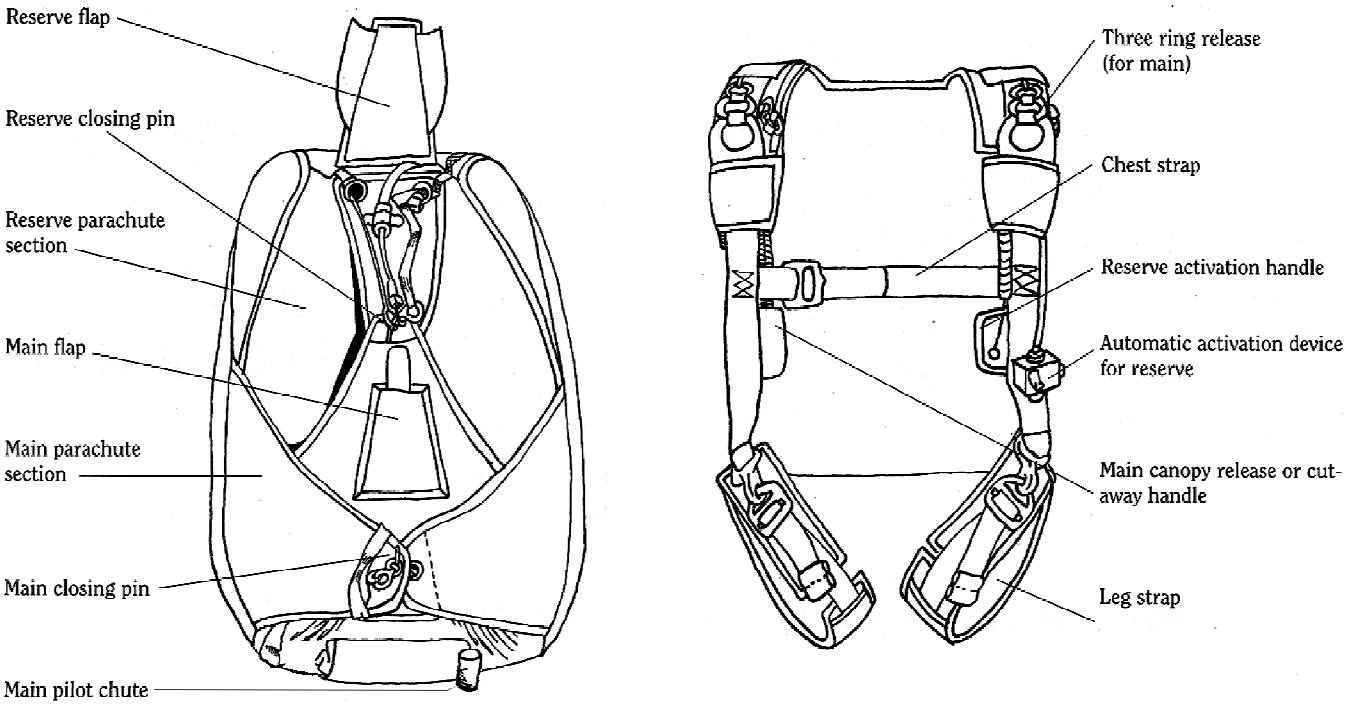
You should be able to identify and describe the functions of each of the major equipment components of the container system:

- Harness: attaches container and canopies to the skydiver
- Container: holds the Main and Reserve parachutes
- Pilot chute (Throw Out, Pull Out or spring-loaded): activates the main or reserve canopy
- Cutaway handle/Reserve handle: release main, activate reserve

- 3-ring release system
- Main closing pin and Reserve closing pin

In addition, your container may contain the following two additional items, discussed later:

- AAD (Automatic Activation Device): safety back-up activation device
- RSL (Reserve Static Line): backup device to cutaway-reserve pull.



3.3 ACTIVATION OF RESERVE (Emergency Procedures)

The initial "cut-away" or Emergency Procedures Endorsement is completed as part of the First Jump Course (FJC) and the Endorsement Card should be signed off at the conclusion of the FJC by the classroom instructor.

The procedure is specific for the particular type of reserve activation used on the equipment (i.e. single-point operation system (SOS) or two-action system (TAS)). Therefore, switching to a different type of gear requires being endorsed on the new type. It is not advisable to switch back and forth between different systems for reserve activation. This is especially relevant for students that may be trying out new equipment, or visiting another DZ where they will be renting equipment.

All training and any questions that you may have regarding Emergency Procedures should take place under the direct supervision of a Certified Skydiving School Instructor (SSI) or Instructor B (IB). Do not rely on the advice of a skydiver unless they have been properly Trained and Endorsed (BSR #1) on training on Emergency Procedures training.

Endorsement	Required For	Signed By
Emergency Procedures	**Solo**	**SSI, IB – This should be done after the FJC**
Solo Checkout Jump	Solo	JM, PFFI, IA
Emergency Procedures Review Solo	Solo	JM, SSI, IB
2 Way RW	A	C2
Emergency Procedures Review A	A	JM, SSI, C2, IB
Main Packing	A	JM, SSI, C2, RA, IA
Sport Canopy A	A	C2, IB
Emergency Procedures Review B	B	C2, IB
Group RW	B	C2
Sport Canopy B	B	C2, IB
Emergency Procedures Review C	C	C2, IB
Night Jumps	Night Jumps	IB
Water Jumps	Water Jumps	IB

Emergency Procedures should also be reviewed constantly. This skill is inarguably the most important safety skill that you will learn.

There are three recommended cut away procedures for a two handle system. In all cases, it is important to LOOK for the handles, as in many emergency situation (e.g. a high speed spinning malfunction) the handles will have shifted from their normal position.

Cut Away Method 1

Arch! Look at your handles. Grasp the cutaway handle with your right hand, and hook your left thumb through the reserve handle.

Peel and pull the cutaway handle down to full arm extension and throw away the cutaway handle.

Place your right hand over your left hand and hook your right thumb through the reserve handle.

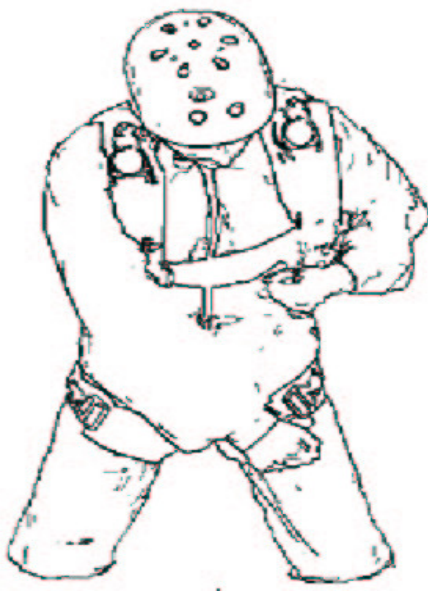
Pull the reserve handle down to full arm extension.

Return to your arch position.

Cut Away Method 2

Arch! Look for the handles. Place your right hand on the cutaway handle and hook your left thumb through the reserve handle.

Finally, return to your arch position.



Peel and Pull the cutaway handle down to full arm extension.

Peel, Pull and Punch the reserve handle down to full arm extension.

Cut Away Method 3

Arch! Look for the cutaway handle. Place two hands on the cutaway handle.

Visually locate the reserve handle, before pulling the cutaway handle.

Peel and pull the cutaway handle down to full arm extension and throw away the cutaway handle.

Transfer both hands to the reserve handle.

Peel and Pull the reserve handle down to full arm extension.

Return to your arch position.

Assess – Think - React

You must use the reserve in any situation where you have anything less than a functional canopy! Assess-Think-React! If it is malfunctioning in any way that is not correctable (i.e., not there, not rectangular, or torn), then it must be cut-away.

The general classification for a malfunction is to characterize them as either HIGH SPEED (inflation issues, pilot chute in tow, bag lock, etc) or LOW SPEED (line entanglements, rips, broken lines). While high-speed malfunctions require an immediate response, it is generally immediately obvious that the reserve is needed. On the contrary, low speed malfunctions present a very serious danger in that the skydiver may spend too much time trying to correct an un-correctable situation, and by the time the decision has been made to use the reserve, they may be too low to do so safely. Regardless of appearance or cause, the action is the same - initiate emergency procedures NOW!!!

It is highly recommended that you read, review and practice your Emergency Procedures on a **regular** basis. The best times to practice are:

- On the ground, after gear up or prior to boarding the aircraft
- In-flight, prior to exit, as a regular part of your pre-exit gear check
- Check pilot chute, and perform a mock throw/pull, grab the emergency handles, and mock going through the Emergency Procedures

Consult with a Skydiving School Instructor (SSI) about any questions pertaining to your gear, Emergency Procedures or specific DZ procedures.

3.3.1 Basic Correctable Situations

In the FJC, you learned to look for some basic correctable canopy situations such as line twists, end cell closures, and high sliders. These were presented as easily recognizable and correctable.

Line Twist

- Symptom: The lines leading to the canopy have spun around one or more times, leaving the canopy inflated and flying, but with no use of the control lines. Note that the risers may also be twisted around one another..
- Corrective action: if the twist is less than ½ the length of the lines, and the canopy is flying straight, then reach up the risers with both hands, and pull apart as much as possible. At the same time, perform a Scissor Kick, swinging one leg hard across the front of the other, to help induce a rotation to un-do the twist. Continue until the twist has cleared and the two risers are separated. This should take no longer than 5-10 seconds.
- If no improvement: or if it is taking longer, then perform Emergency Procedures.

Collapsed End Cell (also known as End Cell Closure)

- Symptom: One or both of the end cells of the canopy do not inflate and appear to be flapping.
- Corrective actions: check first for line twists and clear these first. Once the line twists are clear, pull down on BOTH steering handles to full length (to the crotch), hold for 2-3 seconds, then raise gently back up to the top position on the risers. Check to see if the end cell has inflated and the canopy is flying straight. Only repeat this process twice.
- If no improvement: perform Emergency Procedures.

Slider Hang-up

- Symptom: can occur as part of a normal opening, or after line twists. During a slider hang-up, the slider is at least half-way down the lines, allowing the canopy to spread open.
- Corrective action: If there are line twists, clear these first. Once the line twists are clear, take the steering toggles and pull down full length to the crotch, hold for 2-3 seconds, then raise gently back up to the top position on the risers. Repeat this process twice. Check to see if the canopy is flying straight.
    - If it comes down further, perform a complete flight control check.
- If no improvement: perform Emergency Procedures

3.3.2 Advanced Correctable Situations

As you gain more experience you can add to your list of correctable situations. The following "correctable" situations are not included in the FJC for the simple reason that they could mask a greater non-correctable problem. With greater experience, these assessments become clearer. Please speak with a Skydiving School Instructor for more information about when you can start using these.

When assessing and reacting to a correctable situation, if the problem has not been corrected after two (2) tries, you must initiate your Emergency Procedures. In addition, always keep your "hard deck" altitude in mind. This is the altitude at which you must have made a decision about the usefulness of the parachute above your head, and below which it is not advisable to cut away because there may be inadequate time for reserve inflation. If you have not corrected the situation by your hard deck altitude (even if you have not tried, or have only tried once) you must initiate your Emergency Procedures. It is better to cut away a questionable canopy at 1500 feet than to realize at 500 feet that the parachute you have been trying to fix is definitely not correctable. Speak with your Skydiving School Instructor about choosing an appropriate hard deck altitude for your experience level.

Premature brake release

- Symptom: canopy turns on opening
- Corrective action: release both brakes, pulling both toggles down fully and evenly and then back up to the top
- If no improvement: initiate Emergency Procedures

Minor steering line entanglements

- Symptom: visible entangled lines, possible steering problems
- Corrective action: pull down once on steering line and/or pull down sharply on the suspension line (only try this twice)
- If no improvement: initial Emergency Procedures

Slow inflation (streamer)

- Symptom: head high posture in freefall, canopy and slider very small above you
- Corrective action: pull down on back risers, once, as far as possible and release
- If no change: - initiate Emergency Procedures.
    - Note that in this situation, you will be losing altitude quickly and emergency procedures should not be delayed if un-correctable.

Pilot chute over the leading edge (nose)

- Symptom – the pilot chute is visible under the canopy, with the bridle passing over the leading edge of the canopy and back into the lines.
- Corrective action - confirm control and steer gently as higher airspeeds during aggressive turns could cause the pilot chute to distort the shape of the parachute
- If the canopy is not controllable - initiate Emergency Procedures

3.4 SETTING AUTOMATIC ACTIVATION DEVICES (AAD)

There are two types of Automatic Activation Devices:

- mechanical sensing and
- electronic.

3.4.1 FXC 12000 Characteristics

The FXC 12000 is a 3- part assembly consisting of a completely mechanical altitude control assembly (which is not dependent upon batteries, squibs, pyrotechnic devices (no electrical parts)), a main body assembly and the pin puller assembly. The device relies on a double aneroid device that detects both altitude and rate of descent. The Model 12000 can be used on the main and/or reserve of a tandem (2-canopy) system, as well as a chest-mounted reserve. The unit is armed by ascent and will fire if the rate of descent exceeds 45 mph (65 ft/sec) under a preset altitude that is adjusted on the ground. When fired, the pin puller retracts 2 inches (5 cm) with a force of 80 lb. It is recommended that the altitude control assembly be mounted on the shoulder. Ensure that the threaded end loop on the puller, attached to the pin, is finger tight. The steel cables must be covered to prevent snagging and to ensure that the pulling wire has a direct clear path to the pin. The white plug seated between the wires where it comes out of the cable must be present and not cracked. A Rigger A installs the unit as per manufacturer's instructions if the gear is set up for it, or Rigger B or FAA Master Rigger if installation requires fabrication.

The FXC altitude settings must be PRESET on the ground at the Drop Zone BEFORE EACH JUMP. Never calibrate the Model 12000 in an aircraft in-flight. Serious injury and/or fatality can result.

The Model 12000's altitude control may be set from 1,000 to 4,000 ft. above ground level (AGL). Ground level may be anywhere from sea level to 10,000 ft. elevation. The altitude control, while on the ground, reads directly in feet Above Ground Level (AGL) at which it has been set to operate. Knowledge of field elevation and/or barometric pressure is not required.

The Model 12000 has a "Safety Lockout Knob." The Jumper, before climbing into the aircraft, must turn the knob to "JUMP". If the jump is aborted for any reason, the "Safety Lockout Knob" must be turned to "OFF". This is done to avoid any possibility of the unit firing in the rapidly descending aircraft when below the release altitude setting.

Under normal conditions the Model 12000 would not operate, due to the parachutist having deployed the main canopy, thus slowing the rate-of-fall below 40 feet per second, prior to reaching the Model 12000's release altitude setting. With aggressive spirals, it may be possible to exceed the activation speed and activate the reserve. Avoid aggressive manoeuvres below 2000' under canopy when using an FXC.

Beginning with serial #4000, the release trigger mechanism's rate-of-descent has been preset during manufacturing for NO FIRE at 40 feet per second, and ALWAYS FIRE at 65 feet per second. The Model 12000 WILL NOT OPERATE when the parachutist is above the unit's altitude setting, regardless of the rate-of-descent.

The Model 12000 will NOT OPERATE when the parachutist reaches the unit's altitude setting with a rate-of-descent that is less than 40 feet per second.
The Model 12000 WILL OPERATE when the parachutist reaches the unit's altitude setting and the rate-of-descent is greater than 65 feet per second.
The Model 12000 WILL OPERATE IF the parachutist is at, or below, the altitude setting and the rate-of-descent increases from less than 40 to more than 65 feet per second.

Typical Examples:
If the Model 12000 has been set to operate at 1,000 ft AGL and the parachutist opened the main canopy at 2,500 ft AGL, the Model 12000 would NOT OPERATE at 1,000 ft. because the parachutist's rate-of-decent would not be great enough to trigger the unit into operation.

A jumper has the Model 12000, which has been preset at 1,500 ft. AGL, attached to the reserve parachute. The jumper opens the main parachute at 3,000 ft. AGL and descends under an open canopy to an altitude of 1,500 ft. At this slow rate-of-descent, the Model 12000 will not fire. However, at 1,200 ft. AGL a mid -air collision occurs, collapsing the jumper's canopy. As soon as the jumper's rate-of-descent is increased to greater than 65 feet per second, the Model 12000 will trigger, pulling the reserve pin.

For this reason, when jumping using this device, one should NOT perform spirals under canopy below 2000'.

Setting the unit

- Turn unit ON, on the ground
- Set altitude, usually about 1200 ft.
- Note: The manufacturer recommends that the minimum main canopy opening altitude be at least 1500 feet above the activation altitude set on the FXC.
- Minimum setting is 1000'

Once turned on and set, the unit can remain on for the duration of the day.

Regulations

- Civilian use only
- Tested every repack cycle in an altitude chamber
- Must have J modification
- Re-calibrated every 2 years by FXC
- When testing must fire with a load on the cable as a no -load fire will damage the unit.

Maintenance:
Send the unit back to the service center if the unit:

- Misfires
- Has mud/dirt obstructing the air vents
- Has been submerged in water (unless waterproof)
- Has been dropped or fired without a load
- Has sustained physical damage or the needle sticks or is broken.
- Requires its re-calibration period/schedule

* You are not allowed to open the unit yourself.

Turning On/Off: Turning the safety lockout knob to JUMP/OFF/JUMP in an aircraft in-flight is safe and does not affect the preset altitude setting or the mechanism. This is not the case for electronic AAD's.

3.4.2 Electronic AAD

Most electronic AAD's are "set" at the factory to 750 AGL. This is to allow 1500 feet between the minimum opening altitude (2200 feet) and operating altitude of the AAD. When turning the unit ON, it will 'boot up', perform a self check, and calibrate itself to use the current elevation as ground (0 feet AGL). For this reason, turn the unit at the DZ, and never try to turn a unit on in a plane that is in-flight. Ensure the unit completes the start up with no error codes.

The major types of electronic AAD's currently on the market (as of this publication) are:

- CYPRES (**Cy**bernetic **P**arachute **Re**lease **S**ystem),

- Vigil, and
- Argus

For details about each of these types of AAD's, please check with either the manufacturer's website or your local Rigger. Some of the common features are:

- Self-test when turned on
- Automatically zero at the current elevation when turned on
- Cypres 2 and Argus are water-proof; Vigil is not (at the date of publication)
- Different models for Student, Tandem, Expert and SWOOP with differing activation altitudes and descent rates
- Cypres, Vigil and Argus shut off automatically 14 hours after being turned on
    - Note: this is NOT 14 hours after the last jump, so it is very important to restart your AAD if you've had a very long jump day, have been jumping all day and will be doing night jumps, or your AAD is still on in the morning.
- Cypres has a 4-year maintenance cycle
- Cypres has a 12 year life; Vigil has a recommended 20 year life;
- Battery life: they lose about 1% per year, and last about 700 jumps or 4 years
- Speed Example: The Vigil, set in expert mode, activates at 317 meters (1040 Ft). If the freefall speed is equal to or greater than 20m/sec. (72km/h - 45 mph).
- An AAD like the Cypres or Vigil, which is designed to be worn on the inside of the container, will be constantly exposed to a low-pressure system caused by the burble created by the body in a belly-to-earth attitude. Therefore, the unit is designed to fire at its designated altitude because it is in this burble. If a jumper was in a stand-up or back-to-earth attitude then the AAD is no longer in this burble and the AAD thinks it is lower than it actually is and will fire at a higher altitude AGL then in a belly to earth attitude. It will fire approximately about 250 ft higher than the set altitude.
- The ability to set an offset for the DZ ground elevation. This is important for skydives where the airport is at a different elevation than the landing area.

Turning On/Off
Most electronic AAD's can be left on during a descent in the aircraft. However, some models, such as the Student Cypres 2, are recommended to be turned off during an aircraft descent due to the lower activation speed. You should know the recommended approach for the equipment you are using.

3.5 RESERVE STATIC LINE (RSL)

What is a Reserve Static Line? The RSL is a system that will activate the reserve upon the release/jettison of the main parachute. It usually takes the form of a lanyard connected from one riser of the main parachute to the reserve activation system. As you fall away from the cut-away canopy, the lanyard activates the reserve system.

Methods of Reserve Activation

The reserve static line (RSL) may run off of one riser, both risers liked with a cross connector, or both risers on a 2 pin reserve container. The other end would be attached directly to the reserve pin or to the reserve ripcord cable.

General Inspection / Check

Any reserve activation system should have enough slack and be retained and concealed so as not to create a snagging problem or allow a premature activation of the reserve. The RSL should be attached positively to its release point and the riser. The main canopy release system (3-ring) must be maintained and operable. See manufacturer's instructions on proper routings and connections for each system you encounter. Note that manufacturer's install specific systems on their rigs. A CSPA Rigger B or an FAA Master Rigger can only do modifications to the RSL.

The proper cutaway handle must be installed. Most manufacturers set the cutaway cables to different lengths so that the side with the RSL releases last. If changing cutaway handles, be certain that the cable lengths are correct for the RSL release. Although highly unlikely, one concern regarding this system is that if the non-RSL riser remains attached, for whatever reason, then the RSL attached riser would activate the reserve when a clean cutaway has not been achieved.

Two Risers — Cross Connector

Check the proper routing of the cross connector as the manufacturer specifies. A concern with this type of system occurs if the jumper experiences deployment of the reserve prior to or simultaneous with main deployment. In this circumstance, the reserve has deployed between the main risers, finishing in front of the main canopy. The RSL cross connector, extending between the main risers, is now wrapped around the front of the reserve lines; this means that the cross-connector, main risers, lines and canopy fully enclose the deployed reserve. A cutaway of the main could cause choking off and collapsing of the reserve canopy.

Both Risers with Two RSL's

This system is designed to deal with the problems of a one riser cutaway activating the reserve prior to the other side releasing and due to the problem of the cross connector interfering with cutaway on a two canopy situation. With this system, both risers must release prior to the RSL activating the reserve. The inspection procedures would be the same as the single riser RSL but performed for each side of the system. The cutaway cable lengths should be the same length.

Students should never undo the RSL under canopy. This can be very dangerous. It is far better to have the odd reserve activated on the ground due to a cutaway in high winds than a low cutaway with the RSL disconnected. For interest sake, the reserve will most likely never inflate unless the ground winds were strong enough (40 + mph) for inflation and in this case we should never have been in the air. Many centers use a riser connector that cannot be released in air.

However, if jumping is being conducted within the limits of a water hazard then the RSL should be released if a water landing is imminent and this procedure must be taught as part of the emergency water landing procedure.

If a center is using a tightened Rapide link or carabineer, then the aircraft should have a wrench on board for disconnection in event of an accidental main activation prior to exit. These RSL types should not be used near water, as they cannot be disconnected in air.

Lastly, if a cross connector RSL system is being used, the students must be taught not to cutaway in the event of a two-canopy situation. They will have to land with both canopies or release the cross connector prior to cutting away the main canopy.

3.5.1 The Skyhook

The "Skyhook" is a modified form of an RSL. Instead of pulling the reserve pin only, the released main canopy will pull the reserve pin then directly extract the reserve free bag, acting as a very large pilot chute for the reserve canopy. This greatly decreases the time it takes for reserve deployment after a main cutaway. In a complete malfunction situation, the reserve pilot chute still functions without relying on the main canopy to extract the reserve. The term "Skyhook" is the name for the direct extraction system developed by United Parachute Technologies. Other container manufactures are developing their own version of the "Skyhook" system. For further information about the direct extraction RSL please talk to your rigger.

3.6 SETTING AND MOUNTING THE ALTIMETER

Set your visual altimeter to zero for the intended landing area. Differences in readings will occur between different altimeters on board the aircraft during the ascent; however this is common and a generally accepted difference is approximately 300 ft provided that the altimeter has been properly cared for.

3.6.1 Analog altimeters

There are three different locations where the visual altimeter can be mounted:

- hand or wrist
- chest strap
- main lift web

The altimeter should:

- be visible when the body is arched
- be secured so it does not vibrate or hide the faceplate
- not interfere with the operation of the container, including the cut-away and reserve handles
- be free from the equipment (e.g. jumpsuit sleeve) so that you can clearly see the altimeter
- be located directly in the relative airflow.

The altimeter reading may be inaccurate on two occasions:

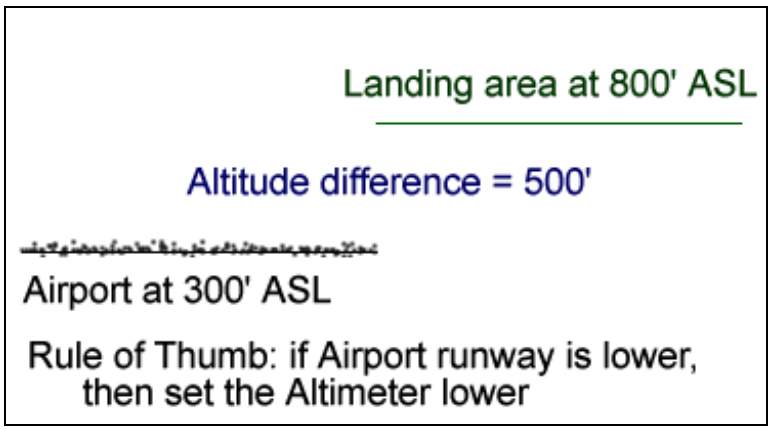
- as we leave the aircraft and accelerate to terminal velocity the altimeter may 'lag' and will read high;

- when the altimeter is placed in a low pressure area or “burble” (such as a chest-mounted altimeter on a back flying skydiver) it can read high as well.

For variation between airport and landing zone elevation, adjust the altimeter to attain a zero reading for the landing zone ground level. If the airport is lower than the landing zone, the altimeter needle must be set lower than zero by the difference between elevations; if the airport is higher than the landing zone, the needle is set higher than zero by the difference in elevations.

EXAMPLE:

DZ landing elevation is	800ft ASL (240m)
Airport elevation is.	300ft ASL (90m)
Set needle Below zero by	500ft ASL (150m)



Combinations of visual and audible altimeters are acceptable and provide an additional level of altitude awareness. Regardless of the combination in use, ALWAYS activate your parachute on the instrument that is reading the LOWEST. An altitude check should include both checking instruments and a visual check of the ground.

3.6.2 Audible Altimeters

Audible altimeters beep at pre-set altitudes, with a variety of sounds, making you aware of your approximate position above the ground. General tips for use are as follows:

- Make sure it is turned on before every jump. Some audible altimeters do not turn on automatically; check it before you jump.
- Use an audible altimeter as a reminder to check your altimeter and not as a primary altitude awareness device
- An audible altimeter should be mounted closely to the ear, but can still be drowned out by free fall wind noise
- Pre-set audible altimeters 500 to 1,000 feet higher than pull altitude
- Different devices have different characteristics
- Ensure the speaker is close to the ear
- As you get older, you may need to lower the pitch frequency

- Full-face helmets can induce a slight lag.

Be aware that instruments are never 100% reliable. Many jumpers, especially free flyers, use two audible altimeters to ensure they do not lose altitude awareness. The best altimeter is your own awareness, both using your eyes to view the ground and your built-in time awareness. This awareness will develop with experience.

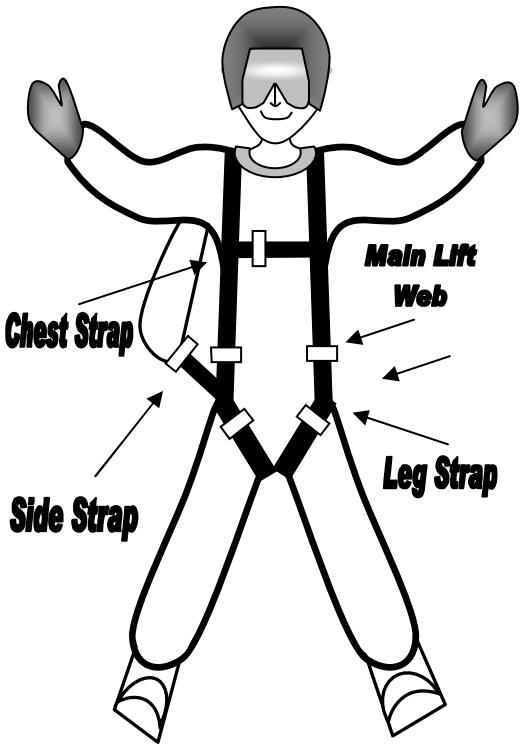
Instrument Combinations: Regardless of the combination in use, ALWAYS activate your parachute on the instrument (including your eyes) that is reading the LOWEST. An altitude check should always include checking instruments and a visual check of the ground.

3.7 GEARING UP PROCEDURES

Rigs can have from three to seven points where the harness can be adjusted. Student rigs have the most adjustment points because they are used by many different people.

Harness Adjustment Points

The sequence for adjusting a student harness to a good fit is:



1. loosen all adjustments
2. Step into the leg strap loops, and slip the rig over the shoulders. Route the chest strap and leave loose for the moment
3. Adjust the main lift web to length to place the canopy 3-ring release at the collar bone and the leg strap junction over the hip bone (if the harness is a fixed length, skip this step)
4. Tighten the leg straps (if B12 snaps are being used, these must be connected first).
5. Tighten the chest strap enough that the main lift webs run down the front of the chest with out pinching the harness inwards. The vertical webbing should come straight down the shoulders to the hips, with no bend.
6. Tighten the lateral adjusters, to lift and pull the container tight against the back (if the harness does not have lateral adjustments, skip this step).
7. Tuck in the running ends of the straps

A loose fitting harness can cause:

- bruised crotch's – loose legs straps
- chest strap high – main lift webs too long
- bruises on biceps – loose chest strap

A snug harness reduces the likelihood of bruises and enhances your safety by keeping all the handles reasonably close to where you would expect them. However, even with a snug-fitting harness, the handles can shift during a spinning malfunction, hence the need to look for your handles during the Emergency Procedures.) A properly fitting harness allows you to be more stable during the opening sequence of the parachute, giving you smoother, on heading openings. This is extremely important when jumping high-performance canopies.

3.7.1 Safety Check

You will be participating in safety checks (gear + pin checks). Observe the safety check pattern used by the instructor and identify the major check points. As you gain experience, add the details until you are checking everything. The safety check is a systematic inspection of the gear:

- Check from top to bottom, left to right
- first on the front,
- then the back.

There are only three points to remember when checking each part.

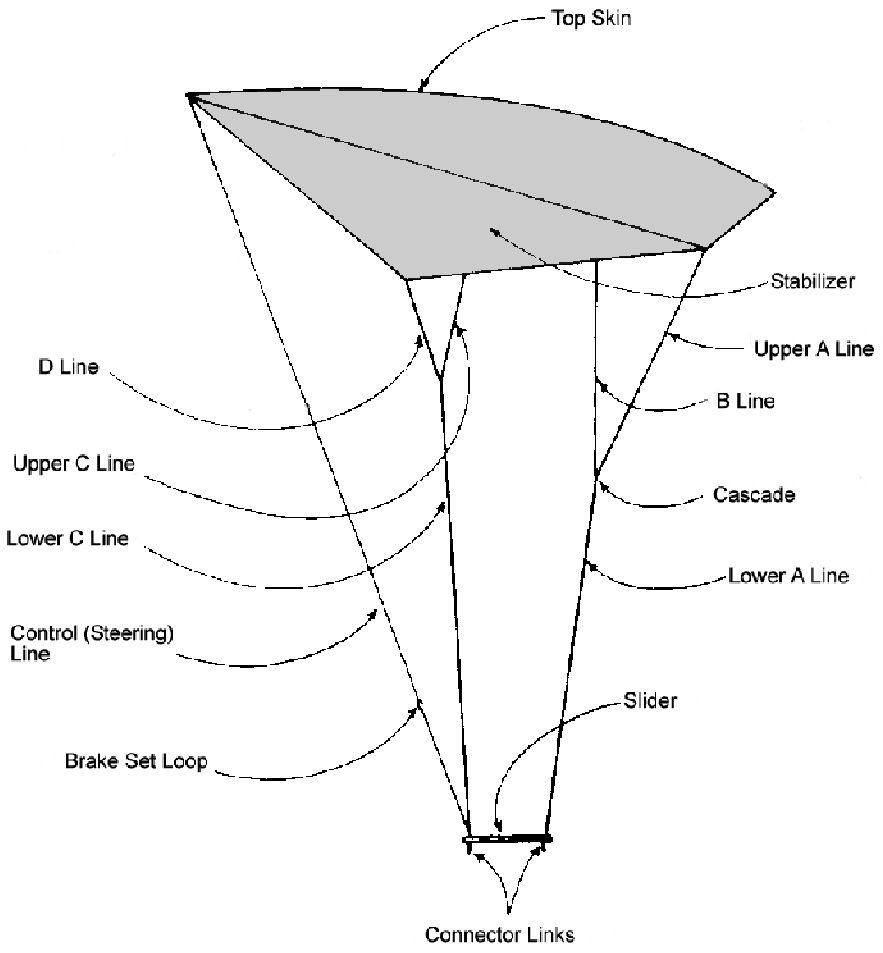
- proper fit: it is secure and in place
- function: it will work as needed
- is it structurally sound? - it will not tear or break when under pressure

An sample guideline would cover the following points:

- Risers – stowed in the keepers
- RSL Connector properly fastened
- Three ring release – rings are properly routed, the retaining loop properly routed, the cables passing through the retraining loop and tucked into keepers
- Chest strap - routed properly through the buckle, running end secured with an elastic band or Velcro to hold in place
- Cutaway handle - seated properly
- Reserve handle - secured in its pocket, cable end free-moving
- Main lift web adjusted, running ends stowed
- Leg straps - evenly tight, running ends stowed
- Side adjustments – tight and running ends stowed
- Automatic activation device - turned on
- Reserve flap and pins - pins seated at the ¾ position, cable slides in housing, AAD attached; if there is an RSL, make sure the connector is placed properly, closing loop tight and in good condition (not frayed), flap closed securely
- Main pin - seated at the ¾ position
- Closing loop tight and in good condition (not frayed)
- Main bridle routing - routed and unobstructed from pin to pilot chute pouch
- Main flap closed and secure
- Footwear, jumpsuit, goggles and gloves: proper fit and in good condition

- Instruments - altimeter set to zero for the DZ elevation, AAD turned on, audible altimeter turned on and set for the appropriate altitudes
- Helmet – proper fit

3.8 PACKING



3.8.1 Packing - Observed

Packing a parachute can appear to be a complicated process at first. As you gain experience, you will see that it is just a series of easy steps. When we pack, we pull the lines until they are all taut, stack the lines and canopy in a pile and pull the edges of the canopy to the outside, and place it into the deployment bag. Your first step to learning packing is to observe a few pack jobs and identify the process. Most jumpers are very good about answering questions as they pack.

The best guides for packing are the manufacturers' instructions for the canopy and the container or a rigger.

A generic flat packing procedure is as follows:

- pick a clean spot and use a packing mat
- place the rig facing harness-down on the ground, oriented as if the wearer was laying face down; remove any line twists
- stretch out the canopy and lines; locate one end cell
- flake the canopy using the leading edge or the tabs as preferred
- lay the canopy flat on the ground (on its side)
- check the line continuity, especially the brake lines; these should be picked up at the canopy and walked to the rig to see that they are clear. With practice, this can be done visually
- fold the nose in, stack line groups from the A-lines on the bottom to the D-lines on top; split the tail, clear the stabilizers
- go to the rig; set the deployment brakes, clear the slider
- bring the slider up to the canopy
- dress the tail and stow the slider (if required)
- fold or stack the canopy to fit into the deployment bag (equal distribution, no lumps)
- close the bag, stow the lines
- place the bag into the container so that the line stows are to the bottom, then route and stow the risers
- close the container, stowing the pilot-chute as required
- tuck in all flaps, secure the risers with the riser covers
- place the rig out of the sunshine or cover it (e.g. with your jumpsuit).

Some additional information about main packing may be found in PIM 2 Part B. After practicing this skill several times, an inspection of wear points should be included as part of the packing routine.

When learning to pack the acronym “PINT” (**P**acking, **I**nspection, **N**omenclature/Names, **T**angles) will be used. Initially you will learn how to pack, and the names of components, through demonstration and hands on participation.

3.8.2 Packing – Clearing Entanglements

Learning how to recognize and clear canopy entanglements can be challenging. Regardless of packing style, the following progression and suggestions apply.

Lay the canopy flat and perform a continuity check to identify the problem. Presenting the slider can help identify if the tangle is above or below the slide. Have a coach take you through identifying and correcting these entanglements. The secret of clearing entanglements is in the control lines. By starting at the tail of the canopy and walking the control lines toward the container, you will be able to identify where the entanglement is.

Some examples of types of entanglements include:

- Front loop/ back loop, between the risers, **below** the slider
- Front loop/ back loop, between the risers, **above** the Slider
- One line, step through, **above** the slider
- One line, step through, **below** the slider
- One line, step through, **above** the slider AND front loop/ back loop, between the risers, **below** the slider
- One line, step through, **below** the slider AND front loop/ back loop, between the risers, **above** the slider

Techniques to help when untangling a parachute are:

- Get someone to help you! This makes things much easier and faster
- lay the canopy flat
- identify the type of entanglement (recognize)
- clearing the steering toggles out of the tangle
- maintaining tension in the lines to highlight the problem(s)

3.8.3 Packing – Canopy Inspection

The key point to emphasize is that you are looking for signs of wear on the gear. Use a routine, which starts at the pilot-chute of the open main canopy, so that the inspection can be combined with the activity of packing the canopy. Examples of wear are:

- abrasion marks,
- small holes,
- broken stitches,
- stains,
- fabric pulling from a seam,
- fraying of the canopy, lines, closing loops
- stress wrinkles,
- for metal parts, bending, scratches, corrosion or separating.

Specific places to check for wear are:

- pilot-chute - burns to canopy, tear in mesh, loss of shape
- bridle - pin attachment, connection to canopy
- deployment bag - grommets, fabric burns, Velcro wear
- canopy - bridle attachment, stabilizer attachment and slider stops, material
- lines - cascade joints, attachment to links
- steering lines - attachment to canopy, brake locking loops, knots at steering toggles, fraying or points of wear (near Velcro)
- slider: - grommets should be smooth, no burrs, fabric had no wear, tear
- risers - links, Velcro, brake system, stiffness at 3-ring, grommets
- 3-ring - anchor loops, housing and fittings, cables, rings

- container - Velcro, closing loop, abrasions, Stiffener flaps
    - A closing loop in good condition is CRITICAL!!! Closing loops are easy to replace, and should be replaced at early signs of wear; ask a Rigger for assistance.

When unsure about the condition of a part of your gear, have it inspected by a certified and qualified rigger.

Inspection of a rig for proper assembly and compatibility (e.g. new gear) should be done under the supervision of a rigger. The same is true when parts require repair or replacement.

The requirements for the Main Packing Endorsement (MPE) are:

- 10 pack jobs, SUPERVISED and signed off by a Coach 1
- A packing test, including reasonable entanglements, signed off by a Jump Master, Skydiving School Instructor, Coach 2 or Instructor B.

3.8.4 Packing - Deployment Control

Your packing can affect the speed and firmness off the canopy opening. This can be manipulated somewhat by:

- Using a larger pilot chute – stronger snatch force
- splitting the Slider –presenting more to the relative wind on opening slows the slider descent and gives a softer opening
- tighter elastics – slows down the line stretch, softer opening
- rolled nose – tighter for a softer opening
- rolled tail - tighter for a softer opening
- pleating the tail neatly – improves consistency and reduces opening time
- pleating the stabilizers high and wide – improves heading control, reduces wear

Be aware of the following characteristics that may cause unusual openings:

- last stow too tight– line twists or turn on opening
- locking stows uneven – line twists or turn on opening
- space between the last stow and the tops of the risers is too short (should be a minimum of 18 inches) – line twists or turn on opening, or a line could become snagged in the packing tray
- loose stows – very hard opening due to “Line Dump”, possible malfunction

While packing, the canopy material can balloon as you squeeze the air out. This can move the D-lines and the steering line to the outside edge of the canopy. During inflation this could cause line damage to the material or malfunctions.

When dealing with high performance canopies, small differences in the pack job will create major changes in the way it opens, sometimes leading to malfunctions. Please ensure that

you know how to pack a small and/or elliptical canopy by consulting with a Rigger or Coach experienced on that type of canopy and container.

3.9 JUMP SUIT SELECTION

The skydiving jump suit is the primary tool we have for fine tuning our tilt on the air, the fall rate, the effectiveness of turns, and they provide grippers to hold on to each other. Here are some characteristics to be aware of regarding jump suits:

- **Loose** suits made of cotton will slow the fall rate – good for heavier people
- **Tight** suits made of nylon will increase the fall rate – good for very light people
- Other materials, such as poly-cotton, have fall rates between cotton and nylon
- the suit *must* allow the jumper to present a neutral body position, to tilt forward and backward
- women sometimes require more blousing on the legs (larger hips and thighs)
- men often require more blousing on the arms (larger shoulders)
- grips and booties are recommended for formation skydiving
- grips are not recommended for artistic events as they can catch air
- Velcro cuffs at the wrist and ankles are recommended for free flying to keep the cuffs closed tightly
- Nylon suits are more comfortable if they include a cotton lining

Make sure you wear the correct Jump Suit for your body type.

As a novice jumper faced with so many choices within the sport it can be difficult to choose a jump suit. Speak with your Coach to get the best advice.

3.10 USING WEIGHTS

Weights are a LAST attempt to help set the fall rate for a lighter individual. Prior to using weights, you should make sure of the following:

- The correct type of jump suit material and fit is being worn
- The correct body position has been achieved. That is, Flat, Neutral, and Comfortable. Until the body position is set, weights should NOT be used

Weights are used in conjunction with good jump suit choices to adjust fall rate and tilt. The weight must be placed appropriately to adjust the fall rate without creating tilt issues. Weights is normally worn on the Front of the body in order to maintain a low centre of gravity (CoG). Avoid placing weights into the container or on your back.

Start by using only a little weight, say 4 pounds, and work up gradually to meet the average fall rate. The goal is to be able to maintain the average fall rate (approximately 120 mph in a flat, neutral body position) and still be able to adjust your body position to arch to go down or de-arch to go up. Thereafter, use a consistent amount of weight with that jump suit. This allows you to establish consistency in the box position so that you can then assess if the overall weight and positioning is what you need.

When on the ground, keep the weights off as long as possible prior to gearing up or heading to the aircraft, and after landing remove the weights as soon as you are back to the packing area. This will help to relieve any undue stress on your back or legs.

3.11 EQUIPMENT TRANSITION

Equipment Transition refers mainly to changing harness/container systems as this can affect main deployment procedures and emergency procedures. Examples of changes may include:

- switching from a single-point operation system (SOS) to a two action system (TAS)
- throw-out belly band to a bottom-of-container (BOC) throw-out
- throw-out BOC to pull-out
- down-sizing canopy size

3.11.1 Equipment Transition – System Changes

Before discussing methods of training for system changes, it is necessary to understand why transition training is important. Main and reserve deployment techniques that are learned first become a formed habit, learned such that the jumper can react "instinctively". In a stressful situation or emergency, people react instinctively and resort to the procedures that they know best. In this situation, handles in different places or different emergency procedures can prove fatal. History has shown that "Transitions can Kill". Proper transition training can reduce this risk.

Transition Training

Look at the new training procedure and identify the differences.

- ✓ Have a Coach/Instructor assist
- ✓ An Instructor should train on changes between SOS and TAS or belly-mount pilot chute to BOC
- ✓ Perform many repetitions (20+) with realistic training aids and time constraints.
- ✓ Include any new sensations that may be experienced.
- ✓ Review additional procedures for pin checks.
- ✓ Later practices should be ‘under pressure’ so the instructor can evaluate you.
- ✓ The old procedures must be untrained by retraining with the new procedure.

If the new skill is not to standard, then train more and re-evaluate. It is common for good transition training to include as many as 100 repetitions.

Once the transition has successfully taken place, procedures should be continually practiced to maintain currency in them.

After transition training it is advisable to do a jump focusing only on the new skill (for example, you might do a jump where you do practice pulls only). Plan to pull higher than normal. Similar jumps can be designed for emergency procedure changes by doing freefall handles checks instead of practice pulls

There is a different follow-up on the pull depending on whether a throw-out pilot chute, or a positive pull out pilot chute is used:

- Throw-out Pilot Chute: The pilot chute is usually located in a pouch on the bottom of the container (BOC). It is occasionally located on a belly band or on the rear of a leg strap. To activate, pull the pilot chute out of pouch in a straight line with the pouch alignment and then to full arms length, releasing the pilot chute by throwing the pilot chute both behind and sideways. You must let go of the pilot chute after extracting it from the pouch to avoid an out of sequence deployment.
- Positive Pull Out: The handle is usually located in the same position as a BOC throw-out. However, the handle is connected directly to the main pin, and indirectly to the bottom of the pilot chute, which is stowed under the main closing flaps (there is no BOC pouch). The basic action is the same as for the throw-out. Grasp the handle firmly and pull out to the side in a sweeping motion. This will extract with pin and open the container. Continuing the pull will withdraw the pilot chute from the container. When the handle is tugged by the inflating pilot chute, you *must* let it go immediately to avoid a possible arm injury.

3.11.2 Equipment Transition – Canopy Down-sizing

Each individual will have a different set of rules for canopy downsizing. However, there are a few guidelines to follow. Once you have your Solo Certificate, you may decided to start experimenting with different sizes of canopies. This is generally encourage, but remember, experimenting with different canopies has put many experienced people into the hospital. It is important to always jump canopies that are within your ability to fly. Before considering canopy downsizing, you must be proficient with the size of canopy that you are currently flying. This is when you must be very honest with yourself.

If you can answer yes to those two questions then you may consider downsizing:

- Can you consistently fly to AND land your canopy in the designated landing area, within 10-20 meters of the target center?
- Can you consistently land standing up?
- Can you achieve the same results even with varying wind conditions?
- Can you land in a cross-wind condition if necessary?

Here are a few more questions you must first ask yourself before downsizing.

✓ Are you willing to accept the risks of a smaller canopy? Do you know what these are? A few considerations include:
- smaller margins for error
- faster landings
- less time to deal with conflicting traffic
- less time to look for potential alternative landing areas during an off-DZ landing
- previously correctable situations may become high-speed malfunctions (e.g. line twists)

- ✓ Are you prepared for the potential for landing this smaller parachute in an off airport landing area, which may not be as pretty as the DZ landing area?

Perhaps a very important question to ask yourself is "Why do I want to downsize?" When purchasing your first canopy, it may be understandable to want to get a sport canopy that is out of the student range of sizes, but appropriate for your weight and skill level. However, if the urge to go smaller is for the sake of increased landing performance, remember that good swoop is the result of good piloting and years of experience, not of flying a small canopy. Learning to get as much performance as possible out of your current canopy before downsizing will make you a much better (and intact) canopy pilot in the long run.

If you still want to downsize then here are a few rules you may want to follow.

- When changing from a square to an elliptical, stay with the same square footage.
- Downsize one canopy size at a time (e.g. If you are flying a 210 the downsize only to a 190)
- When changing from a rectangular canopy to an elliptical canopy, stay within the same square footage. For example, if you were jumping a 170 rectangular canopy, then you should transition to a 170 elliptical, before downsizing to a smaller elliptical. On the first jump on the elliptical, pull high and work on canopy basics: learn the new flare point, stall characteristics, rate of turn, riser control, and feel and see how much more altitude is lost during a turn
- On your first jump on a new canopy, the most important thing to do is to learn how far you must pull down the toggles before the canopy or stall? You must practice the landing flare several times up high. Feel how the canopy re-acts.
- Be smooth and even with your toggles and avoid jerky motions. Rapid toggle inputs can put an open canopy into line twists, with severe consequences at low altitudes
- Follow a standard right or left-handed approach, without aggressive turns, and only minor corrections on the final approach.

Ideally, the winds for your first jump should be low and consistent (around 5 – 8 mph) and you should pull above 5000'. Before you consider downsizing again, you should ask yourself the questions listed above. Always let the pilot know if you are planning on opening higher than normal.

An elliptical canopy will be more responsive, than a square canopy of the same size. It will turn faster, and lose more altitude during the turns, than a square canopy. Elliptical canopies also generate more lift during a flare than square canopies.

When downsizing, it is best to think of the smaller size of a canopy in a percentage rather than in square feet. If we are to set a rule when downsizing, we will only downsize one canopy size at a time. This allows for a greater difference in canopy size in the larger spectrum of canopies, and a smaller difference in size in the smaller spectrum of canopies.

It is important to understand that wing loading is not the only consideration when downsizing. A 1:1 wing loading on a 210 square foot canopy is not the same as 1:1 on a 120 square foot canopy. The smaller canopy will be faster and more responsive than the

larger canopy due to less drag from shorter lines and less material, and the shorter distance from the pilot to the canopy affects how the canopy will turn and flare. A spiral under a high wing-loaded smaller canopy will lose 1000 feet in 3 – four revolutions.

A wing loading of 1.2+ is considered a high performance canopy, and this is where most accidents are occurring. Downsizing too fast is the #1 reason. Stay on a larger canopy for as long as possible to build up experience and do more exercises; slow down on downsizing or you may become another statistic.

Flying smaller canopies can be fun and exhilarating, but it can also be dangerous if it is not done correctly. Please downsize conservatively and always seek the advice of an experienced canopy pilot when trying new smaller parachutes. If a Coach or Instructor offers you advice on your canopy flying, listen to them respectfully and follow their advice – it may save you from being injured.

SECTION 4 IN-FLIGHT SKILLS

Previous Section 3 – Equipment ..... Next Section 5 – Free Fall

4.1 INTRODUCTION

In-flight skills include activities done in and around the aircraft. They include such things as seating arrangement, spotting, exit order and climbing out to exit.

4.2 SEATING AND MOVEMENT

Although the DZ will determine the seating positions depending on the aircraft type, generally the seating arrangements are determined by the following factors:

- The need to maintain the Centre of Gravity (CoG) for balance and control of the aircraft
- The need to maintain communication between Pilot and Jump Master
- The need to minimize congestion during the exit
- The type of jump: exit order

In smaller aircraft, such as C-182 or C-206, it is important to load the aircraft to balance the weight under the wings to achieve the best CoG. When seating has the heavier jumpers to the front of the aircraft, it is unnecessary to learn forward, or worse, stand forward, as this puts everyone in a dangerous position. The only case where leaning forward may be necessary is if seating positions require a heavier person (such as a Tandem Instructor with gear) to be seated at the rear of the aircraft. In this instance, that person can kneel while seat-belted to aid them in leaning forward yet remaining secure to the aircraft.

The Exit Order also determines the seating arrangements, particularly in larger aircraft. Standard exit order, depending on the drop zone, is:

- Canopy Formation Skydiver: usually far up-wind from the landing zone
- Skyboard/Skysurfer: due to equipment, must sit near the door
- Large FS group
- Small FS group or solo jumper
- Large Free Fly/Sit Fly group
- Small Free Fly/Sit Fly group or solo
- PFF students: typically opening around 4000'
- Tandems: typically opening around 5000'
- Wing Suit: typically last to open due to longer free fall time
- High altitude canopy openings (above 5000 feet)
- Differing opening altitudes (e.g. 2500 vs. 3500 feet)

Once seated you should stay in place, with seat belts and helmets fastened for take off until about 1500 feet, and focus on mental rehearsal techniques and visualization to improve your skydive.

Space inside the aircraft can be quite limited. Advise others that you are moving (getting up) so the others can make room and protect their handles. Remember to move the rig clear of potential hang-up points. When another person is moving, make room for that person while protecting your own handles.

Finally, on smaller aircraft, such as Cessna 182 or 206, you should time your actions with others on the load so that only one person is getting up at a time. This may not be realistic on larger aircraft, such as a Twin Otter, but at the very least, you should avoid getting up at the same time as the person next/in front of you.

Everyone should be ready for the exit before the in-flight door is opened by having the gear fully secured (e.g. straps tight and tucked), helmet and goggles on, and prepared to jump.

When others move in the aircraft, protect your cutaway and reserve handles. This is done by placing your right hand over the reserve handle and the elbow over the cutaway.

4.3 PILOT BRIEFING

You probably have heard your JM perform pilot briefings on each of your previous jumps. During the preparation phase, you should arrange for instruction in the technique of pilot briefing. Key points for you to cover during the pilot briefing are:

- number of passes and the jump altitudes,
- specific direction of jump run, using ground references,
- exit types and air speeds - if applicable
- solo and group exit details for each pass

- canopy opening altitudes if higher than 4000 feet AGL.

The aircraft instruments are very useful to sport parachuting. Once familiar with them, you can discern the aircraft situation at any time without distracting the pilot. A jumper should know the location and function of the following: fuel gauges, fuel selector switch, aircraft altimeter, artificial horizon, airspeed indicator, rate of climb indicator, turn and bank indicator. Ask your drop zone pilot to teach you the details about these items.

4.4 VERBAL REVIEW

After the aircraft is airborne, the Jump Master will review with you the key events of the jump. When your verbal review is complete, continue with other in-flight skills. Key freefall events at the introductory level are to relax, arch in the box position, and maintain altitude awareness. Other elements will vary according to the exercise or task.

4.5 SPOTTING

The term "spotting" involves three individual tasks. Each time you are spotting, you may be doing some or all of these tasks. These include:

1. Determining the ground and upper winds so you can estimate an appropriate opening point that will allow you to get back to the DZ under canopy; and an appropriate exit point, that will result in you drifting to the opening point in free fall.
2. With the exit point known, you will direct the plane to fly directly over this point, usually while flying directly into the wind.
3. A final safety check to make sure you are not jumping into clouds, over water, etc. and that there are no other aircraft in the area.

These will be discussed in the following section.

4.5.1 Ground Orientation

On the first few jumps of the traditional Gradual Free Fall (IAD or SL) program, one should start to observe your DZ prior to exit at 3,000-3,500 feet. If you are in the PFF program, this can be accomplished during the ride to altitude as you pass by 1500', 3000' and 4500'.

On subsequent jumps, as you climb to a higher altitude, the DZ will be smaller, perhaps more distant, and harder to locate. You should learn to find key land marks around the airport, identify North, and know what the ground wind direction from an altitude of 5,000 feet so that you can check out the canopy flight path. Have someone point out landmarks that will help you to locate the DZ.

4.5.2 Spotting - Observed

Observed spotting is as simple as watching your instructor spot. This should start early in your progression. The pilot and Jump Master will aim the **jump run** into the wind over the DZ and the first jumper will get out up-wind of the DZ. Know the plan.

Establish one or two ground references and observe the movement of the aircraft across the ground toward the **EXIT POINT**.

The exit point is the ground reference point over which the skydiver wishes to begin the free fall. The exit point takes into account these three variables, and is therefore NOT over the desired landing area:

- forward throw from the aircraft,
- exposure time to the winds, and
- the wind direction and strength.

Forward Throw

When you hold onto the aircraft, you are moving horizontally at the same speed as the aircraft. After exit, you continue to move forward for roughly 5 seconds covering a short forward distance. Forward throw is more apparent in:

- light wind conditions
- downwind jump runs, used for Style competition series, or
- higher exit speeds used at higher altitudes and by large aircraft (e.g. King Air).

Exposure time to the winds

All objects in flight, falling through the air and under canopy are subject to the wind. The distance we drift in free fall or under canopy can be calculated based upon the observed strength of the wind and the exposure time to it. The average canopy descends at 1000 feet per minute. With an opening height of 3000 feet and winds of 15 mph we would drift ¾ of a mile.

Both free fall drift and canopy drift can be calculated with the same formula once the winds have been observed.

Wind Direction

Most jump runs are upwind jump runs. This is when jump run is flown over the drop zone, directly into the upper winds. This allows:

- reduced effect of forward throw
- reduced ground speed
- reduced sideways drift of the aircraft.

A slower speed across the ground allows some latitude in judging when you are directly over top of your exit point. Alignment with the wind at altitude will also make this job easier. Adjusting for a crosswind can be frustrating when first attempting to spot.

4.5.3 Spotting – Assisted

Several assisted spots will be needed before you feel comfortable to move on to unassisted spotting. The instructors will introduce the techniques for assessing the winds to calculate the opening point and exit point.

Spotting Technique

The pilot maintains control of the airplane door. Each type of door has a limited speed range that it can be opened safely within. Always get the pilot's permission before opening the door, even if only a small amount. (The door should only be opened according to the local drop zone rules)

The actual spotting technique to use is:

1. move into position at the aircraft door and get permission before opening the door (depending on the drop zone rules)
2. position your head outside the door so you can look straight down
3. identify the present position of the aircraft relative to the landing zone
4. indicate a corrections by placing your hand where the pilot can see it, point in the direction you need the plane to turn, indicate to stop the turn when needed. The aircraft should be heading directly into the wind (in other words, you should not observe any sideways movement) and it should pass directly over top of the landing zone.
5. watch for an effect (about 10 seconds) and indicate to stop the turn when needed,
6. near the spot, advise everyone to 'get ready' and ask the pilot to check speed and the "brakes on", if necessary,
7. start your climb out.

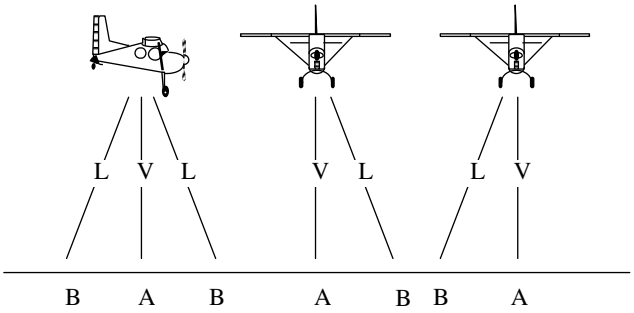
If you are considerably wrong in guiding the aircraft to the spot, the instructor will step in and provide corrections. This will prevent you from exiting in the wrong place, and decrease the chance of you landing in unfamiliar areas and possibly being injured.

Common Errors

There are some common spotting errors that you should be aware of.

Not looking straight down (failing to select a vertical line of sight) causes the following errors in determining the airplane's position over the ground. Note: the errors are larger at higher altitudes and often result from using the attitude (tilt) of the plane to select a line of sight.

- Looking ahead or nose high: short spot
- Looking behind or nose low: long spot
- Looking to the left or right wing low: right of spot
- Looking to the right or left wing low: left of spot



A - Actual position in relation to ground
B - Assumed position in relation to ground

V - Vertical line of flight

L - Actual line of sight

Spotting safety

While most DZ's are listed in NOTAM's (NOtice To all AirMmen) published by the Department of Transportation, there is a possibility of encountering air traffic over the DZ. The responsibility for avoiding an aircraft in-flight remains with the parachutist, since we have greater visibility and manoeuvrability.

- Always make a thorough VISUAL CHECK for other aircraft in the vicinity before leaving the airplane.
- An aircraft two miles away flying at 120 mph toward the DZ on the start of a 60 second delay can be over the DZ and possibly beneath you at opening time.

4.5.5 Spotting - Unassisted

Spotting unassisted is when you accept responsibility for observing the winds, calculating exit and opening spot, and directing the aircraft to the spot.

Spotting is a developed skill and requires practice. An accurate spot helps to avoid landing in a hazardous area. A haphazard selection of an exit point can lead to long walks in the countryside and earns the wrath of fellow parachutists at a minimum.

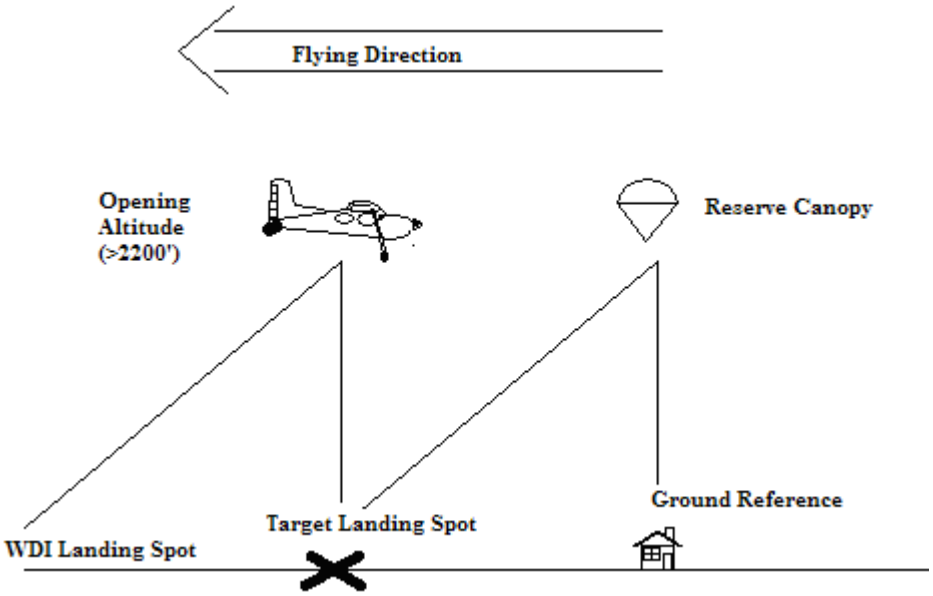
Opening point selection

Each jump day, we observe the winds so we can calculate where we want to open our parachutes so that we can land on the drop zone. Essentially, we want to determine approximately how far we will drift in 2 minutes (about the time we would be under a reserve canopy if we had a malfunction), and the direction we would drift. To do this we need to know what the wind is doing on the ground, as well as at various altitudes up the opening altitude. We do this by watching wind drift indicators, flags and wind meters, and performing rate 1 turns on the ascent through 1000 to 2000 feet.

Wind Drift Indicator

The most accurate method for judging canopy drift is the use of a Wind Drift Indicator (WDI). The WDI is a large crepe paper streamer that descends at about 1000 feet per minute.

It is dropped at 2,000', slightly less than opening altitude, directly over the target (A) and drifts downwind (B). A ground reference point (C) is selected an equal distance upwind from (B). The point (C) is the ground reference point over which the parachutist should open. It is referred to as the opening point.



THROWING A WDI

As part of your spotting progression you have been called upon to observe the winds. You might even ask to make the WDI prior to the jumping. Advise the pilot that a WDI will be thrown at 2,000' AGL.

Prepare the WDI by unrolling two to three feet of paper. Spot the WDI run, and throw the WDI directly over the target. Have the pilot circle while you observe the descent of the WDI (a right-hand turn is required if you are going to watch the WDI). A small aerial photo placed in the aircraft is very helpful for showing other jumpers in the airplane where the WDI landed, and where the spot should be.

Construction: a WDI is constructed from a piece of crepe paper approximately 25 cm. by 6 m. (10 inches by 20 feet), weighted on one end with 7 rolled magazine sheets and then tightly rolled up in order to carry it safely in the aircraft.

This technique should yield a WDI descent rate of 2 minutes. The advantage of using a weight made of crepe paper is that once exposed to weather the entire WDI will disintegrate rapidly. Weights made of coat hangers or welding rods can possibly damage farm machinery or injure farm animals. A WDI must be clearly visible from at least 3000 feet away or more under a variety of conditions and or backgrounds. To improve visibility, throw two differently coloured WDI's (e.g. red and yellow). You can use different coloured WDI's for different seasons and types of ground-cover:

- summer: yellow, red or orange
- snow: red, blue or purple
- crop stubble: red, blue, or purple
- water: yellow, orange, or white.

The wind drift should descend at approximately 300 m/min. (1000 ft./min.). To facilitate an accurate spot, you can time the WDI to ensure the descent time is correct. If it is different by more than 10-15 seconds, make the following adjustments:

- short descent time: Add to the distance in proportion to the time missed; the WDI did not drift as far as a parachutist would under a normal canopy.

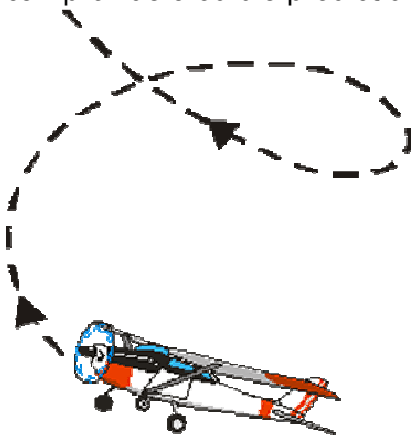
- long descent time: Subtract from the distance in proportion to the extra time; the WDI will have drifted further than the parachutist under a normal canopy.

Exit point selection

An objects drift is related to the time in the air and the air's speed and direction across the ground. Methods you may use to observe freefall drift are:

- meteorological reports (MetRep) - wind velocities at different altitudes
- aircraft drift - rate one turn or pattern-flying
- cloud drift – from the ground or in the air

Meteorological Reports (MetReps) are a forecast of expected winds acquired by the pilots, generally, from Nav-Canada. They often include 'real time' information from other airports and can provide credible predictions of local weather. (http://www.navcanada.ca/)



Rate 1 Turns are a standard move for pilots. It is a 360°turn that takes 2 minutes to complete. The pilot starts the turn over a ground reference and maintains a constant rate of turn. At the end of the 360° of turning and 2 minutes of time, the point below the aircraft is identified. The distance between the starting and completion points is the approximate distance that you will drift if exposed to those winds for 2 minutes. This method can also be used at lower altitudes to determine the opening point, since the drift during the 2-minute turn will approximate the drift under canopy during a 2 minute descent

Cloud Drift can be observed very effectively from the aircraft. The direction and speed of the clouds shadows can be measured. From the ground, the clouds' heading can be observed as well as a rough indication of their speed.

Pattern Flying is performed by flying the aircraft in two directions in order to triangulate the jump run. pattern flying

- fly compass N or S and check for side drift
- fly compass E or W and check for side drift
- Turn into uppers and adjust to eliminate side drift
- Fly 90° to uppers for 45 s, build a parallelogram to tell distance of freefall drift

Observation of the other jumpers on a previous fligh can provide solid information as well.

Building the Spot

- build the spot from the bottom up: landing point, opening point, exit point
- know where you are going to land and approximately where you are going to open before you get in the aircraft
- determine exactly where the opening point is as you fly to 2000'
- determine exactly where the exit point is as you fly to altitude
- the jump run is into the upper winds, following a line that goes through the opening point
- allow time for the climb out, taking into account the forward throw based on the strength of the upper winds

Tips

- take an active role in spotting; even if you are sitting in the back, know where the spot is
- know where you are at least 1:30 minutes prior to exit
- use your resources when spotting, i.e. the pilot, other experienced spotters
- do the 3-dimensional spotting exercise with your Coach to assist learning and understand spotting

4.6 IN-FLIGHT GEAR CHECK: Handles and Pins

Prior to exit the jumpers need to move from their seated positions to a kneeling position ready for climb-out. During this period of movement, it is possible to interfere with the gear accidentally. An in-flight gear check is an opportunity to confirm that the rig still safe and functional. Prior to exit, perform the 3-Handle Check (assuming a TAS: pilot chute, cut away handle, reserve handle). Touch every handle and confirm:

- its location
- that it is securely held in place
- that it is positioned correctly

To reinforce the order of proper use, physically touch the handles in the correct order with the correct hand, in the order that you would access them in the opening sequence:

1. The main deployment (pilot chute or rip cord): the handle is in reach, with no excess material hanging out
    a. Mock Pull the Pilot Chute as you would in free fall;
2. Cut-away handle: well seated against the Velcro, clearly visible, not covered or folded under the main lift web
3. Reserve handle: well seated against the Velcro, clearly visible
    a. Mock Pull the cut-away handle fully to the crotch
    b. Mock Pull the reserve handle fully to the crotch
4. Think about returning to the arch position, and what you will do with the handles.

Make this a part of an established routine that will work for every jump of your skydiving career.

Before Exiting the aircraft, Check Your Handles:
1. Pilot Chute
2. Cut away
3. Reserve

In addition, check the following:

- Altimeters should all read about the same
- Reserve pins - seated at the ¾ position, flap tucked
- Main pin - seated at the ¾ position, flap tucked.
- Main bridle routing – confirm that the bridle is well tucked into position and that none is exposed
- Overall appearance still neat
- Goggles and helmet on
- some audible altimeters can be adjusted in-flight

There are some items that do not need to be checked in-flight:

- many AAD's are placed in spots where it is not possible to check in-flight
- checking if the Reserve cable slides in housing is difficult
- the harness fit is difficult to check due to sitting posture, however make sure the straps are tight and the ends stowed.

When checking someone else's pins, avoid the practice of giving the pin cover flap a good pound to indicate that everything has been checked. This may inadvertently knock something loose after you have just checked it!
It is better to tell the person everything is OK, or pat them on the shoulder.

4.7 EXIT TYPES (poised, dynamic, hanging, dive)

Regardless of the type of exit, heading control is important. To remain on a chosen heading, you should present your torso to the wind and present a symmetrical arch and stop any turn that starts. In the first moments look up and use the aircraft itself as a reference. As the forward throw bleeds off adjust to a reference on the horizon.

There are four solo exit positions commonly used at most DZ's. They are:

- poised
- dynamic
- hanging or flying
- dive

Each exit is discussed in three stages: the climb-out, the set up, and the launch. The descriptions are based on aircraft such as a Cessna 182 or 206 or others with a similar set up.

Poised Exit: For the climb-out, move outside of the door onto the step and into the airflow. Both hands should be on the strut and the torso centered forward between the hands. The shoulders are higher than the strut and the torso level to the horizon, elbows are bent, and the head is looking forward toward the horizon. The right leg should be off the step and trailing behind. The launch motion is a gentle rock forward then back and to the right. The right leg should swing forward and back to emphasize the motion. Following through into the arch, keep the head up and the hips pushed out hard.

For larger aircraft, climb out and turn to face the aircraft, holding onto either the inside bar or the outside bar over the doorframe. Stand poised on the right foot, with the left leg dangling. The left leg will be used to swing for the count, and will be presented into the wind. Release the left arm, and simultaneously swing the body out, turning directly into the relative wind. Reach the arms and legs as wide as possible and push the hips forward. You should be "standing" in the wind, watching the wing as you launch.

Dynamic Exit: The climb-out begins from a kneeling position in the door. Grasp the front and back of the doorframe, place the left foot on the step and reach out to the strut with the left arm. Place the right foot into the back of the doorframe. Stand and balance on the left foot, taking weight off right leg. Your hips must be well above your right foot, which supplies a forward push to balance in the wind pressure. The shoulders should be as square with the wind as possible. The launch is side step away from the aircraft towards the wing and swinging the right foot out to assist with the launch. Follow through by spreading out wide, pressing the hips forward and look up.

Flying or Hanging Exit: The initial climb-out is the same as the poised exit. Once in the poised position, move both hands outward along the strut as far as possible, prepare your arms to support your weight and smoothly step off too place yourself into a hanging position away from the step so that there is no chance of contact with it during the launch. Maintain a good grip on the strut by wrapping the fingers over the front edge of the strut. Clench the

buttocks (this presses the hips forward), spread your legs slightly, press your toes and pull your head back so you can see your arms (this will arch the chest). Essentially, your arch is presented at this point. Release the hand grip, keep looking up to the wing as you let go, and swing your arms back and out into a spread-eagle position; stretch outward to the maximum.

Dive Exit: The climb-out for this exit is different from previous exits. To set up, move up beside the pilot and into the doorway, turning to place your back towards the direction of flight, facing the tail of the aircraft. Your set-up position is kneeling, with the left foot outside on the step, depending on the aircraft. Ensure your set up is clear of any A/C controls (fuel, flaps, throttle) and the doorframe. Bend forward so that the *shoulders are lower* than the hips, and angle your body at about 45° in a downward level. The launch action is a roll off the left leg, with no pushing, following a dive action of the upper body. Extend the arms far above your head, as if you were doing a handstand, and tuck your feet against your buttocks. As the forward throw ceases, follow through by returning to the neutral arch position. Maintaining eye contact with the horizon will allow you to assess your heading control.

4.8 INTENTIONAL UNSTABLE EXIT – Ride the Slide

The purpose of an intentionally unstable exit is to give you confidence. Successfully completing this task will confirm to you that the arch works, and will increase awareness and relaxation. Some types of unstable exits are back or front loops immediately out the door or holding one foot with the opposite hand. It is all good fun!

In this exit, you leave the aircraft facing the tail, in a feet-to-earth orientation. Your back will face the relative wind rather than your chest. The initial climb out is the same as the dive exit, but is completed by placing your right foot on the step, next to your left. Your right hand should be gripping the rear of the doorframe, and your left hand may grip the strut for additional support. The launch is a large step forward, toward the tail of the plane. Place your arms straight out the sides, with your palms facing down and back. Your knees and hips should be slightly bent, and your knees wide apart. Immediately after launch, you will likely be in a vertical, feet to earth attitude. After a short time, you will most likely be falling with your back towards the earth. If upright, you can use a point on the horizon to assess your heading control. However, this will be difficult if you are back-to-earth.

As part of the SOLO requirements, you are to performed one “Ride the slide exit” (sitting exit with back towards propeller) for 5 seconds prior to rotating back to belly to earth. This should be explained to you and practiced on the ground prior to boarding.

4.9 IN-FLIGHT UNUSUAL SITUATIONS

Weather problems can sometimes force you to alter the planned exit height or exit spot for the jump. Since jump activities are conducted under Visual Flight Rules (VFR), your pilot is not allowed to fly above a broken cloud layer (50% coverage). Pilots are permitted to operate above cloud level in scattered conditions provided that a horizontal separation of 2,000 feet and a vertical separation of 500 feet from any clouds is maintained.

If the weather deteriorates to the extent that exiting at the planned jump altitude and spot would be a violation of VFR procedures, then you must a change the dive plan. A jump below the ceiling with a shorter freefall can still be made. This should only be considered when a jump could be safely completed. After consulting and briefing the pilot a prompt decision should be made.

If you decide to make the jump at a lower altitude, reduce the number of tasks or repetitions in proportion with the reduction in altitude.

If the jump has to be cancelled due to low cloud or high winds, sit comfortably for the descent and fasten your seatbelt. Mechanical AAD's such as the FXC 12000 should be switched to the OFF position. Some electronic AAD's, such as the student Cypres, should be turned off, if possible. You should know the procedure for the equipment you are using.

Equipment problems in the aircraft should be dealt with promptly. Examples include:

- a leg strap coming loose
- a loose pilot chute
- a handle becoming unseated
- a parachute partially deployed

You should also advise other jumpers if you experience a serious problem or see a serious problem with their gear. The only case where you would take immediate, independent action is if you see a main or reserve parachute going out the door - THROW THE PERSON OUT of the airplane. They may not be aware of the problem and it is better to be in the air than inside the aircraft when a Pilot Chute goes out the door.

Physical problems such as your leg going to sleep due to a leg strap being too tight should also be dealt with. Stretch out and flex and wiggle the affected limb. You should be able to handle this situation easily.

Aircraft problems can and do occur. If they do, **you must listen to the pilot's commands**, then follow instructions as quickly as possible. There are only two possibilities:

"prepare for an emergency landing"
or
"emergency exit" from the aircraft

If you are below 1500 feet expect an emergency landing. Fasten your **helmet** and **seatbelt**, get into a kneeling position or sit on your bum, tuck your head to your knees and clasp your hands behind your neck as taught in the FJC.

For an **emergency exit** you will:

1. Take no independent actions except to fasten your helmet, be ready to move, but stay STILL to allow the pilot to fly the airplane.

2. Wait for the pilot to command "**This is an aircraft emergency! Go!** "or words to that effect.
3. If required to leave open the door and perform a fast dive out exit - everyone needs to get out quickly.
4. Activate the main (above 2500 feet) or the reserve (between 1500 and 2500 feet)

It is important that everyone listen to and obey the pilot's commands. Opening the jump door at high airspeeds can damage the airplane making a bad situation worse. Many emergency situations could require increased airspeed. For example, in the case of an engine fire, the pilot will dive the plane to blow out the fire. The pilot will inform you when it is safe to open the door. **Never** open the door during an engine fire as this will introduce more oxygen into the cabin and may make matters worse. Listen to the pilot!

If a minor problem (e.g. low fuel), develops above normal opening altitude the pilot may choose to give you a jump run during a gliding descent. In this case, you may be able to exit over the spot and use your main. You may need to open higher than planned if you are far away from the landing zone.

Since some form of aircraft failure is a real possibility, you must be properly prepared. This topic is covered on the First Jump Course and includes the information required by Transport Canada.

SECTION 5 FREEFALL SKILLS

Previous – Section 4 In-Flight .... Next – Section 6 Canopy

5.1 INTRODUCTION

This section deals with those activities that occurs following aircraft exit, up to canopy inflation. Theoretical models for freefall control skills and application of the freefall model are found at the end of this section. The skills are in order from simple to complex.

5.2 THE ARCH

STABLE ARCH

An X-shaped curved body position was introduced during the first jump (IAD/SL or PFF). It is also referred to as the "spread eagle". To attaining this position:

- arch at the hips by clenching the buttocks and thrusting your pelvis forward hard!
- spread arms and stretch out roughly 45° to the horizon, palms placed forward into wind, with the arms back in the wind a bit
- place your feet slightly wider than shoulder width apart and point toes, with a slight bend in the knees
- head should be tipped backward as far as possible; this will help to accentuate the arch
- relax into the body position; the curve requires a bit of tension, but do not over do it!

After 5 seconds of freefall, and the forward throw from the aircraft has been lost, a more relaxed "Box" position may be used.

BOX POSITION (aka The Boxman)

The box position is important for sequential Formation Skydiving. It is a widespread, symmetrical falling position. When falling in a neutral falling position the body is slightly arched to spill air and remain on one spot. To form the box, arch with the arms bent 90° at the shoulders and elbows and the palms pressing into the relative wind. This will bring the hands forward and out in front of the head. The legs bent at the knees so that the legs are slightly bent, with the feet and lower legs pushing out slightly onto the relative wind (see diagram below), and a slight, relaxed curve in the torso at the hips. This position presents balanced amounts of drag from top to bottom, left to right. This position will also cause one to fall straight down because there is no tilt presented to the air (tilt, as we will learn later, is what we use to cause movement in the air). The narrower stance of the Box versus the X-man, and reduced curve of the torso from the hips causes us to trade stability for manoeuvrability. When moving in freefall it is very important to have this good and balanced starting position prior to doing your moves. You should return to this box position after completing a move and prior to executing the next move. Having a good body position is important for the rest of your skydiving career.

Box position

- place arms and legs to the sides, bending 90 at knee and elbow joints,
- open your hands, palms placed down into wind, and point your toes,
- relax the body position; it requires only a bit of downward tension for control, but there should be no tension in the limbs.

When practicing the Box position on the floor or on a creeper, you should keep the arms – elbows and hands – on the floor whenever still. Press down slightly with the hips (pelvic bone) into the floor or creeper to feel the positive pressure, but it should still feel comfortable. It is incorrect to "lift" the arms off the floor, as this is counter to what we actually want to do in the air, which is to press down on the relative wind in order to generate lift in the upper body.

The advantages of this position for formation skydiving are:

1. The square position allows the completion of certain sequences with just a centre turn on the spot
2. The wide stance provides more lateral (side-to-side) stability while falling. It also provides a solid failing position that can take a rough dock and not knock the skydiver or formation into an unstable position.
3. The positioning of the hands being equal to or forward of the head is a good placement to receive docks or take grips without changing the body position.
4. This body position gives formations geometric and structural integrity which permits them to build and fly properly.
5. The box stance allows for efficient movements with only minor joint movements due to the effect of full body air deflection (e.g. twist your waist).

5.3 DEPLOYMENT COUNT

"**ARCH** thousand
two thousand
three thousand
four thousand
five thousand
CHECK thousand."

As your parachute deploys it is important to develop a sense to keep track of the time. This is a key component in identifying if the canopy has opened. The count starts from the moment the pilot chute is released. If you are performing a long free fall delay, the instructor may shorten the count due to the higher airspeeds. The count should be loud and clear to ensure that it takes the correct amount of time. Please note that the count includes two important reminders: ARCH and CHECK. As you progress, different tasks may employ variations of the deployment count.

5.4 ACTIVATION

To deploy the main canopy it is important to remain stable through the pull sequence and the deployment, however, do not sacrifice altitude for stability. If performing training pulls, proceed as directed by your instructor.

Relax - Follow the proper pull sequence, pulling deliberately and smoothly.

Remain stable - Focus on keeping the torso curved during the pull. Eye contact with the horizon will help with stability and self-awareness.

Grasping the pilot chute - Moving both arms at the same time helps to maintain heading control and balance. The right hand sweeps out and then down to the pilot chute and the left arm does a smooth pivot (at the shoulder) 'upwards' to place the open hand one foot above or in front of the head (as if blocking the sun out of our eyes). Reinforce the timing of the arm motions by thinking, "both arms in".

Throw the Pilot Chute - With a firm grip on the pilot chute handle, extend both arms to the T-position and release the handle behind and away from you. This places the pilot chute as far away from the torso as possible and establishes a wide base of support. Ensure that the right hand is presented palm to the sky to eliminate a possible pilot chute entanglement. Reinforce the timing of the arm motions by thinking "both arms out".

Arch, relax, count – Stay arched and perform a deployment count. The canopy takes a few seconds to deploy and inflate.

5.5 ALTIMETER USE

Altitude awareness is our primary survival skill in skydiving. Visual Altimeters may be located on the chest or wrist. When free falling, perform the following sequence when checking an altimeter:

1. maintain stability
2. locate the altimeter, moving your head only, keeping the arms still
3. ensure a positive reading of altitude
4. glance at the face briefly, just enough to read the display
5. return head to facing forward

Development of the following skills related to altitude awareness is equally important.

> Altitude Awareness is our #1 survival skill

Time Sense: To be a successful, independent skydiver one must develop a sense of freefall time. It is a very real necessity. A time sense is what will cause the skydiver to divert attention from whatever one has been doing to the job of checking where one is, or why the canopy has not yet inflated, "because it has had long enough." Once you have advanced to longer delays (e.g. > 10 seconds) you should demonstrate this sense.

Eye-Balling: Complementing time sense is an ability commonly known as "eye-balling". This is the skill of judging your altitude with your eyes. This skill can be difficult to refine and is used as cross check of your altimeters. Initially, concentrate on identifying 3000 feet AGL. Being able to confirm visually if you are above or below this height will serve you well. This can also be done during your climb in the aircraft.

Your view of the horizon should be virtually the same at any DZ from any specific altitude (unless you are jumping in a narrow valley between high mountains).

Haze is a regular summertime problem for most DZ's and this presents certain problems. Depending upon its severity it will restrict the visibility, ranging from obstructing the horizon to obscuring all but the area immediately below. It may affect vertical and downward slant observation of the ground making it difficult to see the normally visible landmarks.

Both of these perceptual abilities, time sense and eye-balling requires regular, active participation in the sport, not one jump a weekend. These two abilities and the judgment, which develops with them, will save very precious seconds in an emergency. Different drop zones, with varied landmarks, different sized field, different topography, and various runway lengths will affect the "eye-balling" judgment that developed at the home DZ. Combined with time sense, however, the correct decisions must be made.

Ground Rush: This is an optical illusion created by watching a fixed point on the ground. As the objects enlarge, they appear to rush outward, giving the person affected a sense of speed. This illusion can be very distracting causing a momentary distraction from the job at hand, which is keeping track of the altitude. If you look down and you experience extreme ground rush, PULL immediately!

Although we should not depend entirely on our eyes to gauge our height, the sudden onset of ground rush is an indication of lack of altitude; the parachutist should pull immediately, regardless of altimeter reading. When in doubt, whip it out!

Instrument Combinations: Regardless of the combination in use (e.g. visual and audible), ALWAYS activate your parachute based on the lowest altimeter reading. You should always include a visual check of the ground when checking your altimeter.

It is common to see jumpers wearing a wrist mount “for themselves” and a chest mount “for their friends”.

5.6 HEADING CONTROL - Turns

The complimentary skill to intentional free fall turns is holding a heading or simply put falling without spinning out of control. It requires that you use a selected reference point to identify if a turn is occurring and to stop it. As a beginning skydiver, you may have heading control issues due to a lack of symmetry in your body position or too much muscle tension used to hold the arch. If control issues occur:

- Mentally and physically check your symmetry torso first, arm and legs second, and then perform an arm or leg exercise as necessary.
- Keep your head up and identify the direction of the turn.
- Bank your upper shoulders the opposite direction until the movement stops. Countering the unintentional turn should be done smoothly and far enough to stop the turning motion completely. It may take a moment or two.
- Return to neutral which is a relaxed symmetrical arched box position.
- If you are unable to stop the turn, or feel yourself spinning faster (called a Flat Spin) you can try a couple of different options to regain control back into the box position:
    - Quickly tuck up into a ball and the immediately stretch out into the X-man position, then recover back into the Box position. Check altitude.
    - Alternatively, perform a short Delta Dive (if sufficient altitude); this should stop the turning action. Then recover back into the Box position. Check altitude.

5.7 TURNS: 90°-180°

This exercise allows practice in the initiation and countering of small turns prior trying large turns. Many moves in skydiving build up momentum. Utilize the concept Initiate-Coast-Counter to manage the momentum.

Intentional turns also require that you identify and use eye contact with a horizon or ground reference to assess the situation. Follow your dive plan for the exit, do an observation circle and select a point on ground at a 45° angle (or more) in front of you. Discussed, as an example, is a 90° left hand turn:

1. Maintain a box position and relax.
2. Look to the left and select a reference
3. Initiate the turn by dropping the left shoulder; this tilts the entire upper body. The air deflected by your chest moves you.
4. Coast by returning the shoulders to neutral. The momentum of your body will continue the rotation unaided.
5. Counter the rotation in order to stop on heading, or at least near it, by dropping the right shoulder to deflect air the other way. The counter-move should be done smoothly but hard enough to stop the rotation completely.
6. Return to a neutral box, assess your heading control, and assess the altitude.

Several turns can be performed if the altitude permits. Remember your dive plan and react correctly for the altitude

Slow, short, controlled turns are all that is needed to be achieved at this point. As you see improvements in your turn technique and your ability to judge the results of your efforts, then longer, more aggressive turns can be performed. Positive results in learning turns can be realized by ground practice utilizing a prone training aid (e.g. creeper).

Plan to invest 2-5 minutes of free fall time learning free fall turns. This allows you to develop some smoothness in doing the turns. Progress from 90° to 180° to 360° turns over several skydives as you build the confidence to do full rotations and go faster.

5.8 TURNS: FIGURE 8

Once a 360° turn can be performed with rhythm and in control, a Figure 8 (two controlled turns in opposite directions chained together) should be easy. As with a single turn, select a ground heading, start the first turn, stop on heading and start the second turn. Remember to perform an Observation Circle after this task.

5.9 ARM + LEG EXERCISES

The purpose of these exercises is to explore the full range of arm and leg motions and the resulting tilts in free fall. Observe the following cause and effects.

- move elbows up (arch) - a head-down tilt
- arm are pushed down (de-arch) - a head high tilt

- move hands forward (reaching) - a head-high tilt
- arm are pulled back - a head low tilt

- extend your legs fully (toes pointed) – a slight head down tilt
- bend at the knees - a head high tilt

These exercises are often assigned to help ‘loosen‘ someone up in freefall. They promote physical literacy in the sport, relaxation and awareness of your body.

5.10 OBSERVATION CIRCLE

This is also called the "Circle of Awareness". Look to the right, left, check the altimeter and check the ground or the horizon. Initially you should perform this after every completed task. As your time sense develops, you will tend to do less of these in the first half of the jump.

5.11 BACK LOOPS

The skills of performing a back loop, a front loop and a barrel roll are FUN to perform and are the first 'recreational' moves to learn. These introduce the two remaining axes of rotation:

- Lateral (loops where the axis is through the hips) and
- Longitudinal (rolls where the axis is through the body from the top of the head to the feet).

You may choose to learn the Front Loop or Back Loop (the lateral axis), or the Barrel Roll (the longitudinal axis) in any order. Please consult with a coach who is familiar with your experience and capabilities for some guidance. All three of these moves require you use your full range of motion (physical literacy) and make decisions about your altitude and attitude in the air.

The key steps to follow for a basic back loop are:

SET UP in the relaxed arch.

INITIATE the loop by breaking the arch at the waist and aggressively bringing the knees up to the chest (impulse); think of trying to touch each knee into a shoulder; avoid contacting your face. Hold your knees against the chest until your torso passes through vertical.

- Bringing the knees up quickly will help the body to follow through the loop. Think of hitting each shoulder with the knees, which creates the momentum.
- The result is that you will rotate or roll backwards
- The faster you transition from arch to tuck and tuck to arch, the cleaner the loop will be.
- Keep the head looking forward toward the horizon. When the knees come to the chest, the head should naturally tuck into the chest. This is correct.
- Note: while often misstated, it is incorrect to "throw" the head back during any loop. Avoid doing this at any time. This will throw off your centre of balance, and actually counters the rotational momentum that you are trying to generate with your legs. Keep the head looking forward and allow it to roll into the chest.
- A good drill for rotating faster is to do a back roll on trampoline. Perform a back drop onto the shoulders and then very quickly pull your feet/knees over your head so that you flip backward and onto your feet. The idea is that, when you do a back tuck, you should be pulling your feet up over your head to rotate, not dropping your head and shoulders.

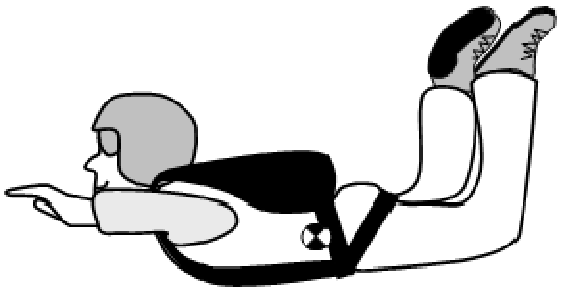
- Keep the arms forward in their box position. As the knees come to the chest, the arms will naturally sweep back along the sides of the body. Keep them along the side throughout the rotation.
- To provide more stability, for beginners, you may place your arms wide out to the side to provide a wider stance and hence more stability; however out front is correct.

COAST until you are at least 270° through the loop. You will see the ground straight below and feel the wind starting to hit your chest.

RECOVER the rotation by extending the legs.

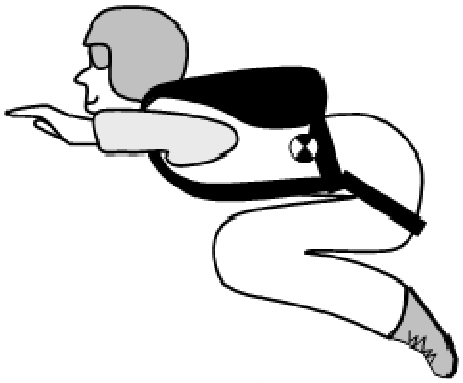
- Stretch the legs back out to an extended position to grab as much air as possible to counter the rotation as you come around to the horizontal position.
- Keep the arms tucked into the side of the body and out of the wind, until the rotation as ceased.
- Once the rotation has stopped, then place the arms back into the relaxed box position.

The momentum from bringing the knees to the chest should be enough impulse to complete the loop. If your torso pitches up past the horizon, that means you had lots of momentum for the loop, and either (a) opened a moment too late, or (b) placed your arms out too prematurely, causing them to catch air and lift the front of the body. As a refinement, you may need too sweep the arms to the sides during the coast or initiate with less impulse.

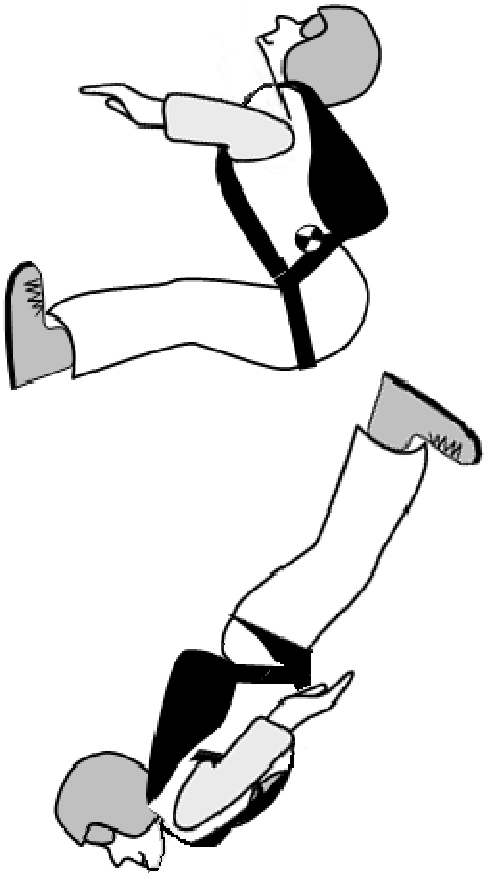


Basic Back loop

Start from a relaxed, neutral body position



Initiate with the knees. The faster you drive the knees to the chest, the faster you will rotate.



The Head should naturally tuck into the chest as the body starts to rotate. The Arms should naturally come to the side of the body as it rotates. The knees should be tucked in tightly to the chest for a back tuck.

Once the ground comes into view, at 270°, recover by extending the legs fully out straight. Keep the Arms tucked along the side of the body. Use only the legs to counter the rotation.

More advanced techniques can be introduced

- De-arch the arms to create floating of the upper body to assist speed of the loop.
- Throwing arms forward and down to speed loop initiation.
- Tucking up into a ball after initiation to accelerate loop. It is a good technique for doing multiple loops for fun.
- To provide more impulse, you can stretch your arms out in front and push slightly down at the same time as tucking the knees. This will result in a much faster loop.

There are other styles of loops:

- multiple tucked back-loop
- pike back-loop and
- layout back-loop.

Once you become proficient in the Back Tuck, you can try a PIKE. The knees remain straight throughout the loop. This requires a lot of flexibility in the back of your legs. Modify your timing. Practice delaying the tuck to set it higher and rotate longer in a straight body position (layout), then, open OUT of the tuck quickly. In this way, you ride the jump longer. Tuck more aggressively (rotating faster) and kick-out of the tuck early. Find more about different loops in PIM 2B and 2C.

5.12 FRONT LOOPS

A front loop is similar to a forward somersault. The steps to complete a front loop are:

Set up in a relaxed arch.

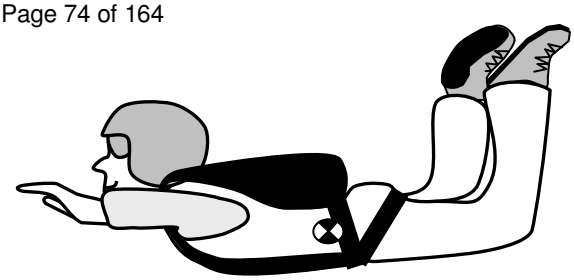
INITIATE

- Bending aggressively forward at the waist to dropping the upper body straight down toward the ground or further. At the same time, sweep your arms to grab the knees.
- The most common mistake when executing a Front Tuck is to throw the head down toward the ground. Instead, be sure to force the upper body downward toward the legs, initiating at the waist, maintaining a neutral head position.
- As the body begins to rotate and the wind hits the back, tuck the knees to the chest to remove them from the wind as the rotation continues. This conserves momentum and the result is accelerated rotation.

COAST: in the tucked position until the body passes the upright position (270° around). It is accepted practice to grasp the knees to hold the tuck tight.

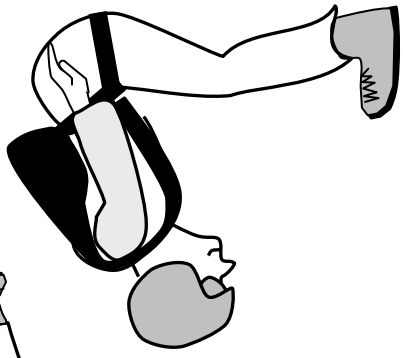
RECOVER: unfold back into an arch, arms first to counter the rotation. After the rotation has stopped, then place the legs out into the box position.

Front loops will rotate faster if the legs are extended during the initiation.

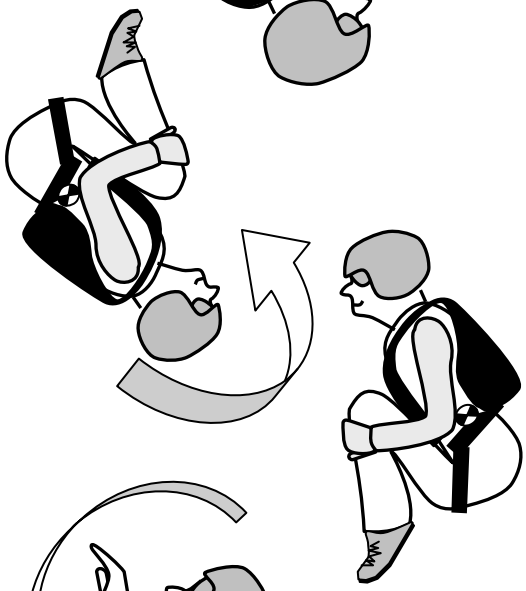


The Basic Front Loop:

Start from a neutral box position.



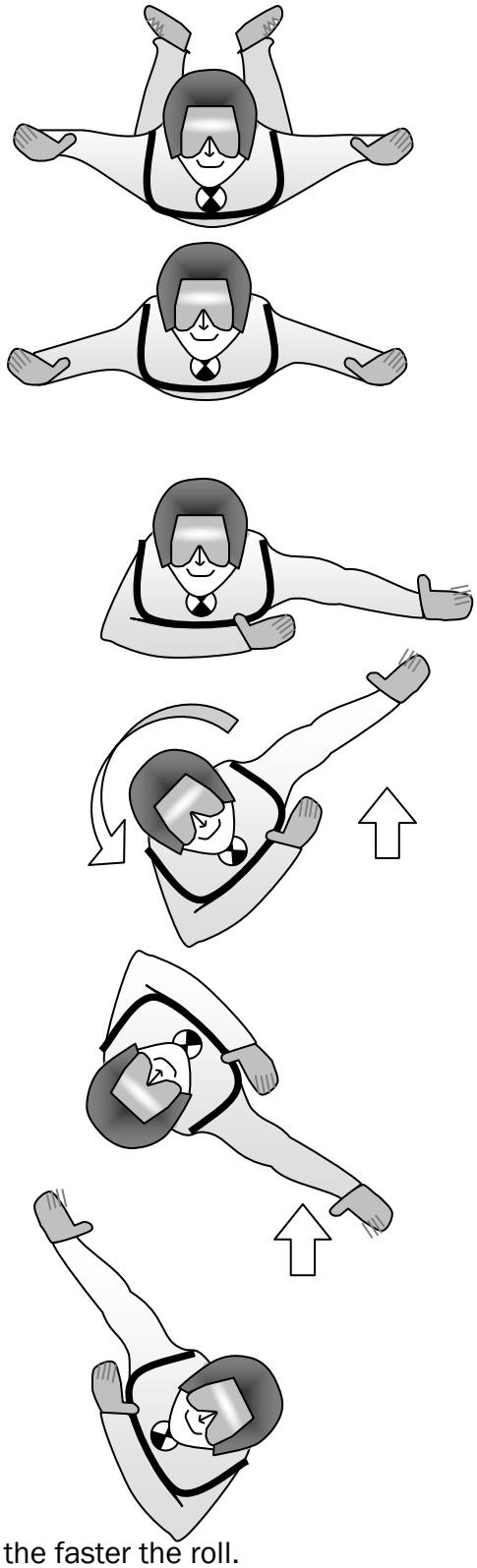
Initiate by bending forward at the waist, sweeping the arms back to the sides.



Tuck the knees in to the chest. You can grab onto the knees if this helps. Bring the legs in tight to help with the rotation.

At 270°, recover by unfolding the upper body by extending the arms out. This will catch the air and stop the rotation. As the rotation stops, extend the legs into the neutral box position.

5.13 BARREL ROLLS



A barrel roll is achieved by applying drag on one side of the axis of rotation. This is accomplished by moving the arms from one side to the other. The steps to complete a barrel roll are:

SET UP: in a box place, extend the legs straight out, toes pointed, and flatten the torso. It should feel as if you were laying face down on the floor.

INITIATE by:

- Bring the one arm in across the chest, as if you are going to punch the opposite shoulder.
- At the same time, forcefully push down on the air with the extended arm, just as you would if pushing yourself over while laying on the floor.
- As you have rotate to 180°, allow your extended arm that is pushing the air to naturally wrap into your body.

RECOVER: at 270° - 300° extend the left arm spread back into a relaxed arch. Once it is extended, re-establish the curve in the torso.

Two things commonly occur during this type of roll:

- Because the legs are extended in order to provide an elongated body position for executing the roll, there is a tendency to fall slightly “head down”. This is completely natural.
- This roll has a tendency to go off heading. The major player in this is not extending the legs fully prior to initiation. The slightest bend will cause the roll to go off heading. Keep the legs straight.

This particular type of roll may be referred to as a ‘King Kong’ roll or ‘Flip Flop’ because of the arm action. This technique relies on the asymmetrical drag to cause the roll as a result you must do the arm motions with lots of speed do to a clean roll. Sometimes this roll is taught as a passive movement: that is, by extending one arm and contracting the other, the wind should push (roll) you over. However a Dynamic roll will produce better results; the more you push down on the air with the extended arm, the faster the roll.

A different kind of roll is the French roll. On this type of roll, you straighten the torso and throw yours arms above your head with a twisting action. It has the benefit of better heading control. [See PIM 2B]

The key is getting the legs straight.

5.14 DELTA and BACK SLIDE

The Delta is used to close significant differences in altitude and distance between skydivers. A back slide is done to recover from the speed and momentum of a delta or it can be a stand-alone move to back away from a formation. The speed and steepness of a delta can be varied greatly. To do a simple delta and back slide drill the steps are as follows:

Delta Dive

Set up in a neutral box. Look towards the horizon.

INITIATE

- Extend the lower legs from the arch into straight legs and point the toes. Keep the knees wide.
- Sweep the arms back smoothly
- Maintaining a curved chest, thrusting your chest forward to lead the body into the relative wind. You will tilt down at the upper body and pick up significant forward speed.

COAST: Hold the position for several seconds allowing the speed to build up. If you are aiming toward a target (e.g. Coach, or a 4-way formation), aim off toward one side, never directly at the target. This is for safety reasons, to avoid potential collisions.

RECOVER: can be stopped one of two ways:

- Several metres above the target, return to a box position and hold for 5-10 seconds to decelerate to 'normal' speeds OR

The Back Slide

The Back Slide can be performed with out first performing a delta. It is used to counter and stop the forward momentum of a Delta, or to simply move backward in the air away from a target. The back slide may also be called a "flare", which is described further below.

INITIATE

- Bend your knees hard to place your feet up against your bum.
- Sweep you arms to reach far above your head; this will create the rearward tilt which counters the forward movement of a Delta.
- When recovering from a Delta, the combination of legs in and arms up pivots you perpendicular to the relative wind produced by the delta, thereby putting on the brakes.

COAST: hold the position as the forward momentum is countered by the rearward tilt, or until you have backed away from the intended target.

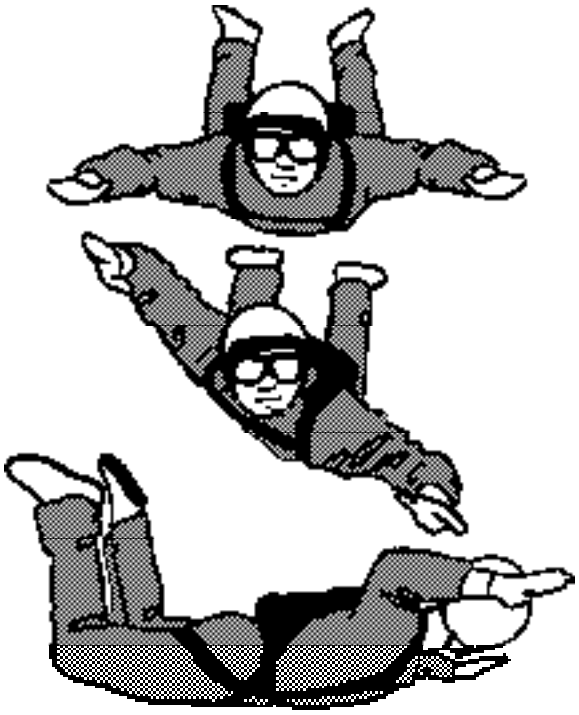
RECOVER by returning to a box position.

Flying a delta through the sky can be one of the most exhilarating activities in skydiving. You can perform turns, rolls and loops and achieve surprising results.

Manage your momentum with Initiate-Coast-Recover (if doing formation skydiving). Allow time to decelerate completely before pulling your pilot chute, and check the altitude more often due to the higher rate of descent.

5.15 ADVANCE TURNS

Once the basic turn has been mastered, there are other types of turns to work on. These types of turns are:



i) KNEE TURN • initiated by the upper body and the rotation is around the knees (basic turn, already covered)

ii) CHEST TURN • initiated by the lower body and the rotation is around the chest

iii) CENTRE TURN • initiated by the full body or chest and knee and the rotation is around the centre of the body

These types of turns can be practiced later in combination with other solo manoeuvres or when participating in FS or Style training with a Coach II.

5.16 COMBINED MANOEUVRES

The objective of this skill is to develop your freefall control and altitude awareness. Combined manoeuvres are a sequence of 2 to 6 moves about one or more of the three axes of the body. Your objective is:

- to demonstrate control of your body in freefall
- by quickly and precisely completing rotations about one, two and then three axes
- and other translational movements.

In addition, one can treat these exercises as training for all skydiving disciplines, as the skills developed here include anticipation, reaction time, awareness, recovery, memorization, precision, agility and speed, all of which are all necessary for freefall control. Time spent effectively at this stage will definitely increase successes at initial FS.

The rotations are performed in relation to a fixed, predetermined heading. Jumps are normally made from an altitude to give the maximum amount of working time, but need not be from the highest possible altitude. For instance, 7,500' or 30 seconds should be more than adequate. Start your sequence after you establish stability on the relative wind and have reached terminal velocity to use the maximum airspeed. Select a set of tasks that can safely be repeated one or two times during the same freefall. Initially, it is better to repeat simple exercises rather than create complex combinations. The following are some development guidelines:

- begin with rotations and counter rotations within the same plane (e.g. left and right turn/paired moves)
- progress to combinations which involve two axes (e.g. turn, loop, turn)
- combinations about all three axis of rotation should begin with pairs of rotations (e.g. 2 turns, then 2 loops, then 2 rolls), then move to singles (a fun idea at this time is to put the names of all basic moves in a hat and draw out moves to make dives of 3-6 point-move rotations)
- for individual moves, start with only 2 & 3 combinations; with control & success, add to the number of manoeuvres, up to 6 or 8 per jump
- include delta, backslide, reverse arch, streamline, flare and other known mastered solo moves in this exercise.
- The break off procedure can be practiced repeatedly at this stage also (see break off procedure in this section)

Here are some general recommendations for any manoeuvre combination that you may attempt:

- emphasize correct actions first, then increase the speed of the rotations; start slowly
- use the box position as the platform for all moves; square off the body position between manoeuvres for symmetrical initiations
- stop the motion about the first axis before starting to rotate about a second
- hold a consistent body position throughout a set of rotations; be aware of leg control and tension.

PIM 2B covers combined manoeuvres in more details and explains this using specific examples.

5.17 The 2-WAY FORMATION SKYDIVING ENDORSEMENT

5.17.1 Pin Practice

[Taken from PIM 2B]

After you have completed the solo exercises, you may want to apply those skills to Formation Skydiving. In learning to do formation skydiving, also known as relative work, you will have to follow a progression of exercises to develop your skills. The objective for you at this time is to get the 2-way Formation Skydiving Endorsement so that you can jump with other qualified people. The following part of this manual deals with the 2-way Formation Skydiving Endorsement and Technical Knowledge sections will prepare you for FS.

These are some recommended prerequisites prior to beginning 1-on-1 FS training:

- an A CoP,
- stable variety of exits (poised, dive-out),
- basic individual manoeuvres (FL BL RT LT RBR LBR),
- demonstrate a stable body position (Box position),
- general recall and awareness,
- altitude awareness,
- ability to move forward in free fall,
- canopy riser control and
- reasonable accuracy.

All of these skills can be learned and mastered by logically progressing through the 4. The progression stages shown in the recreational skydiving skills grid should have at least two jumps per stage to learn the skills adequately. A Coach 2 will assist you to become 2-Way FS Endorsed.

The following skills are presented at this stage:

- pin practice with proximity
- break off procedures
- FS signals

5.17.2 Pin Practice with Proximity:

The objective of this exercise is to learn the skill of performing a safe dock with another person in freefall. The Coach will set up in front of the novice who will practice forward movement and docking from short distances. The coach adjusts small level differences to match your levels during the dock. Break off procedures are initiated and carried out while the coach watches.

A suggested standard for advancement is three to four successful pins in one dive from 9500 ft. A pin is a verb to describe the action of performing a two-way star. As a novice skydiver, you must learn where to set up, how to approach, how fast to approach the coach as well as how to take grips. Working with your coach, you will select the most comfortable exit position, perform the exit count and launch. Once you have exited, you should follow these steps:

- concentrate on being stable on aircraft heading
- relax
- visually locate the coach 2

The coach's set-up position would be about 2-4 meters back and about 1-2 meters below your position. The level your coach picks may vary from one individual to another. Once set up, your coach signals you (see signals sections below) to approach. As you approach the coach, they will remain a passive target (with the exception of them providing level control). The actions to perform the pin are:

- relax
- extend legs to create forward movement
- once movement begins coast in the box position
- fly in a straight line
- increase upper body arch as needed-elbows above shoulders in the box stance
- arms out to stop and immediately back to neutral just before you arrive
- watch and respond to signals
- maintain altitude awareness.

Any movements done in close are small adjustments from the neutral box position. Forward movement, when close, is achieved by legs out only. Within 2 to 4 metres of the base (the coach), your arms should be in the box position. Backward movement or stopping in close is done with the legs only.
Once the pin is complete, it is time for you to check the altimeter. Then your coach will back off to the set up position again and, if time allows, will repeat the exercise. As you get more proficient, the distance of the set-up may be increased. As the distance that you have to cover increases, break your approach into the phases:

- initiate,
- coast and assess,
- and Recover.

You will be responsible for breaking off the exercise on all jumps.

5.17.3 Level Control (up and down)

Another task is level control and docking procedures. The objective of this exercise is to learn how to perform level control. You should practice matching levels from steep angles as well as shallow angles. This exercise will enable you to recognize what body positions to attain to keep the same fall rate as your partner. The exercise will begin like the pin practice exercise. Once your coach is set-up, they can sink or float and you will have to perform the correct streamlining body position to get down or the correct reverse arch to float. This may be done over a couple of jumps. This exercise can be pre-planned as to what sequence you may want or as a "Simon Says" exercise.

Streamlining: (down, fast fall, punching out)

A streamlined position allows a higher terminal velocity to be achieved because there is less resistance to the airflow. The body position is knees higher than the hips and elbows high above the shoulders and an exaggerated arch from the hips. Maintain the box symmetry while in this position. It is used to close short vertical distances, or to increase the rate of fall of a formation, perhaps allowing for heavier people to fly in later. Doing this exercise increases awareness and ability of the skill at extremes so you can learn the effects to perform.

Another way to fall faster, especially for lighter or smaller people, is to “let go”. Literally, let go of the arms and legs, allowing them to blow back by the relative wind. By removing any resistance, a smaller person can lose a lot of relative altitude without too much effort. Of course, continue to punch out at the hips to increase the fall rate.

Reverse Arch: (up, slow fall, floating)

The maximum "slow fall" position is attained by de-arching the body at the hips or waist. Maintain the box symmetry while in this position. Lift the hips as high as possible, creating an air pocket. This offers greater air resistance and results in a slower rate of fall. To enhance this, extend the arms forward of the head, and counter any backward movement by extending the legs straighter and closer together. Manoeuvrability is limited but horizontal movement may be created by extending or pulling up the legs. Pulling up the legs also used as a method to quickly slow vertical speed during an approach (flare).

In freefall the coach sets up in front of you and you practice matching levels with the coach who will vary the fall rates, (down, down and up, up) - streamline and reverse arch. Downs will be about 1 to 2 meters ft and ups will be about 1 meter. You will call break off and carry out correct break off procedure.

A suggested standard for advancement is the ability to match levels with the coach, twice in each skill (streamlining and reverse arching) in one dive from 9500 ft.

Docking Procedure with Level Control:

The objective of this exercise is to learn how to perform different angles of approach with level control. It is the sum of the two previous skills, pin practice and level control. You should practice pinning from steep angles as well as shallow angles. The exercise will begin like the pin practice exercise. Once your coach is set-up, they can sink or float and you must respond correctly. You will have to perform correct downward and upward movements combined with forward and backward movements. This is best learned over a couple of jumps. This exercise can be pre-planned as to what sequence you may want or as a "Simon Says" exercise.

In freefall, you approach the base (Coach) and dock. The coach then slides away to lay a new base and you approach again. As you approach, the coach will keep the fall rate constant and you must adjust your fall rate and levels prior to docking. You call break off and carry out the correct break off procedure.

To dock on a lower formation, you will also move downward at the same time as you move forward. Stop the forward and downward movement just prior to docking by flaring and performing a reverse arch for a short time. Anticipate stopping on level by braking above your partner's level to stop on level. Get neutral immediately to prevent sliding back out. Now that you are level and just in front, get your legs out and finish the dock! Dock when stopped and on level. Remember to Initiate-Coast-Recover. The box position should be used when coasting.

To dock on a formation that is above you, you will also move forward at the same time as you move upward. The priority is to move up first then forward. Move yourself to a position that is one half to 1 meter higher than the base and about 2 meters out. Stop the forward and upward movement by backsliding and arching for a short time. Get neutral immediately to prevent sliding back out. Now do a short down and forward to finish the dock! Remember, dock only when stopped and on level.

The area that extends from the grips of the person you are docking on to 10 feet out, from on level, is called the FINAL APPROACH ZONE. These docking procedure exercises enable you to develop control in the final approach zone.

Relativity Control:

Relativity control is the ability to stay in place and fall straight down in relation to another person doing the same. Relativity control requires that you fall in a good box position that is often referred to as the neutral position.
The objective of this exercise is to learn how to stay put in freefall with no movement in any direction. This dive is useful if you are having difficulty with this skill during the other levels of beginning formation skydiving. In essence, it is the foundation for successful turning and docking.

In freefall, perform a tight exit and hover, no contact, hand over hand (a no-contact ½ star). Carry out the correct break off procedure at the end of the dive.
A suggested standard for advancement is a successful dock within 15 seconds, a good box position and be relative until break off. It is a good idea to learn this skill as it will be used extensively for the rest of your skydiving career for FS.

5.17.4 Maintenance of Fall Rate:

The rate of fall adjustments should only occur through the hips and torso by either spilling or cupping the body with little or no change from the box symmetry. When performing sequential formation skydiving we find that our fall rate is constantly changed. Every time we turn or slide in any direction, we spill air, which causes us to fall faster. When we move we must either compensate for the spillage of air or hope that the base does this for us. The latter only happens on well-trained teams who pre-plan such compensation whenever their teammates have a long move to make. Because we will spill air every time we want to move, ideally, we want our base to always start with and work towards maintaining a good rate of fall. Once this fall rate is established, we then work at maintaining a constant rate of fall through the entire jump. This constant rate of fall provides the flakers (skydivers docking on the base) with a target whose location they can anticipate. This setting of fall

rate and compensating is done with a minimum amount of variation from the symmetry of the box position. This body position disciplining is one of the basics of becoming a good skydiver.

5.17.5 FS Signals

Hand signals and visual motions are a valuable aid to successful FS. Listed below are some of the more common signals used, with their interpretations.

- Crossing and waving the arms widely -- break off
- Hands gesture to come forward -- approach
- Outstretched arms forward with the palms placed vertically as if to push on an object -- Stop
- Waving or fluttering (mimic) then demonstrates skill -- mimic
- Thumbs up -- all okay, ready to proceed; or
    - come up to this level
- Thumbs down -- come down to this level; or
    - arch more
- Wave off -- time to break off; or
    - caution, I'm going to pull now
- Pointing -- look or move in the direction indicated
- Tapping on head with any hand -- Think/Relax
- Pointing at any altimeter -- Check Altitude
- Hand held up with the thumb and small finger extended and it may be waved -- Check your arms
- Index finger of both hands pointing at each other -- It may include the direction of motion
- also Knees closer together
- Index finger of both hands pointing away from each other -- It may include the direction of motion
    - also Knees wider
- Raising elbows up in a pumping fashion -- Elbows up or down; mimic final placement by the coach
- Motion with arms to pull them back or push them forward in a pumping fashion -- Elbows Back/Forward to mimic final placement by the coach
- Coach Breaks Off on a 1:1 basic FS coach jump -- Deploy immediately. Do not track yourself as you risk being low! This means that next jump you need to work on altitude awareness. Be altitude aware next time!
- Coach Deploys on a 1:1 basic FS coach jump -- Deploy immediately! If the Coach deploys, this is a definite indication that you may be low!

5.17.6 Freefall Grips:

There are many ways of taking grips in freefall. It starts with docking in your assigned slot or place in freefall at all times. Proper grips of arms and legs can be taken both high and low on the appendages. Take the grips the same way as was planned or instructed in the dirt dive. Grips should be taken in a manner that does not disturb the formation or interfere

with the other persons flying. After you have taken grips, you should pay attention and keep flying to eliminate any tension on the formation. When beginning FS, it is good to take grips by flying yourself to a position and stopping where you can put your hand on top of your coach's grips without actually grabbing. This may seem hard at first but it will help refine your neutral position in a hurry because you have to keep flying at all times!

To fly in the formation there are several tips that will help. For in-facing docks, fly with your legs slightly extended and upper body arched. This establishes a slight positive pressure to the centre of the formation. Fly towards any tension to try to eliminate it; in other words, keep the legs pressed out slightly to provide positive pressure toward the centre of the formation. Pick up your grips and make sure you are still in the box with elbows and hands up ("pick up" your grips). These, plus paying attention all help in maintaining the rate of fall of the formation.

There are several terms that we use concerning grips. "Presenting" means that you put your appendage in a certain place and someone else will grip it. The person who is going to take that grip is "taking". "Stiff arming" is a technique to absorb a hard dock. It starts with a straight arm and moves back to the box as the presented grip hits the taking hand. During that short time, try to absorb the momentum of the dock. It is hoped that your skydiving will consist of presenting and taking grips with minimal stiff-arming!

A suggested standard for advancement is the ability to close vertical and horizontal separation at the same time and to finish with a safe pin, three times in one dive (down-dock times 2 plus 1 up-dock to pass) from 9500 ft. You must be able to demonstrate the docking procedure with quadrant control as a requirement for the FS endorsement.

As you advance beyond the A CoP, more information on FS Skills is presented in PIM 2B.

5.17.7 FS Rules and Courtesies

There are a few general FS rules:

Flying slowly means to remain in control within your limits allowing you to do your job correctly the first time, every time. Remember, slow is smooth and smooth is fast. First, you must get good, and then you can get fast! Then you are good and fast!!

Entering cleanly means always docking in a manner that does not disturb the formation. Carrying any momentum in any direction into the formation risks waves or even a funnel. Remember the correct docking procedure. Dock on level and in control.

Flying with the formation means to keep flying your body even after you have docked with your partner. Remain alert and conscious of your job and what your partner is doing. Pay attention and cross-reference through the formation’s center point.

Turn and track at break off is essential for the safe opening of all parachutes. Everyone has three responsibilities at the assigned break off altitude:

1) To make sure that you are not over top of anyone
2) To make sure it is clear above you before you deploy
3) Not open directly beside someone. Track to clear space and track until assigned altitude.

Other people may be having problems or the cameraperson may need the space. If everyone follows this then freefall/canopy collisions should not occur. Tracking is essential for a safe break off.

Remember, FS is a team effort; the formation is the first priority, not any one individual.

FS Courtesies:

- Listen to and respect the Load Organizer! They are in charge.
- be considerate of others - their time and their feelings
- be ready with the group
- co-operate with the manifest and the pilots; without them you will not get many jumps
- if you go low, go far out from your quadrant, come back above the formation from the outside and approach again, properly; never stay beneath the formation or beneath an approach area
- approach your quadrant high, approach facing your slot and remain in your quadrant at all times; never circle the formation, you will cut off many others
- always proceed as planned, take your assigned slot, do your job and only your job. Always follow the plan; there is no plan B
- pull at the required/assigned altitude
- follow the prescribed landing pattern, keeping your head on a swivel for other canopies in the approach path
- when you land, come back for a debriefing; admit your own mistakes; Never point out another's mistakes – it is not for you to say.
- use your energy to prepare for another jump – make it a good jump rather than reliving a bad one
- focus on the positive and the points to improve on as you will achieve more in the end; being negative is destructive as opposed to constructive
- and remember, others have to learn, just as you did once.

5.17.8 Formation Skydiving Theory and Questions

Theory Information: You will have to know the answers to the questions listed below for your FS endorsement.

1. Define Initiate, coast, recover, final approach zone.
2. Describe the correct sequence of the break off procedure and at what altitude it is recommended to occur?
3. Name the four common exit positions from a Cessna 180/182 type aircraft? Larger aircraft?
4. After deploying in a FS jump, is it safe to do unplanned CFS and why?

5. BSR's relate to fatalities. Is participating in FS without being FS endorsed breaking a BSR? TSR?
6. While participating in a FS jump, the formation begins to funnel. Describe your actions.
7. While beginning your accuracy approach, you notice that the approach and target area is congested with other canopies in the air. What should you do to ensure a safe landing?
8. To close a long vertical distance on a FS jump, what type of dive should you perform? Where should you dive to in order to minimize the possibility of a mid-air collision?
9. While on a 5-way FS jump, you find yourself low on the formation. You begin to slide underneath it. Describe your immediate actions.
10. As a B CoP holder, are you allowed to do FS skydives with A CoP holders? Explain.
11. As you are tracking away at break off, you notice another jumper tracking right below you. What are some options that you can immediately take to prevent an incident?
12. While participating in a 4-way FS jump, you notice that the group is significantly below break off altitude. Describe your immediate actions?
13. Immediately after your canopy is deployed on a FS jump, you notice another canopy is about to collide with yours (flying at you). Describe your immediate action?
14. When learning the basic skills of FS, discuss why "Big formations" may not be "Better"?
15. Describe several procedures that you can complete prior to a FS jump and as a part of your in-flight routine that will enhance your performance in the skydive.

Practical Skills: Your practical skills will be evaluated on a checkout jump similar to the one listed below. The skills must be performed to at least an efficiency of 80%.

1. demonstrate ground preparation and basic safety routines
2. demonstrate proper exit procedures and exits free flown with good timing and placement on the airflow (stability).
3. demonstrate directional control in freefall and completes a minimum of 3 properly executed pins from 9500 AGL on the same dive.
4. demonstrate altitude awareness by completing the correct break off procedure with stable activation at the required altitude.
5. demonstrate canopy control collision avoidance techniques and traffic awareness.
6. demonstrate awareness on the entire jump and documents it with accuracy and completeness.

Once you have passed the quiz and checkout jump, get it documented in your logbook that you are FS endorsed. A Coach 2 must sign the appropriate areas. Now that you have your FS endorsement, finish your requirements for the B CoP. See a certificate administrator as soon as possible to obtain your B CoP. After that, follow the logical FS progression as outlined in the freefall section of this manual.

5.18 BREAK OFF AND TRACKING (BOAT)

During the SOLO to A CoP training for the 2-way Formation Skydiving Endorsement, it is adequate that one demonstrate the ability to:

- move forward using the legs
- while maintaining heading
- check for clear airspace before pulling
- pull on time.

Once you have satisfactorily demonstrated the ability to move away from the centre of a formation in a straight line and covering a modest amount of distance, the next step is to learn how to Track, in order to maximize the separation between skydivers.

The Track is similar to the Delta in that it creates forward motion. The track is actually more effective in moving forward without losing altitude than the delta. The difference between the two is that the delta is done by maintaining an arch, whereas the track uses a flat or reversed arched body position (track is a combination of the two skills of forward movement and reverse arch that you have learned individually before trying this). A fully streamlined track position will create the fastest forward speed from slight to approximately 70 mph. The track position offers from medium to high horizontal speeds; with a marginal increase in vertical speed, depending on individual proficiency. The major use is for achieving separation at break off. The priority is direction first then speed. High speeds experienced in these positions demand caution in their use.

BOAT – Break Off And Tracking is a series of skills (turn, track while looking around, adjust direction if needed, look, flare and wave, and pull) and is critical in Formation Skydiving (FS). The break off procedure is used to gain horizontal separation from other skydivers at the end of a Formation Skydiving (FS) jump in order to get clear airspace for safe deployment. Developing a good attitude towards altitude awareness and potential traffic problems is very important for everyone's safety. When learning the break off procedure, start it at least 1500' above your normal opening altitude and then progress to an altitude of at least 1000' above your normal opening altitude over a series of dives. The following sequence should be demonstrated on every FS jump:

- shake or wave off at the assigned altitude (one wave/shake only)
- turn 180° from the centre and stop the turn
- track for 3-5 seconds, covering as much horizontal distance as possible, while looking forward and to the sides
- in one simultaneous motion, flare, look straight up over your head and wave as a pull-warning to others
- pull by your normal pull altitude (or as assigned by the load organizer, the Coach or DZ rules)

The three responsibilities that you have at break off are:

1. you are clear from being over top of someone and;
2. it is clear over top of you: if all FS skydivers do this at break off then theoretically there should be no freefall/canopy collisions
3. you are not directly beside someone: track to clear space and track until assigned altitude.

The entire break off procedure should be completed in approximately 7 seconds. You must be able to consistently demonstrate the correct break off procedure with adequate separation as a requirement of the Group FS endorsement and the B CoP.

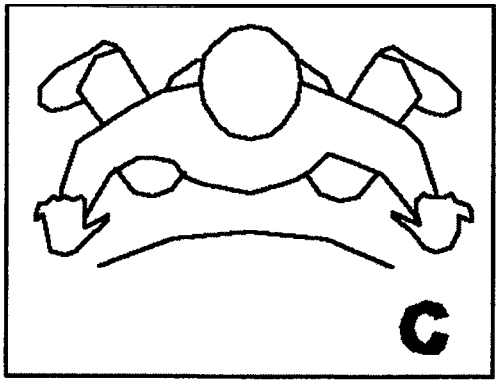
There are several dives during progression to the B-CoP that BOAT is confirmed.

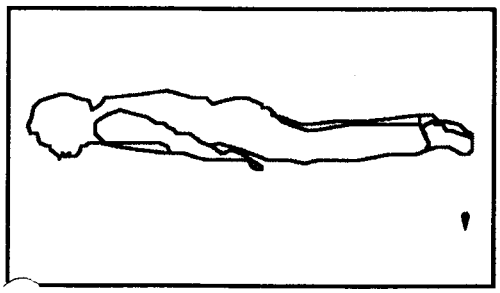
TURN
First, maintain altitude awareness and leave the formation at the correct time. If you are the first to leave, a quick "wave off" confirms to the others it is BOAT time. Relying on others to indicate break off is unacceptable.

Secondly, turn away from the formation and select a heading that puts the group directly behind you. This becomes supremely important as you begin to do small group FS. Ideally, you should aim 180° from the centre of the formation. The larger the formation, the more important this directionality becomes.

TRACK
Tracking is NOT the same as the Delta, and should not be described in any relation.

- The Track creates forward motion WITHOUT any loss of altitude.
- The Track is done at the END of the skydive in order to create separation between skydivers prior to pull time.
- The track needs to be more effective at producing the maximum forward speed and the minimum of altitude loss;
- performed correctly, the Track will actually produce "lift" in relation to the formation.





The tracking body position is:

- Legs extended straight and close together, heel touching heel
- De-arched hard through the hips to produce lift
- shoulder rolled forward to catch air
- arms pressed straight down to the side to reduce fall rate
- your head in line with your back

The combination of the narrow stance and de-arch make the tracking position difficult to balance from side to side. A small deviation in side-to-side tilt can produce a significant. The track has a range of speeds from slight to approximately 70 mph horizontally.

The steps to do a Track as a drill are:

Set up in a box and look forward to the horizon toward a fixed point

INITIATE

1. Slightly de-arch the body at the waist/hips
2. Fully extend your leg position and narrow them to shoulder width or less. Point the toes. (This is where booties really come into play)
3. Roll the shoulders inwards and suck in the stomach.
4. Sweep the arms to the sides, out from the body a few inches. Cup the hands

COAST

The track will become more effective (faster) the more you streamline your body. Streamlining is accomplished with the narrow stance. The trade-off is the reduced directional control. Work on directional control before trying "full speed". Hold the track position to continue movement as far as necessary (for 3 – 5 seconds). Heading can be maintained by steering the body by rolling the shoulder inward slightly, by offsetting the arms to create a slight turn and by extending or retracting one leg.

RECOVER

Allow enough altitude to smoothly sweep the arms back to an arch and backslide to stop. Note: Make sure the forward movement of the Track is stopped completely before deploying.

Flare: A flare is the same as a backslide position, but has a reverse arch instead of an arch. This position is used when countering a track, delta or dive to eliminate forward and/or downward speed by changing the body position to create a braking action. The steps are:

1. Pull out of the track, delta or dive and pass through the box position.
2. Immediately adopt a maximum reverse arch position and/or simultaneously adopt the backslide position
3. Hold position until the movement being countered (flared) has stopped.
4. Return to the box.

LOOKING AND WAVING

With control of your heading and good separation (distance) you should be clear of other skydivers. No one else should be near you at this time. Nonetheless, a quick check that the space above you is clear is necessary. While you swing your arms forward for the back slide (recovery) glance up and over both shoulders. The wave is done with your arms in the back slide position.

5.19 Theoretical MODEL FOR FREEFALL CONTROL

The factors discussed here are:

- curve (amount of arch)
- stance (how wide the arch)
- balance and tilt
- airspeed

Curve or arch

Positive stability can be demonstrated with a badminton bird. A body in freefall with a belly-forward curved position will flip over face-to-earth, even if tumbling. The air flips you over to the position of least drag. This also places the Center of Gravity in the lowest possible position.

A positively curved body (Hard Arched) is less likely to flip over than a flat position. A negatively curved (reverse arch) position is likely to flip you over. The lower the Center of Gravity, the more stable. A student adopts a hard arch in order to be as stable as possible.

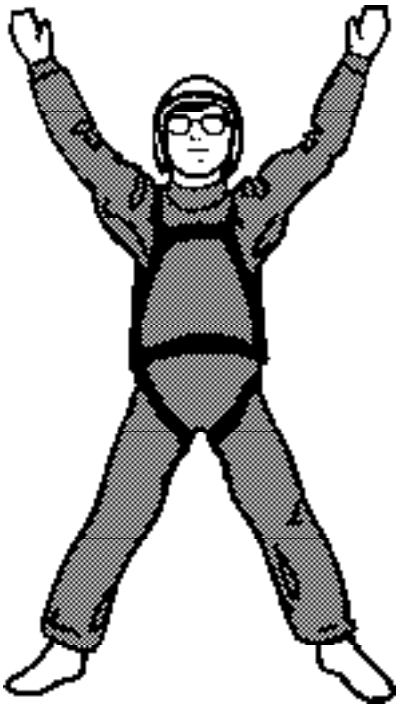
A strongly curved arch (hips pushed hard forward) affects manoeuvrability. The physical actions to do a loop and rolls are much longer.

When performing knee turns (see turn types) the air deflected by the chest is partially deflected to both sides of the torso.

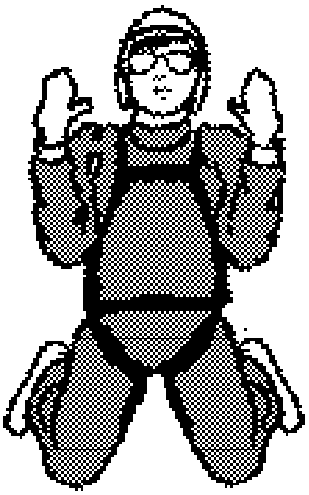
In a Neutral or Flat arch manoeuvrability is enhanced because the physical action for loop/rolls is shorter and the control surfaces (the chest) is presented more effectively. The center of gravity is in the middle of the base of support. The position will recover to a balanced position if no excessive tilts occur.

In a negatively curved arch (Cup) manoeuvrability is greatly reduced. All the control surfaces (the torso) are presented strongly to the wind and your limbs are ideally placed to catch air. If you tilt at all you may flip over. The center of gravity is above the base of support. Even a small tilt or a slight lack of symmetry can cause dramatic effects.

Stance refers to how wide the arms and legs are spread. A wide stance provides added stability on both the lateral and longitudinal axes. There is a longer distance to travel to perform a roll or loop. A narrow stance on an axis (e.g. Tracking) makes it very easy to tilt on that axis and rotate around the stable axis.



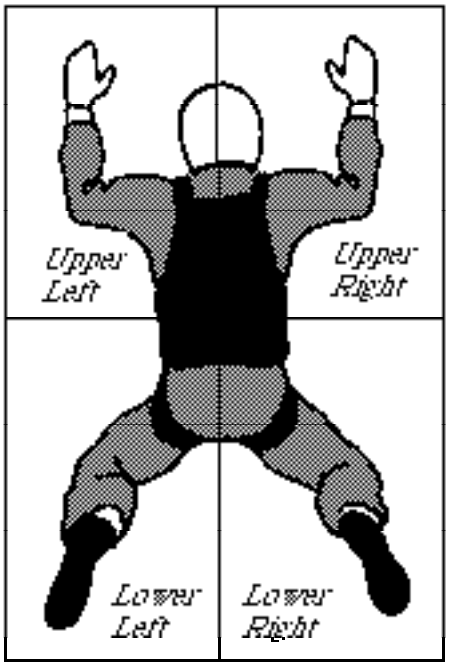
Wide Stance-Stable

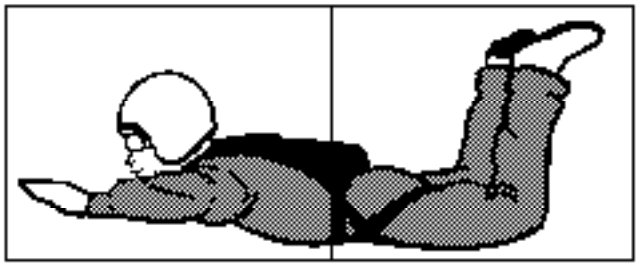


Narrow Stance-Unstable

Balance & Tilt

Looking at the body from above, the body and the air which supports it can be divided into four areas: upper left, upper right, lower left and lower right.

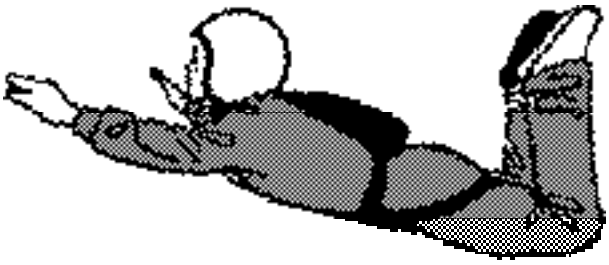




Balance is the term used to describe the relative amounts of drag when comparing the top and bottom AND the left and right side of the body. If the drag is equal in all four quadrants then no overt movement will be seen, and one is considered “balanced” in the air.

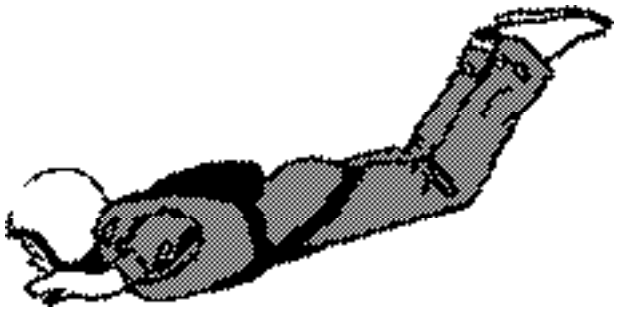
Level-Neutral

Tilt is the inclination of the body (or a part of the body, such as a shoulder or a leg) relative to the wind. This results in deflected air that subsequently causes one to move. If the freefall position is tilted, one will move towards the lowest quadrant along a line from the highest part of the tilt. By comparing the tilted position against the balanced position you can know what to expect. The reverse is also true; if there is an unexpected result in free-fall you can analyse that result and deduce what caused it. This can get complicated if you have several tilted areas e.g. tilted shoulder and legs extended.



Head High Tilt (caused by arms reaching, legs bent past vertical)

You can tilt your body to move forward, backwards, sideways or turn you. This tilt can be caused by cupping air, spilling air, extending air or legs, or dropping a shoulder.



Head Down Tilt (caused by legs extended, arms brought in)

Diagram #1: maximum stability

Diagram #2: some stability

Airspeed

Airspeed also has an effect on freefall control. Increasing your rate of fall or airspeed simply gives you more power to use. The faster your fall the faster the reaction to any body change.

Summary

Now you know the "secret" of freefall control. You trade off stability for better control surfaces, or get narrow to roll faster, or you tilt yourself to slide, arch harder to fall faster. The trade offs can be specific for one move or broadly affect all of your skills. There are definitely two times to consult with coaches to discuss your specific needs.

5.20 APPLYING THE FREEFALL MODEL

After you have understood the Freefall model, you may find it helpful to have this information related to everyday skydiving. Some examples of how to apply the model to freefall control are:

1. turns
2. loops
3. rolls
4. up and down
5. forward and backward
6. sideways movements
7. relative wind
8. summary

With body flight there are many things to do in freefall. You can go down, up, forward or back and turn, and a combination of these to name a few. All you have to do is learn when and how to do these things.

In learning the basic body positions the main point to remember is that it is the torso, with its large size, that provides the most deflection of air. Without increasing surface area, the jumper can increase or reduce drag to induce a tilt (fall rate and tilt) with the biggest surface available, the middle of the body. The outer extremities enhance our deflection with our main body surface.

1) Turns (Basic Turn):

By simply twisting the torso to misalign the shoulders from the hips, the jumper assumes the shape of a propeller. When the right shoulder is higher than the left, the jumper spills air to the right of the body and that pushes the upper body to the left. With the hips tilted an equal amount in the opposite direction (left hip higher than the right hip) the lower body is pushed to the right. This results in a turn around the center of the body. Using only the upper or lower body will cause a turn about the knees or the chest, respectively. The three turn types (center, knee, and chest) are described in the manoeuvres portion of this section as well as in PIM 2B.

Turn about the centre of the body

2) Loops: Loops are manoeuvres that rotate around the lateral axes. Loops, front or back, use a combination of extreme pressure difference forward or back of the body's center of balance and a person's physical power and coordination. The success of these manoeuvres depends on:

- the speed and force of initiation,
- point at which you decide to return to the arch,
- maintaining lateral stability (side-to-side).

3) Rolls: A barrel roll is a manoeuvre done by rotating about the longitudinal axis. A roll is achieved by twisting the upper body, and thereby varying the air pressure from one side of the body to the other.

4) Up and Down

i) Up: in freefall, the resistance of the body to the air determines the fall rate. To change your fall rate, you must change the resistance. To fall slower, you must increase resistance. This is achieved foremost by de-arching at the hips. Laying flat on the ground in the box position with your arms and knees pressing lightly into the floor, d-arch by raising only the hips as high off the ground as possible. This should create an open area under your hips.

This motion alone will catch air enough to slow down the fall rate substantially. Pushing the hands forward over the head and straightening the legs will cup even more air. This decreases the rate of fall, and you will go 'up' in relation to someone else.

Cup to go "up" from the **Hips**

ii) Down: To go faster and catch up with jumpers below you lower drag. This is called punching out. Pushing the hips forward, arching the back and pulling hands and feet above shoulders and hips to reduce drag. The airflow becomes smoother and you pick up speed. You go down.

Punch out the Hips to go down

5) Forward and Backward

i) Forward: If a jumper is tilted in freefall, they will slide in the direction of the tilt. To go forward, tilt the body so that the head is down. The jumper will then move in the direction they are facing. To achieve a head-down tilt, extend the legs to offer more resistance in the back part of the body. The more you extend your legs (lower feet), the greater the tilt and the faster the resulting slide. To increase the tilt even more, bring the arms back to reduce resistance on the front of the body – a delta. When introducing a strong tilt, surface area is also reduced. This acts like streamlining and causes an increase in fall rate as well as a slide. It's a trade-off. To go forward you must also go down (unless you compensate for losing that resistance i.e. tracking).

ii) Backward: It is not often in freefall that a jumper wants to actually fly backwards. We like to see where we are going. However, tilting the body so the head is higher than the feet (elbows and shoulders higher than knees and hips) will also act as brakes if you have been moving forward. We use this all the time. To tilt the body head-high, you should increase resistance on the front by pushing the elbows lower than the shoulders. For even more tilt, lower resistance at the back by pulling your feet and knees higher than the hips for streamlining. The greater the tilt induced, the faster the backwards movement or positive braking action of the flare.

6) Sideways Movements: If a jumper is tilted in freefall, they will slide in the direction of the tilt. To go sideways, tilt the body so that the arm and leg on the same side of the body is down, and you will move in the direction you are tilted down. To tilt more steeply, extend the opposite arm and leg to offer more resistance on that side of the body. The more you extend the arms and legs, the greater the tilt and the faster the resulting slide. To increase the tilt even more, bring the 'down-side' arm and leg towards the body to further reduce the resistance on that side of the body. When side sliding, you are spilling more air than otherwise. This acts like streamlining and causes an increase in fall rate as well as the slide. As with forward movement, to go sideways you must also go down (unless you compensate for losing that resistance).

7) Relative Wind: Relative wind is the direction that the wind strikes us as we pass through the air during freefall. As we change direction during freefall, the wind changes with us. Hence the term "Relative Wind". There are two times when understanding the direction from which wind is coming will help. These are:

i) transition from exit to stable freefall
ii) flaring (a delta, track or a dive)

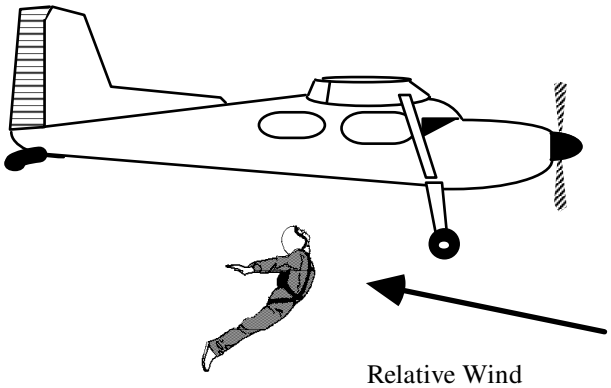
i) Transition from exit to stable freefall: On exiting the aircraft, the air is coming from directly in front; there is no wind from below. When leaving the aircraft the body should be almost straight upright relative to the earth. Once clear of the aircraft, the wind direction changes. Holding the body in a relaxed arch, the jumper's angle relative to the ground will change as the wind direction changes. The body responds to the wind's drag or pressure, not directly to gravity. It takes about 5 seconds for a body to reach a level, belly to earth attitude; by then the wind is coming from straight below.

Starting with the exit launch, gravity creates an increasing rate of fall while air resistance causes loss of forward motion. The relative wind changes its direction from along the aircraft to coming from the ground. If body position is maintained and is relaxed, we will remain directly into the relative wind and therefore stable.

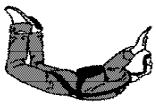
ii) Flaring: When moving through the air, the wind direction also changes. Whatever the direction of our motion, this is the source of the relative wind.

To slow or stop a created movement, we must flare into the wind. When doing a dive, returning to an arch will place the body into the wind. When doing a delta or track, there is

forward motion that must be stopped. The flaring must be done directly into the relative wind. To flare effectively we must sit up against the wind. The greater the forward speed, the more we have to sit up. With experience, you will learn to judge this using a visual reference (a target) and a feel for the air.



Relative Wind
at exit



Relative Wind
at terminal

Relative Wind

8) Summary: The positions previously described should provide a good understanding of body flight. The offsetting of pressure from one side of the body to the other creates movement. Spilling or deflecting the air in one direction will cause a movement of the body in the opposite direction. The body positions described are the basic manoeuvres that will create movement forward, backwards, up and down, or the exaggerated stability manoeuvres involving complete rotations (turns 360, loops and rolls).

Once the skill of doing the basic positions and transitions to more extreme or maximum modes of those positions is natural, movement in different directions such as sideways or diagonally will be possible by body tilts and different directions of flights. These positions will come easier once you learn relaxation in freefall and a good feel for the air. Once you become proficient at the basic solo manoeuvres, it will be time to begin combining these skills to do formation skydiving or to make the most out of your freefall with various combinations of manoeuvres. Be imaginative and make the most of our aerial playground. Knowledge about these skills can be gained from a Coach II.

5.21 FREEFALL MATH

Calculations are not performed for most jumps, but there are situations where you may find this information useful. These situations include:

- if intended jump altitude cannot be reached,
- maintaining an accurate record of freefall times.

The following abbreviations are used in this section:

Seconds - s
Feet - ft
Meters - m

For these situations a knowledge of the distance fallen during the acceleration period (sub-terminal), and the distance fallen per second (terminal velocity) while falling in a stable body position, is needed. These are:

- time it takes to reach terminal 12s
- distance fallen to reach terminal 1483ft (450m)
- terminal velocity 174 ft/s (53 m/s)

Table 1 Distance fallen in each second, to terminal velocity

Seconds	Distance (M)	Distance (FT)
1	5	16
2	14	45
3	23	76
4	32	104
5	38	124
6	42	138
7	45	148
8	48	156
9	50	163
10	51	167
11	52	171
12	53	174

If it is necessary to adjust exit altitude during a flight, you will not have time or the resources to calculate the available working time in freefall.

A quick and simple method is to round off the numbers to get a rough idea of the time you have in freefall. The required information is:

- 1500 ft (500m) is the sub-terminal distance giving approximately 15 seconds (15 for 15).
- after terminal, each 1000 ft (300m) gives an additional 5 seconds of freefall time.

Example: As the aircraft climbs to its intended altitude, the ceiling drops to 8000 ft (2400m). The intended activation height is 2500 ft (762m).

- exit altitude = 8000 ft/ (2400m)
- subtract 1500 ft (500m), 12s
- subtract opening altitude, 2500 ft (762m)

Available altitude for freefall=4000ft/ (1100m)
- 4000 ft x 5s or (1100m x 5s) =20s/ (18.3s)
  1000 300

12s + 20s = 32 seconds of freefall time

Mental calculations can be done in the aircraft. When doing these calculations, the resulting time should always be rounded to the lower number as a safety measure. This method gives you less working time than you could have by about 6 seconds. You should remember that your fall rate will vary as you perform different manoeuvres and that altitude, not time, is the important item to measure. Monitor your altitude by making regular altimeter checks.

If a more precise calculation is desired for your jump records, take the drop zone's altitude above sea-level into account as well as the physical factors previously listed. The higher the drop zone is above sea level, the thinner the air is, causing us to fall faster. For each 1000 ft (300m) above sea level, 10% of that amount should be added to the normal jump altitude. If your drop zone is 2500 ft (750m) above sea level then 250 ft (75m) must be added to the jump altitude to provide you with the same amount of delay you would have at sea level.

For precise calculations, the following models are useful:

1) to determine the jump altitude AGL for a given delay:
- select length of delay (seconds) and split it into 12s of sub-terminal plus the remaining seconds of freefall at terminal velocity.
- multiply the remaining seconds of the intended delay by 174 ft/s (53 m/s)
- add the distance fallen in the first 12s (1483 ft or 450m)
- add activation altitude.
- add allowance (10 %) for the DZ elevation ASL
- determine total altitude
- round up to the nearest 500 ft/ 100m for safety

Table 2 Total distance fallen (accumulated) in Increments of one second

Sec	Distance (M)	Distance (FT)	Sec	Distance (M)	Distance (FT)	Sec	Distance (M)	Distance (FT)
1	5	16	21	930	3049	41	1991	6529
2	19	62	22	983	3223	42	2044	6703
3	42	138	23	1036	3397	43	2097	6877
4	74	242	24	1089	3571	44	2151	7051
5	112	366	25	1142	3745	45	2204	7225
6	154	504	26	1195	3919	46	2257	7399
7	199	652	27	1248	4093	47	2310	7573
8	246	808	28	1301	4267	48	2363	7747
9	296	971	29	1355	4441	48	2416	7921
10	347	1133	30	1408	4615	50	2469	8095
11	399	1309	31	1451	4789	51	2522	8269
12	452	1483	32	1514	4963	52	2575	8443
13	505	1657	33	1567	5137	53	2628	8617
14	558	1831	34	1620	5377	54	2681	8791
15	612	2005	35	1673	5485	55	2734	8965
16	665	2179	36	1726	5659	56	2787	9139
17	718	2353	37	1779	5833	57	2840	9313
18	771	2527	38	1832	6007	58	2894	9487
19	824	2701	39	1885	6181	59	2947	9661
20	877	2875	40	1938	6355	60	3000	9835

EXAMPLE: 25s delay at a DZ 1500 ft ASL with intended activation at 2200 ft AGL.

- 25s delay = 12s of sub-terminal + 13s of terminal freefall
- 13s x 174 ft/s = 2262 ft
- + 1483 ft
- + 2200 ft
- + 150 ft
- total altitude = 6095 ft
- safe jump altitude is 6500 ft AGL (round up for safety)

EXAMPLE: 25s delay at a DZ 500m ASL with intended activation at 750m AGL.
- 25s delay = 12s of sub-terminal + 13s of terminal freefall
- 13s x 53 m/s = 689m
- + 450m
- + 750m
- + 50m
- total altitude = 1939m
- safe jump altitude is 2000m AGL (round up for safety)

2) to determine seconds of delay (to the safest second) from a given altitude:
- select the exit altitude
- subtract allowance (10 %) for the DZ elevation ASL
- subtract activation altitude.
- subtract the distance fallen in the first 12s (1483 ft or 450 m)
- divide the remaining altitude by the terminal fall rate, 174 ft/s (53 m/s)
- add 12s plus the remaining terminal seconds of freefall to get total delay time
- round off to the lower (safer) number of seconds.

EXAMPLE: exit at 11,000 ft AGL at a DZ 2500 ft ASL with intended activation at 2200 ft AGL.
- 11,000 ft
- - 250 ft
- - 2200 ft
- - 1483 ft
- 7067 ft ÷ 174 ft/s=40.61s
- total delay 12s + 40.61s=52.61s
- total safe delay from 11,000 ft
  =52 seconds

EXAMPLE: 3500m AGL exit at a DZ 75m ASL with intended activation at 750m AGL.
- 3500m
- - 75m
- - 750m
- - 450m
- 2225m ÷ 53 m/s= 41.98s
- total delay 12s + 41.98s 53.98s
- total safe delay from 11,000m =53 seconds

For delays shorter than 12 seconds, it may be easier to memorize these distances:

- 5s delay = 366 ft (110m)
- 8s delay = 808 ft (250m)
- 10s delay = 1138 ft (350m)
- 12s delay = 1483 ft (450m)

You should get to know both calculations, The general method is useful to know, and for your CoP exams you will need to know how to do the calculations precisely.

5.22 FREEFALL UNUSUAL SITUATIONS

A pull problem may be experienced for various reasons. Hard pulls and lost handles are two kinds of pull problems. These are high-speed malfunctions and you must be aware that time is running out. After trying to pull twice, you must use your reserve. The procedure is:

1. relax ☺ and breathe...
2. look and identify the handle clearly
3. try again (second pull). If this does not work, look at the reserve handle and pull. As the saying goes, ONLY TRY 2 TIMES to deploy your main

A stability problem can occur on exit or at any time during the freefall. If any unusual sensation is felt, you should strengthen and hold the arch. If stability cannot be regained you must understand "never to sacrifice altitude for stability". When pull altitude is reached it is time to deploy something, regardless of orientation. If instability is encountered high and stability cannot be regained, then the pilot chute should be tossed regardless of altitude. It is better to deploy high than to risk losing track of altitude altogether. Regardless of the cause of instability, you should:

1. relax ☺ , breathe, and check your stable spread
2. emphasize the arch and spread. If spinning counter hard
3. pull at your standard pull altitude, whether you are stable or not. Pull time is Pull time.

If altitude permits, and arching has not helped or is taking too long, a delta will help to regain stability very fast. Once in a delta go back to box position. But never sacrifice altitude for stability!

A visual problem can result from breaking or losing goggles. If the goggles are broken, clear the goggles from your face. Proceed with freefall exercises if possible; otherwise give the FS wave off to signal intention to pull. You should then activate your main. If you are experiencing problems seeing, remember, "when in doubt, get it out"

An instrument problem may occur if the altimeter is tilted so that you cannot read it. In this situation try to fix it by reaching in to turn it towards you. If the instrument is still not readable, or is broken, look at the ground to estimate your altitude. If you are quite high (just exited the aircraft), you can continue to follow the jump plan for a few seconds only, then pull.

Pilot chute/bridle caught on hand: make a brief attempt to release or clear hand from the bridle by straightening your arm and pointing it straight upwards away from the relative wind and shake the arm twice. If the bridle does not clear by the second try, carry out your emergency procedures.

Pilot chute hesitation: To ensure that the pilot chute clears the burble, the correct pilot chute placement procedure is required. If a pilot chute hesitation occurs it can be cleared by doing a good shoulder check on both sides. This will tip the body, allowing the airflow over your back to help inflate and clear the pilot chute.

SECTION 6 CANOPY CONTROL SKILLS

Previous – Section 5 Free Fall ..... Next – Section 7 Solo Check-out

6.1 INTRODUCTION

This section deals with the basic skills that are performed from canopy inflation through to landing and recovery.

6.2 CANOPY IDENTIFICATION- Visual Check

You must be able to recognize a Good canopy (e.g. rectangular and controllable) and make the decision to proceed with the actions of a normal jump. This is covered in the first jump training course and should be reinforced on each subsequent jump. The list of things to check will increase as you become more familiar with the different key components, including their names and their normal and abnormal appearance. The key points to emphasize on the first few jumps are:

- on the canopy, check the shape (leading and trailing edges), the lines, the slider (more than ½-way down), the risers and the steering toggles.
- on the harness (rig), check the canopy 3-ring releases, cutaway and reserve handle(s) to make sure all are securely fastened

On subsequent jumps, once under canopy:

- locate the pilot-chute and bag
- differentiate between suspension lines and control lines
- check the line connectors (Rapide links, slinks, etc.)
- check the space between the harness and your shoulders (does it fit well?)
- on the cutaway system confirm there is no tension on the housings, cables or anchor loops.

Note: For information pertaining to canopy malfunctions refer to "Canopy Unusual Situations", on page 129.

6.3 FLIGHT CONTROL CHECK

You should perform a flight control check on each jump, immediately after opening, assuming you are clear of other canopy traffic. The objective is to confirm that you have a functional canopy or to assess if a minor problem (e.g. a broken line, a small tangle) is landable. The procedures are:

- release the brakes; visually confirm that the control lines are clear
- flare, both steering toggles at full range, recover toggles back to the top (this can be repeated)
- Look, then turn 180 at full control input, right or left, and stop (one turn in each direction is sufficient)
- perform a landing flare

The turns and flare confirm that the parachute is functioning or provide the opportunity to assess a minor malfunction.

6.4 OBSERVATION OF DRIFT

While you are flying around up high, you are encouraged to practice observing the drift of your canopy relative to the ground. Remember that the canopy is always moving forward through the air; this does not change. The air moving across the ground, however, may change in speed and/or direction. To observe drift, pick a heading, adjust to it and then wait two or three seconds until flying straight toward the target under canopy (i.e. not swinging under your canopy). Look straight down between your feet, or perpendicular to your body, and watch the drift for about five seconds; the movement observed is a combination of the forward speed of the canopy and the effect of the wind. The wind may add to or counteract the forward speed of the canopy. It may act at an angle, which is observed as sliding or drifting to one side, in combination with some forward movement. Estimate the wind speed and direction; make a 90° turn, observe and assess again. Repeat three times for a full 360 rotation. Note the difference in drift when you are "running" with the wind versus "holding" against the wind.

6.5. OBSERVATION OF SURFACE WINDS

The skill of assessing the direction and speed of the surface winds will be valuable to you throughout your jumping career. Initially, you should be able to locate and interpret the appearance of the windsock and flags. Once this is learned, identify other things that can indicate the ground winds. For example, smoke, laundry, waves on the lake, and "waves" in long grass. Find as many indicators as possible.

6.6 CANOPY CONTROL and MANOEUVRES

6.6.1 Full Glide Turns

Full glide turns are done from the full glide position (i.e. steering toggles start all the way up). The further a steering toggle is pulled down the further the canopy rolls to the side and the faster the resultant turn. As the canopy rolls, it accelerates toward the centre of the turn, with the pilot swinging out to the outside of the turn. With small inputs, the canopy will stay relatively level and lose minimal height. A harder turn will roll more and will LOSE more altitude.

Spiral turns are done for extra fun and excitement during your canopy flight. To perform this turn, pull down one steering toggle to a full arm extension and hold the toggle in this position until you complete a 360° turn. If you hold the spiral longer, the time required to complete each turn will progressively decrease. The degree of roll (tilting) of the canopy will increase. After several rotations, the flight of the canopy will develop into a spiral, with you swinging out to the side of the canopy and facing more toward the ground. Perform right and left turns as well as a couple consecutive 360's in one direction. You will feel an increasing pressure or load against the harness and you may experience an increased strain against the steering toggle. You should ease the effort after four or 5 rotations, gradually returning the toggle to its location at the top of the riser. Always be smooth and steady when initiating the turn and when returning the toggle to the upper position.

Note: this manoeuvre should not be performed below 1,000' AGL.

Prior to initiating any turn, look **below** and **behind** your position in the air. If there are any canopies in this area, wait until they clear, move to a clear area, or abort the attempt. Spiral descents are to be avoided at low altitude, especially in the target area as canopies are converging on the target, or if wearing an AAD. This is of particular concern when there is more than one jump aircraft in operation. In addition, when coming out of a series of spiral turns, release the toggle slowly and be aware of canopies in front of you and at the same level. The canopy will have extra forward speed with a slower rate of descent for a few seconds after the turn. Note that while in a spiral, the canopy has a significantly higher rate of descent than a canopy in normal flight configuration, too high to land without injuring or killing yourself.

6.6.2 STALL PRACTICE

You should practice the **stall** and **recovery** action until you can repeatedly stall and recover the canopy without experiencing any excessive surge or swinging back and forth. The "surge" is a forward swinging action that occurs when the canopy begins to fly again, which can be controlled by only releasing the brakes by a small amount during recovery.

Every canopy will stall with the steering toggles in a different position, as this depends on the design of the canopy and the length of the steering lines. Generally, the stall point should be at the lowest possible arm position. The action of stalling the canopy requires that both toggles be pulled down slowly as far as possible until the stall is recognized. Hold the toggles at this position for several seconds; you experience a slight loss of directional control and a sensation of dropping downwards and backwards.

Hold the canopy in a stall only for a couple of seconds. To recover from the stall, move the toggles up slowly, just high enough to break the stall, and then recover to forward flight by raising your toggles by roughly 6-8" (to your belly button) and then all the way up. Ensure that the hands move **slowly** upward. Recovering too quickly will result in the canopy surging forward and diving to regain airspeed. You must learn to recover gracefully in order to avoid any possible surge of the canopy, or swinging motion of your body. This is very important close to the ground where an abrupt recovery from an accidental stall could cause the canopy, and you the pilot, to drive at the ground.

When flying straight and level, with the same suspended weight, your canopy will stall close to the same toggle position every time. You should learn this point, so that it is not crossed accidentally. During any higher speed manoeuvres, such as turns, spirals, swoops, (or anything that makes you feel heavier in the harness), the canopy will stall with the toggles in a higher position. Practice up high to learn where your canopy stalls.

After some experience has been gained with stalls, you can increase the time during which you have the canopy stalled, and you may raise the toggles only slightly higher in the recovery action. These two actions will increase the amount of surge that the canopy will make during its recovery.

Stall and Recovery should be practiced each time you transition to a new canopy! Know the Stall Point, and how to recovery gracefully.

6.6.3 REAR RISER MANOEUVRES

[from PIM 2B]

Note that when performing any riser manoeuvre, do so without letting go of the steering toggles. Steering lines should be set such that you can reach the front and rear risers without much effect. If this is not the case, your steering lines may be too short.

There are four types of manoeuvres that can be done with the risers:

- Turns
- Spirals
- Stall
- Landing flares

Each action is appropriate in certain circumstances, while being inappropriate or dangerous in other circumstances. You are encouraged to practice these riser manoeuvres well above the ground in order that, as necessary, you will know when and how to perform each action and the resulting change in-flight pattern. In addition, when transitioning to a different canopy, one should perform these manoeuvres each time in order to understand the performance characteristics of each canopy.

Rear Riser Turns:

A rear riser turn is performed by pulling down on one of the rear risers. Reach up as high as possible on the riser; grasp it with one hand or both hands, then pull down quite firmly. The rate of turn is related to the amount the riser is pulled down. Pulling a riser down requires more force than pulling the steering toggle. This is because the riser connects to a much larger section of the canopy (about ¼, rather than the trailing edge only).

You may have to use this technique during the deployment process in order to avoid a collision with another canopy – see Opening Avoidance Techniques, Section 6.12 on page 118. The action is faster than trying to locate a steering toggle, release the brake and then turn. This technique may also be used if a brake cannot be released or if a steering line is broken during deployment. In other words, you can control the canopy flight using the rear risers only.

6.6.4 Rear Riser Spirals:

This technique is performed in the same manner as a riser turn, but the riser will be held for longer. Pull down firmly on one riser, and hold the riser down. The canopy will roll to the side pulled, with your body swinging out to the other side. As you continue to hold down the riser, with the speed of the rotations will increase.

CAUTION: Ensure that this manoeuvre is performed above 2000 ft.

Prior to initiating a spiral turn, look below and behind your position in the air. If there are any canopies in this area wait until they clear, move to a clear area, or abort performing the manoeuvre. Spiral descents are to be avoided at low altitude (below 2000'), especially in the landing pattern area as canopies are converging on the target. This is of particular concern if there is more than one jump aircraft in operation. In addition, when coming out of a series of spiral turns, release the riser slowly and be aware of canopies in front and at the same level. The canopy will have extra forward speed with a slower rate of descent for a few seconds after the turn stops. Note also that while in a spiral, the canopy has a somewhat higher rate of descent than a canopy in normal flight configuration, too high to land safely.

6.6.5 Rear Riser Stalls:

This technique is performed by pulling down on both rear risers at the same time. It is usually necessary to pull down as far as possible to cause the canopy to stall. The stall is recognized by the backward, dropping sensation. That stall is usually much more abrupt than with the steering toggles. Looking at the canopy, it may appear that the cells are only partially inflated; the pilot chute and bag may be trailing out in front of the leading edge.

The primary reason for practicing rear riser stalls is to learn where the stall point is in the event of needing to do a rear riser landing flare. Because the stall will occur with less warning than a stall using the steering lines, it is even more important that you be familiar with the stall point if using this on landing. In some situations, this technique may be used to lose altitude without gaining excess forward speed.

6.6.6 Rear Riser Flared Landing

A rear riser flared landing is performed by pulling down on both rear risers just prior to landing to stop the vertical descent and slow the horizontal speed. This is an alternative to the normal flared landing using the steering toggles. Set up a normal final approach to the landing area; allow a little extra distance in front of or beyond the estimated landing point. Without letting go of the steering toggles, take a **firm** grip on both rear risers (visually check this). At the usual height above the ground (10 – 15'), pull firmly and evenly down on both rear risers. The canopy will flare, changing its downward movement for lift. The canopy will float and land somewhat past the expected landing point. Properly done, the landing should be quite soft. Use caution with rear riser landings, as the stall point is reached with little warning, and may stall unexpectedly.

This technique can be used for landing when a steering line breaks. It can be practiced at any time, although having a 7 to 10 mph wind helps for the first try or two. Try the flare many times at a higher altitude in order to know how far down to pull the rear risers to achieve a flat, planed-out glide, and at which point a stall will occur. Pulling too far will result in either a pop-up, or a stall, and not pulling far enough will not produce the flare; either way the landing could be quite hard.

A word of caution about grabbing the rear riser is necessary: **look** at the risers when taking the grips. In the past, individuals have inadvertently grabbed the front risers or one front and one back riser resulting in injury causing landings.

6.6.7 FRONT RISER MANOEUVRES

Front Riser Turns:

These turns are performed in a similar manner to rear riser turns, by taking a grip on either the left or right front riser. Again, this should be done without letting go of the steering toggles. You will notice that pulling a front riser requires significantly more force than pulling the steering toggle or a rear riser. This is because the riser connects to a much larger section of the front of the canopy and supports a greater amount of the suspended weight. The turn that is experienced is a diving turn and will noticeably accelerate your forward speed. This turn usually loses altitude much faster than a rear riser turn. The rate of rotation can equal the rate of a turn with the steering toggles or rear risers. Front riser turns can create significant descent rate increases over normal canopy flight. For this reason, they are generally performed above 2000 ft. as they could cause activation of an AAD. The rate of descent will be more pronounced if the riser is pulled further down.

This type of turn is used for rapid canopy descent, moving down to have adequate space to make an accuracy approach or to do CFS with another canopy at a lower level. It is not used at low altitude (<2000') nor in close proximity with other parachutes.

With many canopies, attempting front riser turns without first releasing the brakes produces some unusual behaviour (such as buffeting) and very high riser pressure. This is because the tail is already deflected, and you are trying to deflect the nose, creating an undesirable airfoil shape. Because of this, plus the increased force required to execute the turn, and the increased forward speed gained during the turn, front riser turns are generally NOT used for canopy avoidance on opening (use the rear risers, as discussed above).

Front riser turns (along with harness turns) are generally the preferred method for initiating turns for high performance landings (aka Swoops). While this is an advanced technique, and should be discussed with a coach or instructor before attempting, it is important that novices realize that hard toggle or rear riser turns close to the ground are NOT the way to start learning high performance landings, but are a good way to break your legs, or worse.

6.6.8 Front Riser Spirals:

This technique is an extended version of the front riser turn. Grip either front riser high up close to the connector links, and pull down firmly. With many canopies, pulling only a few inches will start the turn, and pulling further may be very difficult. When pulling on the front risers, the top of the canopy takes on a "stair step" configuration, which is not conducive to smooth airflow over the top of the canopy. Therefore, only pull the front riser as far as necessary to initiate the turn. Note: prior to initiating the turn, ensure that the area around is clear of other canopies. The rate of the turn will increase through the first few rotations. If any buffeting or bumping is encountered, ease up a little on the riser that has been pulled down. CAUTION: In turbulence, severe front riser turns have caused some canopies to momentarily collapse. *Avoid it altogether in turbulent conditions*.

This technique is used for rapid loss of altitude to gain separation from another canopy while setting up for accuracy. There is a significant loss of altitude during a front riser spiral, as well as considerable forward speed resulting when the turn is released. Caution should be exercised at low altitude and in congested areas around the target where people are landing and packing.

6.6.9 Front Riser Dive:

A front riser dive is performed by pulling down on both front risers at the same time. Without letting go of the steering toggles, take a grip on each front riser and pull down both risers as far as possible. The canopy will increase both its forward speed and rate of descent.

This technique is used in situations where a skydiver needs more forward speed and altitude is not a critical factor. Some possible situations are being slightly downwind of the target in high winds, or trying to move forward in strong winds. It may be used on an accuracy approach when you find you are not getting sufficient forward movement to reach the target. With higher performance, high aspect ratio canopies, altitude loss can be rapid. Exercise caution when using this manoeuvre close to the ground. Avoid it altogether in turbulent conditions. Swooping and hook turns are not recommended for lower experience jumpers; consult with a Coach or a highly experienced canopy pilot before attempting a front riser dive close to the ground. *Avoid it altogether in turbulent conditions*.

If learning higher performance landing techniques, a good start is to apply slight front riser pressure once on the final approach to gain some airspeed without any turn. This approach will give the pilot some experience with the increased landing speeds and changes in control input, without the need for a low turn. Be sure to release with plenty of altitude remaining to flare using the toggles. Please speak with your instructors or coaches before attempting these approaches.

6.6.10 FLAT TURN

Flat turns will enable you to make corrections on final much more safely. The flat turn keeps the parachute over your head and not banked off to the side. The canopy also maintains a constant descent rate.

The flat turn has to be trained; it is not an intuitive response to an unusual situation. The instinct is to bury a toggle quickly to turn to avoid a near-ground obstacle or another canopy. Using the 2-staged approach, first we want to stop the descent (going to ½ or ¾ brakes); and then train to turn with minimal roll of the canopy, and minimal swing to the side. During a flat turn, the jumper's body should always remain UNDER the canopy, with only a very slight swing to the side.

To turn flat, go into ½ - to ¾-brakes then letting up on one steering toggle (or pushing down a bit on the other) executes a flat turn, or a ½-brake turn. This type of turn enhances safety and precision by reducing the pendulum effect. This reduces the bank the canopy does, which maintains a slower rate of descent during the turn and reduces the chance of disorientation.

The Flat Turn is one of the most important canopy safety moves you can use close to the ground. Understand it! Practice it! USE IT!

6.6.11 FLARE TURN

While flat turns are very appropriate for turning with a minimal loss of altitude, such as a correction on final to avoid an obstacle on the ground that you just noticed, the time it takes to initiate the flat turn may not be reasonable in a sudden collision avoidance situation. To turn quickly the pilot needs to swing out from under the parachute to get the canopy to roll. This generally results in the rapid loss of altitude that can be deadly at low altitudes. However, in a Flare Turn the canopy is flared during the turn to prevent the loss of altitude.

To initiate a flare turn, begin the turn by pulling down on the appropriate toggle. Immediately after the canopy begins to roll, start bringing down the opposite toggle (you will now be pulling both toggles down, with one leading by several inches). As you come to the desired heading, usually just a 90-degree turn, stop pulling with the leading hand and pull the trailing hand down so that the toggles are even. This will stop the turn, and you will be in a flared, slow flight configuration. If you are close to the ground, complete the flare and perform a PLF. If you have the altitude, recover slowly to the full glide position.

Like the flat turn, it is extremely important, not to mention fun, to practice these turns up high so that they become automatic. Try it flying next to a coach to get an idea of the altitude change.

6.6.12 S-TURN

[from PIM 2B]
This is an accuracy as well as a CFS technique intended for use to hold a position over the ground without losing excessive altitude. Make a 45° to 90° turn to one side; this should be executed smoothly using not more than ¾ of the full range of steering toggle movement. Once the turn is complete, a second turn to the opposite side is executed; the heading will change by 90° to 180° for the second turn. Successive gentle turns will be executed until the position is correct and relative to the target (bowl or other canopy). Seen from above, the flight path is a series of gentle S-shaped turns.

6.6.13 SASHAY

[from PIM 2B]
This is primarily a CFS technique intended for losing altitude quickly. It has the effect of diminishing the forward movement and expending altitude. To execute the technique, depress one of the steering toggles to its maximum extent; then at the point where your body has been swung to the side, return the toggle to its up position. Pause briefly as the canopy moves back to centre and ahead, in a slight dive attitude. Then depress the other steering toggle to its lowest position, until you have swung far to the opposite side. At that point, move the toggle to its upper position, and repeat the action to the first side, alternately depressing the left then right steering toggles. The result of the sashay will be limited forward movement (over the ground) and a large drop in altitude. It is only one of

several techniques used in CRW. For further instruction in CRW, find a Coach 2 who has had CFS experience.

6.6.14 PARALLEL FLIGHT

[from PIM 2B]
Flying canopies close together is a situation that jumpers may encounter when doing canopy formation skydiving and freefall formation skydiving, particularly on large formation jumps, or even when doing solo skydives at drop zones with large or multiple aircraft. Taken to the extreme, jumpers may fly together "bumping" end cells. This would be the beginning of Canopy Formation Skydiving (CFS). A jumper may wish not to partake in canopy formation skydiving, but they should be comfortable with parallel flight for those occasions when the approach to the landing area is crowded.

To perform this manoeuvre, discuss the jump with a Coach 2 who is an experienced canopy formation skydiver. Practice on a jump where you can open high (preferably over 4000 ft), and discontinue unnecessary parallel flight below 2000 ft. After activation and your canopy check, locate the other canopy. Depending on whose canopy is lower, the other person will have to front riser dive, sashay or front riser spiral to get on the same level. The lower canopy will pick the direction of flight with the higher canopy's position in mind and generally holds ½ brakes. When the canopies are at the same level, close the separation by converging towards each other using no greater than a 60° angle. As the canopies get closer bring the canopies to smaller converging angles until parallel flight is achieved. Remember you have to work as a team to accomplish this. Maintain the canopies side by side using brakes or front risers if necessary. Avoid aggressively bumping end cells as this could cause an end cell collapse on a high aspect ratio canopy.

6.7 LANDING TECHNIQUE

The skill of landing a canopy has two elements:

- the position of the body under the canopy, and
- the flight of the canopy.

For a good landing, both elements must be performed correctly.

Body position:

In a good body position, the legs are together, with knees slightly bent. The body should be vertical, with the feet directly below the hips. The feet should be close together (approximately 6" apart). The arms should be raised so that the canopy is flying at full speed prior to the flare.

Canopy flight:

The canopy should be flying into the wind line in the direction of the landing target by approximately 200' above ground level and approximately 10 seconds before landing. Then make small, gentle movements to correct or maintain this heading. The toggles are

positioned close to the risers so that there is no tension on the control lines and the canopy is flying at full speed.

The height to begin the landing flare is different in every situation and depends on many factors, but usually starts at approximately 15' above ground level. The toggles are pulled steadily down, in a smooth motion, to maximum extension of the arms; this action takes roughly 2-3 seconds. The legs and feet are held together. When contact is made with the ground, push against the pressure that will be felt from the ground. It may be necessary to take a step forward, so long as landing softly. Once your feet are on the ground, collapse your canopy immediately to get it out of the path of other approaching canopies.

Getting a Good Flare:

Focus on getting *a good flare;* this will increase your enjoyment of the sport tremendously. Understand what is happening and why, by asking your coach.

There are 2 main objectives during the landing flare:

1. Stopping the descent
2. Slowing the forward speed

Stop the descent by applying the 10-second rule: ensure you are taking at least 10 seconds on the final approach (after the last turn) flying at full speed. This ensures that you will be initiating the flare with plenty of airspeed, but a relatively low descent rate (remember that the descent rate increases greatly during a turn), and that you are hanging under the canopy, not off to the side where much more lift would be required to level off. The flare begins by pulling the toggles to a point that will stop the downward motion of the canopy. This point will vary depending on how fast you pull the toggles, and you can adjust for the altitude that it is started. For example, If you start a flare and realize that you are a bit low, increase the speed of the flare, and you will get more lift to stop the descent sooner. If the flare is applied very slowly, you might reach the stall point before you have completely stopped the downward motion of the canopy. If you held the toggles at this position, the canopy would fly level for a short time during the plane-out, and then start to lose some airspeed and to descend again if nothing else is done.

To slow the forward speed while keeping the canopy in the plane-out (i.e. in level flight), you must continue to add more and more flare (pull the toggles down further) as the canopy slows. At some point, the ground speed will be low enough that you can transfer your weight onto the ground and finish the landing. Try to use as much of the control range as you can. In low winds, aim to finish this landing sequence just as you reach the stall point.

A useful concept to help improve the landing flare is this: try not to land for as long as possible. Think about it like a game. How long can I go from starting the flare until touching down? This will encourage you to use all of the entire control range available to you, and will help avoid bad habits such as reaching for the ground with one foot.

SPEED = LIFT
Understand that you do not need to be afraid of the forward speed of the canopy. The forward speed is what will give you a better lift, and hence, a better landing.

This takes time and practice, including practicing at opening altitude as well as upon each landing. The key thing to understand is to let the canopy fly....and you will land better.

See Section 6.17.4, page 138 on Landing Problems and Canopy Control for more information.

6.8 SET-UP ASSESSMENT

This skill takes time to develop and is best learned by watching other jumpers making approaches to the target area. Use the information from Observation of Drift wisely.

The "set-up point" occurs 200 - 400 ft and is the point the canopy is turned onto the flight control line (i.e. the final approach). Determining of how far back to set up the control line is dependent on experience in observing drift, the surface winds and other awareness of jumpers. When properly chosen, the set-up point will allow the jumper to land close to the intended target (+ or – 10 m). It is important to remember to focus on setting up for a proper, safe landing, and not to get mesmerized with hitting the target. If you miss the target, that's Ok, you have many more jumps to try hitting it again. The canopy should be flown at full glide (*hands all the way up*) at least 100 ft above the ground and land with a full flare.

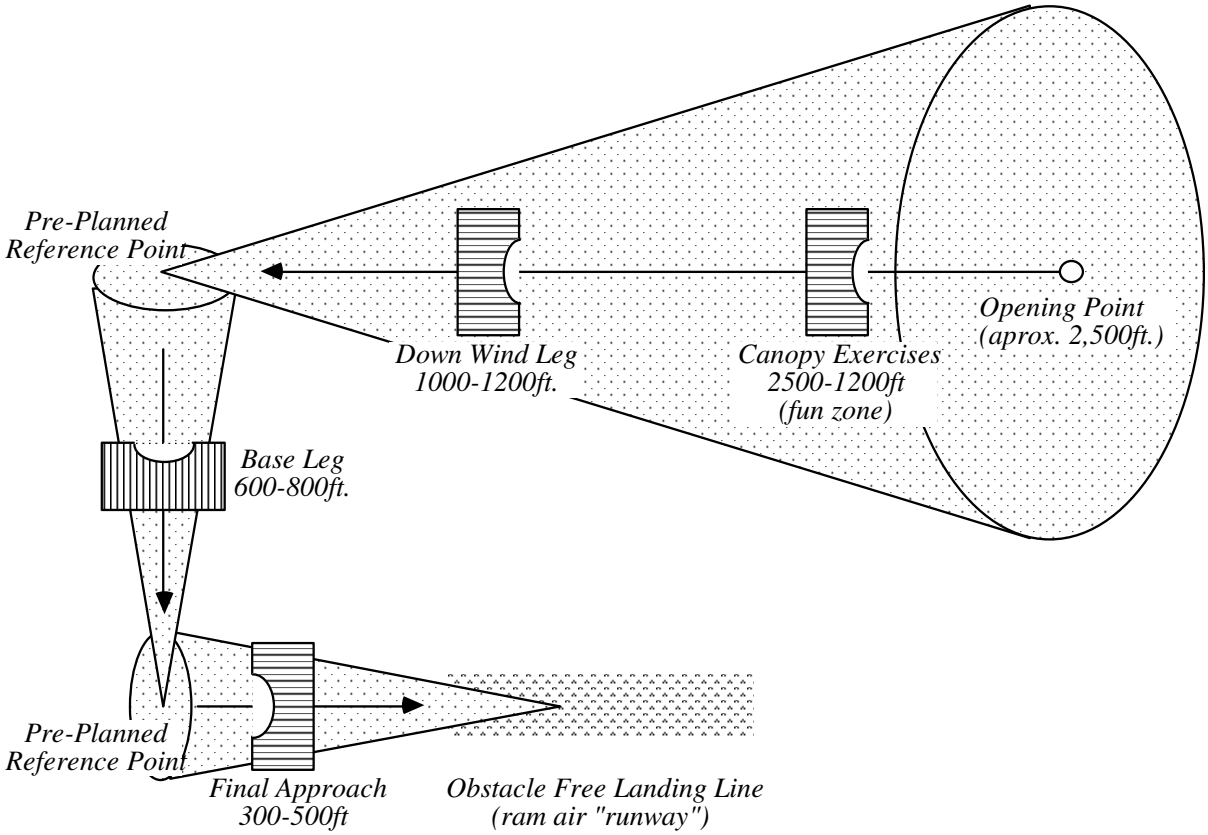
6.9 LANDING PATTERN

Just like airplane pilots, canopy pilots should follow a common landing approach. This is generally considered a Left Hand Pattern (keep the target on your left until on final approach, and only do left hand turns in the pattern). The landing pattern may be different at your DZ, so always ask. Learning the landing pattern can start by plotting a pre-jump flight plan. This can be achieved by first using an aerial map, followed by a walk out to the landing area (an obstacle free line for landing). There, pick out your route and ground reference points for the downwind, base and final legs of the approach, with a coach's assistance if necessary. If the area does not have useful reference points, setting out three or four visible markers such as highway marker cones may help. Once a general pattern has been established, remind yourself of the following key points:

1. Once under a good canopy, assess the opening point, wind drift and surface winds following a canopy and flight check.
2. During the first half of the descent the canopy's flare and stall points should be tested. Other exercises can be practiced until about 1,500 ft. Below this altitude, any erratic manoeuvres should be stopped and your attention should be focused on the landing approach.
3. Fly the canopy from a half brakes position.
4. Manoeuvre canopy to the flight pattern reference points to meet pre-assigned altitudes.

Suggested altitudes for an approach are:

1. turn downwind - 1000-1200 ft.
2. turn base (crosswind) - 500-600 ft.
3. turn final - 200-300 ft.



Once flying the pattern make periodic reference to wind indicators for any final adjustments. If any change in wind speed or direction has occurred, evaluate the new landing approach or direction from 1000 ft., not 100 ft. Upon turning on final, hold the wind line until landing. Check for any side drift and gently correct to hold the wind line. Ease up on the steering toggles to return to full speed for landing.

Think of the landing approach like an aircraft **Runway**, NOT a *dart board*! ☺ Or, think of it as a **bowling lane,** to use another analogy…stay in your own lane, not in the gutter.

Safety tips to consider are:

- turn onto final by 200 to 300 ft. even if off the intended landing area,
- identify obstacles and select a clear landing strip,
- ensure there is enough runway on final,
- always maintain control of your canopy until you have landed,
- watch for other canopies.

Assessing the Terrain

[Taken from PIM 2B]

The skill of assessing the terrain provides two types of useful information. The first relates to the flight of the canopy and trying to identify areas of rising and descending air. The second relates to landing the canopy. It is important to be able to identify areas of smooth airflow for safe landings, while recognizing areas of turbulence that should be avoided. In general, dark coloured surfaces and developed property (buildings & paved areas) are sources for rising warm air on a sunny day. The air above lakes, trees, swamps and grasslands is most often stable or descending. In addition, a change in ground level such as a ridge or some small hills may cause the air currents to be moving upward, depending on the wind direction.

Turbulence is usually associated with the disruption of airflow or the mixing of two different airflows, such as a thermal. This type of turbulence is most often the result of features on the surface such as a large building (e.g. the hangar) or natural features such as a hill or a tall line of trees. The airflow in front (upwind) of these types of features is quite stable. Behind or downwind from such a feature the air is tumbling or circling. This is a very poor place to attempt to land (or crash) one's parachute. Avoid landing immediately downwind of large buildings, tree lines, etc. Similarly, the airflow just downwind of the top of a ridge or small hill is quite turbulent; landing in that area should also be avoided.

FS LANDING APPROACH

[Taken from PIM 2B]

You must be aware of other jumpers flying their canopies when coming in on final approach. If you are close to other canopies move away from them to practice your canopy skills. As the altitude decreases there will be more jumpers flying their canopies in a smaller space. Make sure you know where they are. When in the air with several other jumpers, it is best to obtain some vertical separation with other jumpers. This will make final approach and landing easier. If you are above someone under canopy, maintain that vertical separation. If you are at the same level, one of you should make the decision to slow your descent and let the other person get to a lower altitude. CAUTION: Vertical separation should only be used if altitude permits. Spiralling in busy canopy traffic to gain vertical separation is a very dangerous idea due to the increased speeds, and lack peripheral awareness. To gain vertical separation, give faster canopies the chance to get ahead by applying deep breaks, bringing the toggles to just a few inches above the stall point (in turbulent conditions, do not go quite so far). This will slow your vertical descent and give the faster canopies lots of time and space to set up for their landing.

Additional rules are as follows:

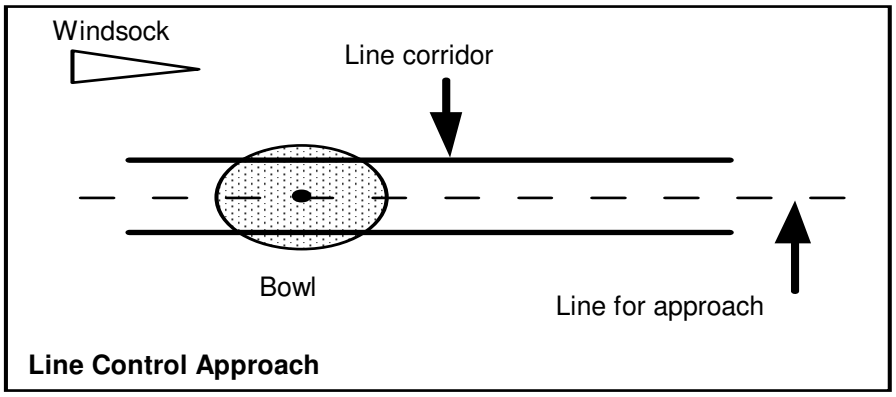
- if your canopy converges with another, the canopy on the right has the 'right of way'.
- yield to lower canopies, less manoeuvrable canopies, a reserve, tandems, camera persons and students.
- if you get behind another canopy, immediately move off to the right side (check to see if it is clear) to prevent canopy collapse due to turbulence.

- look in the direction you wish to turn before you turn. If it is clear, make the turn.
- do not perform any radical manoeuvres.
- if you are on final, do not S-turn or brake hard. There are probably other people behind you and you could cause a collision.
- if the landing area is too congested, choose another site.
- yield to canopies which have landed and if you are landing close to them give them a shout.
- once on the ground collapse your canopy immediately and clear the landing area so others do not have to deal with a congestion problem. Watch for other canopies.

These are the general rules of the air, but remember situations may arise that dictate the use of other actions.

6.10 WIND - LINE CONTROL APPROACH

Wind line control on approach is the first skill in refining your accuracy. This term is used to describe a line that runs through the center of the target and in the direction of the wind. The line begins about 500 ft downwind of the target and runs upwind through the target into the wind. The width of the line decreases with increasing skill of the jumper.



Line Control Approach

When making an approach to demonstrate line control, keep the shoulders, hips and feet square. The body position should not change except for the arms. The steering toggles should be roughly at the ¼-brake position. The objective is to land along the line that runs through the target. Landing long or short is of no importance at this stage.

6.11 ANGLE CONTROL

The term angle applies to the descent angle of the canopy during final approach, the last 300' to 500' of the canopy flight. The angle is measured using the ground as the horizontal to an imaginary line from the target to the jumper.

The approach angle is the third element in the accuracy approach, after body position and line control (Section 6.10). You should have a reasonable degree of skill with the first two *prior* to starting work on angle control. To practice angle control, set-up on the wind line in the usual manner at a distance of 75 to 100 meters downwind from the target. Start with

the steering toggles at ½ brakes. Observe an increase in the steepness of the angle; the landing point is now closer to you. Hold the steering toggles at the ½ position until landing if you will make the target (e.g. bowl). If not then ease the steering toggles up to ¼ brakes and flare for landing. If the target is missed then adjust the set-up point for these *similar wind conditions* by the distance that you were long or short of the target. Repeat the exercise several times until familiar with the set-up points for high, medium, and low wind conditions.

You may notice that it takes considerable strength to hold the canopy at ½ to ¾ brakes for the total time of the final approach. The toggles may not be set at the proper positions to use your strength most effectively; you may be making a longer approach than necessary (say from 1000') or you may require some arm strengthening exercises.

Warning: if you let the toggles up too quickly, the canopy will surge forward and you will not be able to flare, and could very seriously injure yourself. The toggles should be back at the highest position on the risers by at least 100 feet in order to produce an effective flare. Do not try to land at ½ brakes under a regular canopy.

6.12 AVOIDANCE TECHNIQUES

[Taken from PIM 2B]

Avoidance techniques are achieved by doing a 90° rear-riser turn in one direction immediately after opening. This is practiced to improve awareness and reaction time for the prevention of mid-air canopy collisions after any skydive. You should practice this exercise with both left and right riser turns when you are doing beginning FS and on solo's.

Keep in mind that canopy avoidance can be necessary on any skydive, even on a solo when another group opens close to you, for example. If there are two canopies flying directly towards each other, both should initiate a right turn to avoid collision. For turn immediately after opening, the rear risers are used instead of un-stowing the steering toggles as this can cost a lot of time. The right turn can be initiated by the rear riser. Remember to turn right to avoid a head-on collision. Canopies at lower altitude have the right of way over canopies at higher altitudes. Also at this time, you should read and learn the Right of Way Rules found under Ram Air Canopies in the Canopy Control Section (Section 6.16 on page 129).

6.13 MODEL FOR ACCURACY APPROACH

[Taken from PIM 2B]
[Accuracy by Craig Winning, CanPara©, Canadian Sport Parachuting Association, 1980]

This information is provided for opportunities when you have clear access to the bowl and is not to be used with FS or during a group pattern approach. The essential element of the accuracy approach is the "final approach" to the target. This is a combination of the body position, line control and angle control, discussed above in Section 6.10 and 6.11. The final approach is flown from a position somewhat downwind of the target to the centre of the target. Final approach should begin at roughly 500' above the ground; experienced accuracy jumpers will often start their final approach at a lower height.

The objective for the accuracy approach is to fly a straight line from the set-up point to the centre of the target, moving forward at a constant speed. The speed of the approach should be about 4 mph, about equal to a normal walking speed. The canopy should be flown with a brake position that can be increased to slow the canopy's flight, or decreased to speed the canopy's flight. The body suspended below the canopy should be virtually motionless, with the hands level (about ½ to ¾ brakes); the torso should be relaxed and square with the canopy. Rocking below the canopy or twisting relative to the canopy's direction of flight will give incorrect impressions of the actual motion. Fly the canopy all the way to the ground, placing the feet below you when you land. Reaching encourages you to stop flying the canopy several feet above the ground and generally causes injuries.

In the time between exit and the start of the final approach, do the following things:

- perform a flight control check, including stall point
- observe the surface winds; select a starting point for the final approach
- drift the canopy towards that point while relaxing; rest the arms (but never let go of your steering handles).

Under canopy, you can ask yourself this series of questions as you make your approach:

- Is the canopy on the wind line that passes through the centre of the target? (check the wind sock)
- Can the canopy land short of the centre? Fly over the centre?
- Is my body position square with the canopy and relaxed?
- Am I still flying to the ground? Keep flying!

There are no secrets or tricks to the accuracy approach. It is a matter of moving slowly closer to the target, making small corrections as you watch where you are going. This type of accuracy approach is for individuals with accuracy canopies.

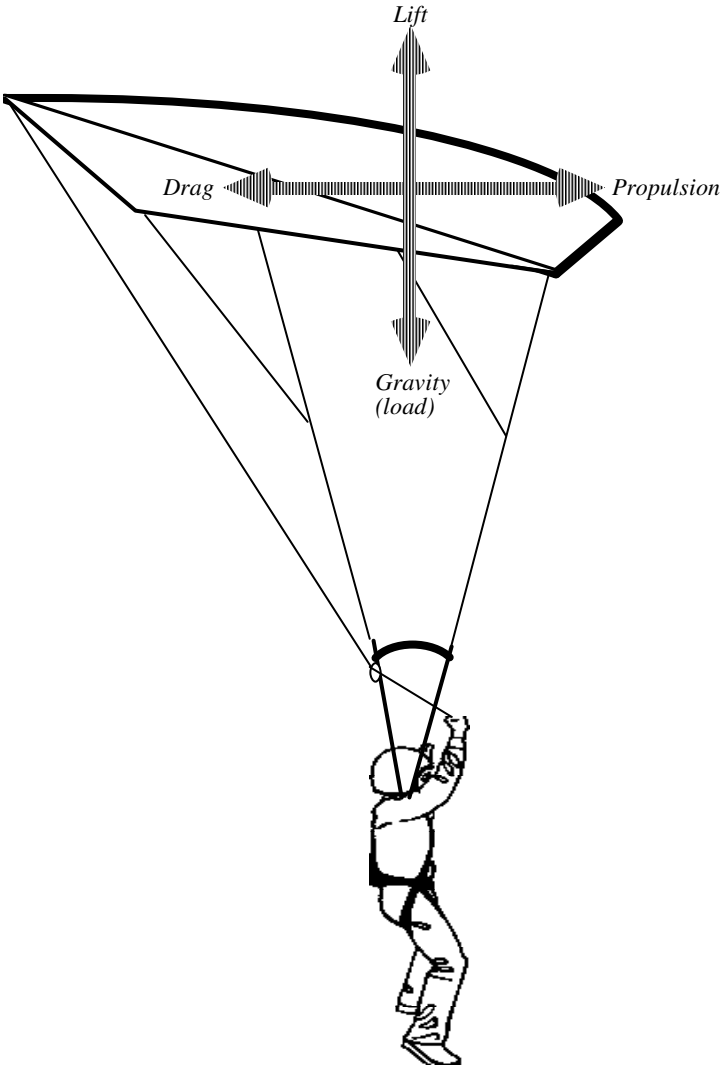
6.14 THEORETICAL MODEL FOR CANOPY FLIGHT

To discuss why you would use particular actions it is helpful to have a model which can be used to illustrate the different factors that affected flight. The following is a simple model which identifies some factors, discussing how each factor affects canopy flight and canopy control. The factors are:

1. gravity/load
2. drag
3. lift

Gravity:

This is the downward force that the earth's gravitational field provides. The skydiver is a load beneath the canopy that is constantly pulling the canopy downward. The canopy is pulled downward through the air by the load (the weight of the skydiver + gear, plus the weight of the canopy itself); this downward motion creates a relative wind that causes the canopy to inflate (after it is activated) as well as contributing to its flight once it is inflated. The parachute forward motion is derived from its downward movement in the air and from the trim of the canopy. The trim is the built in nose-down angle of the canopy. It determines the airspeed that the canopy will fly at in a full glide. The trim is designed so that the canopy flies safety above it is stall speed, but low enough that that it can transition into level flight during landing. The lines going to the front part of the canopy are shorter than the lines connected to the back half; giving the canopy its nose-down trim. The downward movement is used to create the forward movement. As the load (gravity) pulls the canopy towards the ground, the air moving up from below the canopy is deflected towards the back of the parachute. As a result, the canopy moves forward.



The 3 Forces on a Ram-air Canopy

Lift:

Lift is generated as a result of the canopy's forward movement through the air. The fabric of the canopy, when inflated with air, forms an airfoil shape similar to that of an airplane wing. There is a greater surface area on the top skin of the canopy than on the bottom skin. Air moving over the top of the canopy, or wing, has a greater distance to travel, and therefore moves at a faster rate than air moving below the canopy. Air moving at a higher speed exerts a lower pressure on the top of the canopy. The difference between the high pressure below the canopy and low pressure above it, results in lift. The lift the canopy creates by moving forward does not necessarily cause the parachute to go up, but does cause it to go down more slowly. A canopy can momentarily go up by converting it's forward momentum into increased lift, but this is not sustainable without some type of propulsion, such as an engine. Some special types of canopy designs, such as Paragliders (not used in skydiving), have very low drag and a much flatter glide. These can climb on rising air currents called thermals. The canopy flies at a descending angle most of the time; it can only achieve level

flight for a short time, after which it loses too much airspeed and starts descending again. Stopping the canopy from going forward will cause it to go downward more quickly.

Drag:

This is the resistance of the canopy to movement through the air due to friction. The drag is generated by the surface area of the skydiver, the surface of the lines, and the surface of the canopy itself. Drag is also generated or increased by pulling on one or both of the steering lines causing the tail of the canopy to hang down or be exposed below the bottom surface of the parachute.

The resultant vector of the 3 factors affecting canopy flight is the forward speed and the glide angle of the canopy.

Flight of the Canopy:

Keep the above 3 factors in mind when reading the information which follows. This information concerns a skydiver's actions in controlling a canopy, and the effect the action will have on the parachute. The following topics are considered:

- mechanics of control
- flight in the air
- landing the canopy

Mechanics of Control: Controlling the canopy is a matter of adjusting the direction that it is facing. This is done by increasing or decreasing the amount of drag created by the control surfaces or by changing the canopy's trim, which is accomplished by pulling down on the front risers.

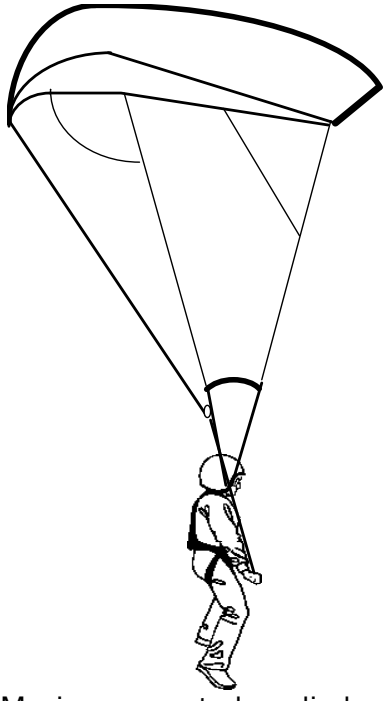
Bringing the arm and steering toggle down causes a turn; returning the arm to the up position stops the turn (some canopies require some counter steering with the other toggle to stop a turn). The amount you move the steering toggles affects the rate or speed of the turn. Moving the arm down to chest level is normal for a turn; pulling the steering toggle further down results in a faster turn. Pulling the toggle only part way down results in a slow turn. The turn is created by increasing the drag on that side of the canopy by lowering the tail or trailing edge. That side of the canopy flies slower, the other side flies around, causing the change in direction.

Using the steering toggles is not the only way in which to turn the canopy. Pulling on any one of the four risers will cause the canopy to turn. Pulling one of the rear risers will require slightly more force than pulling the steering toggle. The turn that results will be gentler with a normal movement, but can result in a steeply banked turn if the riser is pulled substantially downward. Pulling down on the front riser will cause the descent rate and airspeed to increase rapidly because the trim of the canopy is being changed, rather than drag being applied (as with a toggle turn). Depending on the canopy design, the front riser turn may be a steeper banked turn than one made with a similar amount of movement of the steering toggle or rear riser, but this is not always the case.

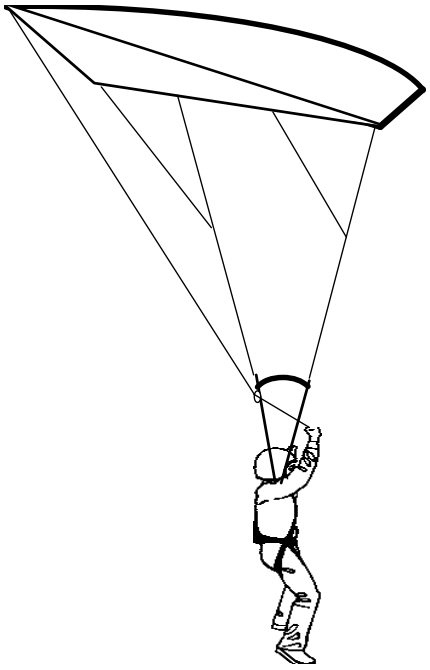
Pulling both steering toggles down increases drag and slows the forward movement of the parachute. Pulling both toggles down as far as possible without stalling slows the canopy to its maximum; the slowest sustainable descent rate of the canopy is found just above the stall point. Pulling down both steering toggles to achieve momentary level flight is called the flare.

Pulling down on both rear risers will also slow the descent of the canopy, more so by flattening out the trim of the canopy than by adding drag. With the trim too flat, the canopy will be flying much slower, and may be close to the stall point.

Pulling down on the rear of the canopy changes the angle of attack (the angle at which the wind hits the wind). [Angle of Attack (AOA) is the angle at which the wing is presented to the apparent wind. With square parachutes this changes when the brakes are applied. During the flare, the act of pulling down the brakes of the canopy in order to slow it down results in an increased Angle of Attack and reduced descent rate. During a Stall, the angle of attack of a wing becomes too high to sustain lift, and the wing is said to be stalled.] This increases the lift but also increases the drag. The result is slower forward speed, and increased lift. If the speed is allowed to get too low, a loss of lift will result in the canopy moving down more rapidly. The more the canopy is slowed, the greater the loss of lift and the greater the increase in downward speed.



Maximum control applied



Minimum control applied

Pulling down on both front risers will cause the canopy to increase its rate of descent, while also increasing its forward speed slightly due to the changed angle of attack.

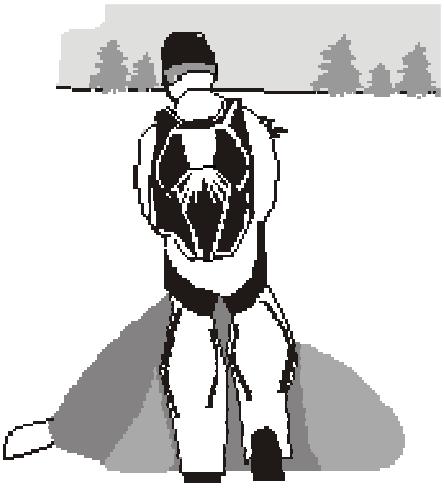
Flying:

The ride under canopy is not 100% smooth. The parachute banks when it turns; the skydiver swings out to the side. The air has currents and the skydiver will feel the bumps from these currents during descent. If the end-cell closes when going through a bump (because the canopy loses air from one side), the corrective action is to pull both steering toggles down to the waist; hold for 2-3 seconds, then raise slowly (two seconds). Recall that this is the same action that is used if one or both end cells are closed when the canopy first opens.

The control of the canopy depends on the suspended load (the pilot) swinging to the sides to induce the roll of the canopy in a turn, swinging forward during a flare to create the nose-up pitch required for more lift (higher angle of attack). However, the canopy and the skydiver are connected by roughly 10 feet of flexible suspension line. The distance between the canopy and skydiver results in some lag time between giving the control input, and the movement of the load under the canopy, and the reaction of the canopy. When a turn is initiated, it takes time for the load to swing to the outside of the turn, which is required to roll the canopy and get the canopy to fully respond. The same applies for stopping a turn. It takes time for the pilot to return to a settled position under the canopy once the turn is stopped. When the canopy hits turbulence or a bump in the air, there will be a time lag before the skydiver will feel it.

Knowing that the canopy has a response time is important when making control actions and when trying to assess the situation during the canopy descent. Each action takes a few seconds before it is required, while decisions based on the skydiver's location in the air must be delayed after a previous control action until the jumper is settled or motionless below the centre of the canopy.

A final point to consider is that a canopy's performance is affected by the weight or size of the load. Canopies, when manufactured, are intended for a particular load or load range, commonly referred to as Wing Loading. [Wing loading is the ratio of weight born by a wing to its surface area. In the US, divide your exit weight in pounds by the square footage of the canopy.] This should be considered when purchasing or borrowing a canopy.



Landing:

To land a canopy we use the technique called a "flare". The flare is a short period of time where the canopy's downward movement is stopped, but before it begins to move down more rapidly. A flare is described in the canopy control section. Technically, it is the conversion of forward speed to lift by increasing the airfoil's curvature and pitch, causing an increase in lift as well as drag, thus slowing the canopy's downward and forward speed. The lift produced in the flare only lasts for a few seconds. Some canopies will float for 3 to 5 seconds while smaller, faster wings may produce lift for a shorter period of time. Once the lift produced is gone, the canopy begins to move downward more rapidly. If no more control input is available to arrest this descent, you have entered what is called a "stall". To recover from a stall, raise the toggles slightly (to ¾-brakes). This will start the parachute flying again, which produces a small amount of lift. At this point, there may be enough lift to make the landing more comfortable than a stalled landing. In any case, keeping feet and knees together and the knees bent (PLF body position) may help to prevent injury from a hard landing.

PLF – Parachute Landing Fall

Many drop zones are starting to shy away from teaching their first jump students how to properly perform a PLF, partly because of the ease with which a student can perform a

stand-up landing, and because of the "cool" factor – PLF is old-fashioned and not considered "cool". This is incorrect thinking.

In this sport, being "cool" gets people killed. Period! All students and experienced skydivers should know how to perform a PLF from chair, bench etc. This is for Safety!!!

1. Students may find themselves in a situation where they may hit ground hard, and need to know how to react by performing a PLF
2. A hard landing may come at any time, particularly during turbulent conditions or landing down wind from an obstacle, or if landing in high winds.

Those who know how to perform a PLF will likely walk away unscathed. Those who do not perform a PLF will likely be carried away on a stretcher.

6.15 HIGH PERFORMANCE RAM AIR CANOPIES

The transition from large square student canopies to smaller square (ram-air) canopies has led to the need to clearly specify what constitutes suitable training for Ram-Air canopies. Although the first jump course provides enough information to safely handle a student ram-air, further training and information is required prior to changing from the forgiving student canopies to the less forgiving higher performance ram-air canopies.

Information and Training

The Ram-Air information section is considerably more extensive than what is provided on the first jump course. The following areas must be covered and mastered by the individual prior to using non student canopies. Note that all of these skills are required for self supervision, and can be found in the Canopy Control and Manoeuvres, Section 6.6 on page 105 of this manual.

Information about packing techniques, storage practices, routine maintenance, deployment control techniques, and packing with inspection can be obtained from a Coach 1. Information about equipment characteristics (main canopy), equipment product information (main canopy) and awareness of canopy specifications as per recommended weight ranges and maximum suspended weights can be obtained from the owners/manufacturers manual for your gear.

Higher Performance Canopies

In dealing with higher performance canopies, some general information and characteristics are as follows:

- they are usually 7 or 9 cells with high aspect ratio (some are cross braced dividing each cell into 3 parts, and sometimes called 21 or 27 cell)
- they are usually made of zero porosity materials
- the wing loading is 1.2 or greater
- has a higher than normal forward air speed

- they can pendulum violently with steering toggles and riser turns
- high performance landing techniques can achieve speeds in excess of 70 km/h (50 mph)
- when doing spiral turns, for some canopies there is a need to bank the canopy gently with light toggle pressure to gain momentum in that direction prior to snapping the spiral turn on
- snapping a spiral turn usually results in line twists which may be severe enough to lock the steering toggle down and cause a spinning malfunction
- radical manoeuvres below 1000 feet AGL are not recommended
- they can stall suddenly in deep brakes
- they can produce excessive lift on a normal landing approach technique
- for safety reasons, make sure your weight to canopy size to experience to DZ elevation ratios match well, miscalculations may be disastrous
- higher performance canopies can have high performance malfunctions creating above normal G-forces in some situations

Safety

Safety is an increasing issue with canopy control. The following are safety considerations that should be adhered to:

- **Never borrow gear** for a jump where you will be attempting something new, complicated or potentially distracting. This especially applies to the novice/intermediate who may have acquired new gear at the same time as they are involved in beginning FS. Borrowing and/or changing gear and systems regularly is not recommended regardless of experience level. Similarly, knowing several emergency procedures and several main deployment procedures is not recommended either. When the time to pull arrives or the emergency happens, valuable time is wasted deciding which system is being worn at that time, and what response to use. There is no guarantee that the momentary state of confusion will be overcome in time to be able to deal correctly with the stressful situation at hand. History clearly indicates that the "borrowed gear syndrome" can lead to serious injury or even death.

- **BSR #1** states, *"No jumper will engage in parachuting activities or use equipment unless properly trained, and endorsed if required, for the same".* When borrowing or purchasing gear or canopies, new or used, it is your responsibility (as well as being a BSR) to be properly qualified, briefed and trained on that gear or canopy's unique performance, flying and landing characteristics, main and reserve deployment procedures and characteristics. Similarly, if you are lending or selling your gear or canopy to someone else, it is also your responsibility to see that the previous training and safety standards are met. For the person borrowing or purchasing the gear or canopy, following these recommendations are measures that may prevent injury. For the person lending or selling the gear or canopy, following these recommendations are measures that may prevent a lawsuit, a coroner's inquest, or both.

- **Low hook turns can result in serious injury or death**. Many experienced jumpers can appear to execute such a move gracefully and skilfully without fail time and time again; yet even the smallest mistake by these extremely experienced jumpers has resulted in either a broken femur, a broken neck, or worse, and can result in death. As a novice, you must understand that it took hundreds, maybe even thousands of canopy landings to **shape** that manoeuvre into the high performance landing you now witness. Other factors are:

    - the many hours under canopy,
    - the hundreds of times dealing with all the varied wind and weather conditions,
    - the motor learning process developed to the autonomous stage for that move and
    - the vast amounts of assessment ability, superior awareness and judgment that comes with extensive experience. Trying to execute this move with insufficient canopy experience or without a long enough shaping period, or both, almost ensures serious injury or death.

- Several new equipment techniques and styles have emerged recently and come with their associated safety concerns. Stowing sliders, removing booties, unzipping wing suits, etc. are distractions and the possibility of poor canopy assessments and canopy collisions are increased. Realizing you have a slow speed malfunction after you have stowed the slider can be dangerous if a cutaway is intended (wasted time, less altitude, possible hang up). With many of the new higher performance canopies in the sky at the same time, the picture of where everyone is changes rapidly and a canopy collision can happen extremely quickly. Colliding without warning can happen while stowing a slider or removing a bootie. Most of these canopies are micro-lined and a collision/wrap situation can result in severe lacerations and even dismemberment.

Jumpers setting up downwind to do a 270° hook turn landing are looking down to judge when to execute the turn. The possibility of colliding head on with someone doing a normal landing approach is *very high* while using this landing technique. Colliding low to the ground is surely disastrous.

The practice of ground swooping or 'turf- surfing' is very popular with experienced jumpers, with skims covering long distances at high speeds. Unfortunately, some swoops are done with less control or consideration of others and are performed crosswind and sometimes even downwind, creating further traffic congestion and risk to others under canopy or on the ground.

Exercising caution, common sense, self-discipline, control, alertness and better judgment is highly recommended to help ensure continued safety under canopy. And never attempt anything beyond your skill level, or without first consulting a certified coach experienced in that discipline.

6.16 RULES OF THE AIR

These right of way rules reprinted from "Parachuting: The Skydiver's Handbook" by Dan Poynter, are common-sense-based regulations that every jumper should be aware of. They are further explained as they apply to freefalling skydivers and gliding parachutes. Note that these are the general rules. Local rules may be different.

1. A reserve canopy has the right of way over all main canopies.
2. Converging: the canopy (on your level) to your right has the right of way.
3. The less-manoeuvrable aircraft has the right of way over more manoeuvrable. A balloon would have the right of way over a parachute, and a parachute would have the right of way over sailplanes, hang gliders, airships, aircraft and rotorcraft, in that order.
4. A tandem pair has the right of way over a solo jumper, both in freefall and under canopy.
5. A cameraperson has the right of way over solo jumpers, both in freefall and under canopy. However, just because you are wearing a helmet on your head, do not assume that other canopy pilots will be giving you the right-of-way.
6. A less-manoeuvrable round canopy has the right of way over a square.
7. Students have the right of way over experienced jumpers.
8. Canopies approaching each other head-on should both turn to the right to pass. If you find yourself heading for another canopy after opening, veer to the right. If you cannot avoid a collision, spread your arms and legs to avoid going through the lines.
9. Pass other canopies to the right. Avoid turbulent air behind and above other canopies (called Wake Turbulence).
10. Under canopy, the lower canopy has the right of way. Give way to the lower canopy, both at altitude and near the ground. Lower canopies should not make hook turns in front of other canopies on final approach. If you are the low canopy, shout to let others know you are there.
11. Approach the target in a left-hand pattern unless local rules dictate otherwise.
12. After landing, clear the target immediately for the next canopy.

6.17 CANOPY AND GROUND UNUSUAL SITUATIONS

Problems under Canopy

A canopy malfunction may occur for any number of reasons. Regardless of cause, your actions are the same:

1. **ASSESS**: check the situation, take a deep breath
2. **THINK**: decide whether to keep the main or use the reserve
3. **REACT**: cutaway and activate the reserve.

6.17.1 Canopy Malfunction

A canopy malfunction is any inflated shape that is not rectangular or controllable.

i) A high-speed malfunction is one where the pilot chute has been released and deployment has taken place to the point of the canopy remaining in the bag, (called **bag lock**), or the canopy is out of the bag but not inflating at all, (called a **streamer**). This problem must be

dealt with quickly and with no hesitation because the rate of altitude loss is very rapid. A streamer malfunction may be corrected by pulling down on the back risers sharply to help air to get into the canopy, however, this must *only* be done twice. If the canopy does not inflate immediately, cutaway and activate the reserve. These malfunctions require immediate reaction but are obvious and therefore easy to assess.

ii) A steering problem is one where the canopy is rectangular but is either continuously turning (spinning) or refusing to turn. The first actions are to perform a flight control check (left turn, right turn, flare). If this works, proceed; if the canopy's response is not satisfactory, cutaway and activate the reserve. A **pre-mature brake release** can occur during deployment causing an uncontrolled turn upon inflation. The first action is to reach up and release both steering toggles. This should correct the problem. **Steering line entanglement** can be visually identified and you can try to clear it by pulling sharply down on the rear riser. If it does not clear after two tries, carry out your emergency procedures.

iii) A **slider hang-up**, if severe, would be a high speed malfunction and should be treated as such. If the slider is only part way down, probably caught up on the suspension line cascades, then pump the steering toggles or rear risers several times and this should bring it down. If this fails then carry out your emergency procedures.

iv) **Pilot chute entanglement** is a situation where the pilot chute has fallen down in front of the canopy and is either trailing free under the bottom skin and/or has become entangled with one or more line groups causing a control problem. Evaluate the situation by doing a flight control check. The canopy may fly normally or perhaps can be flown with some compensation with the steering toggles. If it cannot be controlled then carry out your emergency procedures.

v) **Broken lines** usually are detected by the presence of a distorted canopy. Assess the canopy with a flight control check. Some lines affect the canopy's controllability. If it cannot be controlled normally or with compensation, then carry out your emergency procedures.

vi) **Brake lock** can occur when attempting to release the steering toggles. If it happens, then control might be maintained by steering the one released steering toggle and the rear riser on the side that did not release. To fly straight, keep the released toggle at the ½ brake position. Both rear risers can be used for the flare on landing, but be prepared for a PLF. This should be practiced a few times on high in order to create a straight-line flare with no turn.

vii) **Line twists** can be corrected by spreading the risers and swinging your legs in a direction to bring your body around to release the twists. Note: leave the brakes stowed until the twists are cleared. If the canopy is turning or spinning, it can add to the twists. In this situation, carry out your emergency procedures.

viii) **Closed end cells** can normally be corrected by bringing the steering toggles down to the full-brake position, holding for a couple of seconds, then returning them to the full-flight position gradually. If the canopy reacts violently or unpredictably, carry out your emergency procedures.

ix) **Turbulence** during the descent may be a problem, particularly if it occurs when setting up for a landing. It is generally recommended to keep the toggles fully up and fly through the turbulence in full flight. If experiencing a significant rocking or sliding action when close to the ground, add can add ¼ brakes and hold until about to land, then flare from the ¼ brake position.

x) **Cannot Locate the DZ** or Landmarks: To locate the DZ, look straight down first, under your feet. Secondly, while watching for other canopy traffic, begin a slow 360° turn, in equal increments scan around and outwards in arcs until you find the DZ. Look for the landing area or runway first. Also, look at the other canopies to see if they are all flying toward a common landing area. Once you have located the larger areas you should direct your canopy there. As you approach, you should begin to locate other points (i.e. designated point, landing point etc.)

If you cannot locate the DZ after the first 30 seconds to 1 minute, it is time to select an alternate landing area and follow the procedure detailed in Off DZ Landings.

If you have found the DZ and are returning to it, monitor your altitude. If you are getting low, you should abandon your designated point, turn to face into the wind, pick a clear runway and land. It is better to land safely upwind away from your intended landing spot than to crash-land while flying downwind right on the target.

xi) **Cannot Find the Toggles**: If you cannot find the toggles, then complete the flight control check by using the **rear risers** and head for the DZ. Once heading in the correct direction, look for the toggles again. They are usually located on the back of the back risers. If you still cannot find the toggles, continue your approach pattern on the rear risers and land using the rear risers.

xii) In-flight radio check: If you are on radio and have not received any communication within 30 seconds after the canopy opens, then check your radio receiver to see if there is something that you can correct. You should not waste too much time trying to correct the problem. The checks should be done quickly. If there is no success then turn your attention towards getting back to the target. Follow the in-air approach to problems: "Try twice, then take an alternate solution." You can start by checking the test bar if it has one. If no sound is heard, clear your ears (e.g. yawn), then check the radio to see if it has been turned on and the volume turned up. If these check out, then the battery door snap can be checked and lastly the antenna connection. The last two usually have an intermittent reception. N.B. These techniques are not applicable to all radio receivers. If all else fails, land in the middle of a large open field.

xiii) Reserve Canopy Control: Note for those students and intermediate skydivers who are using and/or planning to purchase a round reserve, you should jump a round parachute (e.g. Para-Commander) at least once or twice provided that you could arrange the opportunity.

Once a jumper's main canopy is activated, they are on their own until landing. However, if another jumper experiences a malfunction, watch their actions. Somebody should follow them to their landing point and others should keep an eye on the cutaway main and reserve free bag if they have one. If you do not feel comfortable with an off DZ landing, you should not be the one to follow the other skydiver. If you were to injure yourself, it would only add to the problem. If you do follow them, help them pick up the gear and walk back together. Someone at the DZ will arrange for pick-up if you are some distance away. You could also follow the main. Do not try to catch it because you or your canopy could become wrapped up in it or cause you to go into a downplane. This has lead to fatalities in the past.

6.17.2 Two Canopy Situations [1]

This section should be discussed with a Coach 2 or someone highly experienced in Canopy Formation Skydiving in order to develop a full appreciation. Understand that the situations presented are the most common configurations, but there are many unknown combinations that can result in a dual canopy out situation.

Two canopy out or dual canopy situations have some common causes:

- Dislodged reserve pin (a good reason to always check your pins before exiting the aircraft!!)
- Freefall collision
- AAD activation (improperly set or low main deployment)
- Main Pilot Chute in tow

The result will be two canopies trying to find air space. Remember that the pilot chute may go in any direction and take any route to find space; this may not result in a clean, clear deployment of the two canopies, and there is a good chance of line or riser entanglement.

There are five common two-out configurations:

1. Side-by-side
2. Bi-plane
3. In-between
4. Down-plane
5. Partially deployed

1. Side-by-Side Configuration

Most of the time, the canopies want to go into a side-by-side configuration; this is the most common result. It is NOT recommended to cut away from the side-by-side. The glide angle with both parachutes flying is pretty flat.

[1] Two-out Canopy and Canopy Collision Information from the research, studies, observations and experiences from US Army study by the Golden Nights, Rusty Vest, and presentation seminars by Jim Cowan of Complete Parachute Solutions, presented at the Parachute Industry Association Symposium, Reno Nevada, 2009.

First, ensure that there are no entanglements. Take the time to LOOK! Trace all 8 risers to see they are clear, up to the sliders, and visually follow the lines up to each canopy. The risers could be entangled; you must look up and follow each riser to make sure they are all clear of one another.

DO NOT Release the Brakes!

If you have already released a brake set, fly that canopy at ½ brakes in order to help match the speed so both canopies will stay together.

Fly using the Rear Risers. When you want to steer, turn one canopy gently, using the rear riser, toward the other canopy to achieve parallel flight and avoid a down-plane situation. Gently "Push" the other canopy into the desired direction – always *Push*, not Pull, when steering. This means you may only turn in one direction. If the canopies turn away from each other (such as may happen if there are line twists), try to use the rear riser to keep the canopies above you and touching each other.

If the canopies or risers ARE entangled, or you are *less than* 1000' above the ground or you simply cannot tell (e.g. a night jump), then steer the best-looking canopy with the Rear Risers. The best-looking canopy is free from line twists, end cell closures and the slider is down the farthest; this means you will have the most control over that canopy.

When landing with two canopies, Do Not Flare! And prepare for a PLF landing. The glide slope with two canopies out is much more horizontal and so you will land at a more shallow angle.

2. Bi-plane Configuration

This occurs when one canopy is flying directly in front of the other, also known as a "stack". The nose of the rear canopy will tend to "lock" into the front canopy lines. NEVER cut away the main canopy when it is in front.

First, ensure that there are no entanglements. Take the time to LOOK! Trace all 8 risers to see they are clear, up to the sliders, and visually follow the lines up to each canopy. The risers could be entangled; you must look up and follow each riser to make sure they are all clear of one another.

DO NOT release the brakes.

If the canopies or risers are entangled (this can happen if the reserve fires through the main canopy during deployment), or you are at *less than* 1000', or you are unsure, then steer the FRONT canopy, very gently, using the Rear Risers. Canopies of similar size will fly compatibly. Try to prevent a down-plane.

If the canopies are *not entangled*, you can use the rear risers on the REAR canopy and steer into a side-by-side configuration. Then follow the information above for a side-by-side.

When landing, DO NOT flare, and be ready to perform a PLF. The descent rate of two canopies out is slower than if you are under a single canopy.

3. In-between Configuration

This would appear to be a canopy configuration somewhere in between a side-by-side and a bi-plane. First, ensure that there are no entanglements. If the canopies and risers are *not entangled*, use the rear risers of the rear canopy to move both into a side-by-side configuration; follow the procedures above for a side-by-side.

If there is an entanglement, or you are *less than* 1000' or you are unsure, steer the FRONT canopy with the rear risers. Turn the front canopy toward the other canopy to *push* it in one direction only. Steer both into the wind if you are able. Do not flare on landing, and perform a PLF.

4. Down plane

This will occur if both canopies are steering themselves in opposite directions, and both will turn straight down toward the ground at a higher rate of descent. Usually one canopy has line twists and will therefore maintain the down plane.

First, ensure that there are no entanglements. If there are no entanglements, cut away. Clear any line twists on the reserve.

If they ARE entangled, try to steer the canopies back together. This may require a continuous turn, especially if one canopy is in line twists. Steer the canopies toward each other using the rear risers. This may require you to turn one in the *opposite* direction in order to get them together and to stop chasing each other. Try to get both canopies above your head.

As a last resort, you might release one toggle on the line-twist canopy in the hopes that it will self-steer and push the two canopies back together.

As a note, a nose-to-nose configuration is better than a tail-to-tail.

As a last resort, pull the cut-away handle; be aware, that there may be an entanglement.

5. Partial Deployment

This occurs when one canopy is open and the other is hanging below still in the Deployment Bag. Keep the brakes set in order to keep the flight slow, or if you have already released the brakes, fly in ½ brakes to prevent enough speed that may pull the dangling canopy out of the bag.

If the Main is not inflated, ensure first that the risers are not entangled, cut away the Main

canopy, and clear the risers (manually pull them off your shoulders so that they are completely free).

If the second canopy starts to inflate, make sure that there is no entanglement with the lines while it is inflating; let the canopies settle into one of the configurations above, inspect for entanglements of the lines or risers, and follow one of the previous configurations.

If the Reserve is not inflated, gather the lines and lift the bag --- SLOWLY! Get the deployment bag into your hands, and keep a solid grip on it. Ignore the Pilot Chute – let it trail. Steer by using a harness turn, or steer only with 1 hand, but Hold onto the bag tightly.

At 15' above the ground, drop the bag and flare using the rear risers, and prepare to PLF.

6.17.3 Canopy Collisions

In 2007 USPA Statistics there were 6 fatalities from canopy collisions, and 4 fatalities in 2008 -- one of these people was a Canadian skydiver.

When starting to work with a Coach 2 on the Formation Skydiving 2-way Endorsement, one new item to be trained on is Canopy Avoidance Drills and Canopy Collision.

The Canopy Avoidance Drill is performed by reaching up, while the canopy is still inflating but not yet open, grabbing onto a Rear Riser, and pulling it down to turn the canopy 90° to avoid on-coming traffic.

Collisions can be avoided by using the rear risers. It is critical to note that one should avoid body-to-body contact as this usually results in severe injury or a fatality. It is better to hit the lines or the canopy fabric. Avoiding body-to-body contact may require one to "swing" under the canopy to avoid such a collision.

In the event of a canopy collision, the "Lower" jumper has the right-of-way. If you are faced with a collision, assume the "Spread Eagle" position, legs and Right Arm out and wide to cover as much surface area as possible. The LEFT arm should cover the chest to protect both the cutaway and reserve handles, with the left hand ready to grab the cutaway handle if necessary.

Understand that two canopies converging on each other will result in a high-speed impact. Each student canopy flies approximately 20 mph, so two canopies flying head-on into each other equates to hitting at 40 mph. Another example, a 190-pound jumper on a 150 rectangular canopy will travel at approximately 34 mph with the brakes on, and upwards of 44 mph in full flight; two jumpers colliding at that speed will hit at 88 mph, too fast to survive. Smaller canopies fly at a much faster rate of speed. At these high speeds, the suspension lines become Razors and can cut through most anything, including helmets. Lines can also wrap around a person's neck and choke them.

First, assess the situation carefully. Communicate the Altitude regularly. Use **POSITIVE** commands only: "Do this..." Only say "Cutaway" when you want the OTHER person to do it, not for yourself. If you are the one cutting away, say "Bye Bye", or "I'm outta here!" as you

are leaving. If you are caught within the suspension lines or risers, you may need to climb out of them.

There are two types of Canopy Entanglements:

1. Fabric entanglement, or a Wrap
2. Line entanglement

If it is a fabric entanglement, usually the lower jumper (not in the wrap) will cut away first. If it is a line entanglement, usually the upper jumper (the one caught in the lines) will cut away first in order to climb out or fall out of the lines.

1. Fabric Entanglement or Wrap

The upper jumper can become wrapped within the canopy, and the lower jumper is in clear air (but obviously without a good canopy above). If this occurs above 1000', the upper jumper likely still has a good canopy overhead. The upper jumper should protect the handles (with the left arm covering the chest across to the cutaway handle), and try to clear out of the mess. Once cleared, a complete gear check needs to be performed: ALL GEAR, including cutaway and reserve handles are seeded and not pulled, harness webbing is not cut, check for broken lines, canopy damage, and then perform a flight control check.

The lower jumper, while clear of the mess, has a bad canopy. Communication is the key to resolving this safely. The lower jumper should:

- Ask the upper jumper, "What do you want me to do?"
- Continuously call up the Altitudes to the upper jumper, who likely cannot see their altimeter
- Help direct the upper jumper to steer facing into the wind by telling how far to turn

If the upper jumper does not respond, lines around the neck may choke them off or they may be unconscious from impact. If the situation resolves itself and the canopies both clear, the lower jumper must perform a complete gear check, including looking "above" the canopy to see if the top skin has been torn (which may not be visible from underneath).

If the upper jumper tells the lower jumper to cutaway, the lower jumper should help direct the upper jumper into the wind line, and then say "Good-bye" just as they are cutting away. The upper jumper must continue to work to clear the canopy away from hi face to see where they are.

If the problem occurs LESS than 1000', DO NOT CUTAWAY!! The upper jumper should protect the handles to avoid possible line snag, and will continue to hold the lower jumper under the single canopy until landing. The upper jumper should steer very slowly. Both should prepare for a fast and hard landing, ready to PLF to absorb the impact. The lower jumper, who is watching the altitude (remember, the upper jumper may be blind in the wrap), should state "Hold onto me!" if the altitude is below 1000'. (Remember, positive commands only.).

If landing in a wrap, and there is a) a high rate of speed due to two jumpers under one small canopy, or b) the one canopy starts to spiral, then the lower jumper may have no choice but to fire the Reserve. This will get two parachutes out into the air to try to slow the descent rate or halt the spiral. In either case, having two parachutes may be a better alternate.

2. Line Entanglement

If the line entanglement occurs ABOVE 1000', the result is that the Upper jumper is caught inside of the lines, and very likely will have a bad canopy as well. First rule, protect the handles with the left hand covering both reserve and cutaway handles, with the left hand placed over the cutaway handle. Attempt to climb out of the lines/risers, including crawling up through if necessary.

If cleared, do a complete gear check, including handles, harness webbing, lines and canopy.

The Lower jumper should ask, "What do you want me to do?" Communication is key. The lower jumper should continuously call out the altitude.

If the upper jumper decides to cutaway, that person should say, "Good-bye, I'm leaving". Disconnect the RSL. One possibility is that the line tension will help the other person to fall out of the lines and into freefall, where the reserve can be deployed. Sometimes, it will require the person to wiggle or crawl out of the lines. In any case, body-to-body contact should be avoided.

Why does the lower jumper NOT cut away? (After all, the lower jumper is in the clear, right?....WRONG!) If the lower jumper cuts away, the tension comes off the lines and the upper jumper WILL become trapped in the lose lines; keep in mind the upper jumper likely will have a bad parachute and cannot fly, steer, land, or deploy their reserve while caught up in the lines. Notwithstanding, if the lower jumper cuts away, their canopy becomes an anchor, pulling on the lines which may tangle around the upper jumper's neck, or cause a down plane or spiral.

If the entanglement occurs below 1000', and the upper jumper is caught in the lines, it is likely they do not have a good canopy. #1 Protect the handles! Attempt to control the canopy as much as possible, but DO NOT cutaway. If the upper jumper is unable to control the canopy (e.g. spiral), a last-ditch option might be to fire the reserve, presuming the back of the rig is clear to allow the reserve pilot chute to launch into clear air.

When less than 1000', the Lower jumper should continuously call out the altitude. If the descent is at a high rate (e.g. two people under one small canopy) or if in a spiral, then firing the reserve may help to slow the descent rate or halt a spiral. The lower jumper should try to control the canopy as best as possible or getting more parachute out into the air may be the only option.

Hook knives should only be used as a last resort, such as the case where a line is caught around the neck and causing choking, or if wrapped around the harness. If the upper

jumper starts cutting lines, remember, it is the lines of the canopy of the lower jumper that are being cut.

To avoid canopy collisions, there are two recommendations:

1. If at a higher altitude, above 1000', especially if high speed, "Turn + Flare"
2. If at a lower altitude, below 1000', "Flare + Turn" (remember, no hard turns near the ground!).

For further guidance and training, please consult with a Coach 2.

6.17.4 Hazards near the Ground

An obstacle in the landing area is a problem if you are moving towards it. The correct action is to turn slightly to either side of the obstacle and choose a new landing strip, below and in front of you, which is obstacle free. Dealing with obstacles follows this process: avoid the obstacle - protect the body - prepare to land.

Avoiding an obstacle:

The jump is not over until your feet are safely on the ground and you are standing still. For this to happen it helps to be aware of existing hazards in the landing area and do your best to stay clear of them. The following can lessen the chance you have to deal with any hazards.

- Know the drop zone. Prior to jumping familiarize yourself with the drop zone and the hazards. Look for the not-so-obvious such as fences and power lines. Identify your landing area and any alternate landing areas that you can use if needed. The target area may not be the only safe landing area.
- Know your canopy control. Knowing how to properly steer your parachute back to the landing area is very important. You should know how to locate the steering toggles, turn the canopy, and slow or speed the canopy's forward speed. You must also be familiar with target perception for glide angle and a designated point system. Make sure that you understand and can perform these skills, as they are the actions that will help you avoid obstacles.
- Look ahead. An obvious piece of advice is to look were you are going. Remember that where you point your canopy is not necessarily were you will go. Understand canopy side drift or crabbing can help you decide if you are headed toward something that you may want to avoid. Also, remember that you can run or hold with the wind to clear or miss an obstacle.
- Look to where you want to land, not at what you want to avoid. If you look at the tree that you are trying not to hit, chances are really good that you will hit it!!

Protecting the body on landing:

The common types of obstacle landings are due to the rural setting of most DZ's. These types of obstacles are:

- Trees
- buildings
- wires
- water
- fence, cars, roads
- congested areas
- livestock

Trees:

- make an effort to avoid the trees or forest
- face into the wind
- aim for a space between 2 or 3 trees, not the centre of one tree
- feet & knees together, feet flat; keep the legs tight together
- flare the canopy just prior to contact with the trees
- bring your arms in front of your face,
- be prepared to make contact with the ground and roll

Power Lines & Telephone Wire:

- make an effort to avoid the wires by turning to one side of the lines or the other to run parallel to them
- If you are going to hit the wires, try to aim for a space between 2 wires. Avoid grabbing any wires in order to avoid electrocution
- feet & knees together, feet flat; keep the legs tight together
- keep your arms in front of your face,
- bring the canopy into ¾ brakes just prior to contact with the wires
- be prepared to make contact with the ground and roll

Water:

- make an effort to avoid the water
- loosen all straps and remove chest strap completely
- face into the wind
- feet & knees together, feet flat; keep the legs tight together
- approach water at ½ brakes and flare as feet contact water
- fall forward out of the rig, front looping to clear the leg straps
- NEVER cut-away above the water; depth-perception is very difficult and you may end up cutting away too high and injuring or killing yourself

Roofs & Building:

- make an effort to avoid the building; approach from a parallel angle
- face into the wind or slightly off if necessary to avoid direct approach to building
- feet & knees together, get your feet up in front with your knees bent to absorb some of the impact. This may save your femurs!!
- flare the canopy just prior to contact with the building
- be prepared to make contact with the ground and roll

- if you are going to contact a wall, it is better hit it at a shallow angle, rather than at 90 degrees.

Fences, Cars & Roads:

- make an effort to avoid the obstacle; approach from a parallel angle (broadside)
- face into the wind or slightly off if necessary to avoid direct approach
- feet & knees together, feet flat; keep the legs tight together
- flare the canopy just prior to contact with the obstacle, use your feet to make contact & push away.
- be prepared to make contact with the ground and roll

Congested Areas: a congested area is one with multiple obstacles where any one landing procedure may not work. There is confusion as to which danger has priority. The steps in dealing with a congested area are:

- find a ram-air runway free of obstacles regardless of wind direction.
- steer down the runway, preparing to land (feet & knees together).
- flare, and roll if necessary.
- if you cannot avoid all obstacles, take the lesser of the dangers

Most of these problems can be prevented by assessing weather conditions prior to boarding the aircraft, carefully determining the upper winds and correct spot, and by preplanning and following an approach pattern under canopy. Recommended procedures in the event of a downwind landing or a high wind landing are as follows:

Downwind landing:

- make an effort to turn into wind, using a Flat Turn (½ brakes) technique; avoid full loop turn technique, as this will almost always result in severe injury or death
- face across or into the wind as much as possible, without making an oscillating turn
- press feet & knees together, feet flat; keep the legs tight together
- flare the canopy just prior to contact with the ground
- be prepared to make contact with the ground and lift both legs up high to perform a BUTT SLIDE (similar to a Tandem Landing). The Butt slide, using proper flare technique, should set one down smoothly onto the ground, presuming the ground is level and free of small obstacles. This is safer than attempting a high-speed roll (or PLF).

If you do not know how to perform a PLF (Parachute Landing Fall), ask an Instructor to teach you…this could save you from breaking a leg one day!

High wind landing: the steps for a high wind landing are:

- turn into wind, let the canopy fly at full speed, toggles raised as high as possible
- feet & knees together, feet flat; keep the legs tight together
- flare the canopy only slightly just prior to contact with the ground
- be prepared to make contact with the ground and roll

- recover & run around the canopy (downwind) to collapse it, or pull on a steering line or rear riser which will cause the canopy to face & fly into the ground, and collapse
- cutaway your main canopy only if the RSL is disconnected and you are being dragged

6.17.5 Landing Problems and Solutions

Weak Flare:

This results from a flare that is slow, late, and/or pulled without enough force. Usually a weak flare is related to the fear of landing, sometimes it is a strength issue. Worst, it could be a habit that was formed early on and was never corrected, such as habitually flaring too high, or never fully putting on the brakes.

One must practice up high with various braking techniques, including a slow, gliding flare and a fast, popping action to help understand the response and characteristics of the parachute.

Solutions for a weak flare: Practice!! Practice the flaring technique while flying in parallel with your Coach, see how the canopy responds while having this visual reference. Try a slow flare to get the canopy to glide horizontally and finish by applying the full brakes before "stopping". Try an aggressive flare, and watch how the canopy pops or scoops up relative to the Coach's canopy. Try flaring with the eyes closed in order to be aware of the sensations: the feel of the wind, and the pressure on the legs. If strength is an issue, get to a gym and start working those arms out. And NO, transitioning to a smaller canopy will NOT help, it will only cause the same problem at a higher rate of speed, which means greater chance if injury.

Incomplete Flare

An Incomplete Flare is not making the canopy stop completely after the glide; typically, the hands come down to ½ brake and stay there, never fully completing the push to the crotch to stop the forward motion. This will result in a higher ground speed at touchdown, followed by the proverbial "face plant".

The solution is to practice holding Deep Brakes at a higher altitude (above 2000'), holding for as long as you are able to feel the braking action, the wind quiet down, and see how the canopy responds. Only brake the canopy, do not go past the stall point. While holding the brakes down in deep brakes, relax and take some deep breaths. While still in deep brakes, practice some turns (but not past the stall point).

Another solution is to practice Stall & Recovery. Go past the stall point, recover only a few inches and stop with stiff arms. Look to see if the canopy has stopped directly over head. If the canopy has surged, then the arms were raised too quickly or too high. If you have any difficulty holding this, better physical conditioning is required.

Premature, Hard braking

A premature or excessive braking action will cause a flare too high above the ground and may result in the canopy and jumper ballooning or going up after the flare, followed by a forward surge after the pop up. This will surely result in a "face plant". This may be caused

by a lack of altitude awareness (i.e. not flaring at the correct altitude) or possibly due to nervousness related to landing.

When practicing flaring at a higher altitude, incorporate breathing exercises and relaxation techniques. Keep the eyes looking forward toward the horizon or the forward landing spot and not underneath the feet. Gain an understanding that the canopy is moving forward during landing, not down.

A solution for a high or excessive flare is to practice flaring at altitude, perhaps with a Coach flying in parallel as a visual reference.

Looking Down, Uneven Landing

Another common issue is looking down to the ground during the flare. From the first jump course, students are told to "keep the head up, eyes looking forward." Looking down usually results in the jumper "reaching" with the legs, or letting up on the toggles just before touchdown, which can result in a canopy surge. Often there can be a lack of symmetry, particularly if reaching with one leg...for some people the arm motion is directly attached to the leg motion -- physiologically this is not true, but mentally it can be.

The solution is to keep the head up, keep the eyes looking forward, and understand that landing a parachute is in a forward motion, not down as is often misconceived. This can be practiced at a higher altitude, relaxed breathing, eyes forward and head up during a practice landing; as well, practicing with the eyes closed and visualizing the forward motion of the ground during the final landing sequence. Adopt the idea that, rather than landing as soon as possible, you want to make the canopy fly across the ground as far and long as possible *before* touching down. Let the canopy fly!

Levelling off too High

In some cases, the person flares a bit early and planes-out much higher than they should. The end of the glide results in a "drop in" effect; often, as the legs are reaching down, the hands come up (We've all seen this time and time again: As the hands flare down, the legs come up...the opposite is true, when the legs go down, the hands go up....face plant!) On the final plane-out glide across the ground, one should be just able to touch the ground with a foot, but without reaching.

To correct this problem of levelling too high and dropping in, work on relaxation and breathing while practicing flaring at a higher altitude. Learn patience. If you know you are consistently flaring too early, then wait one more second next time, slow (but not too slowly) and steady on the flare. Practice different types of flaring: slow glide, hard and scoop, and try to find the middle-ground. Practice initiating an early flare, letting up to the stomach, and re-flaring again. Point the eyes forward and down on the ground to the presumed target landing point.

Standing up a Bad Landing — Bad idea

If you have not already been taught how to perform a PLF – Parachute Landing Fall –ask an Instructor to teach you one. You are going to need it. Some Drop Zones have stopped teaching the PLF, which is quite unfortunate. Eventually, everyone will need to do one in

order to come in on a hard landing, and the PLF might just be the difference between walking away and being carried away. If landing in a high-speed or down-wind situation, the butt slide is the recommended method.

Leaning Back

Some people will lean back in the harness in order to touchdown the landing, usually due to reaching with the legs. This can result in at least a butt slide, or at worse an ankle injury or landing hard on the tailbone. Often this is a result of a poorly finished flare.

To correct, after the canopy flight check, loosen the chest strap to open the risers up and give more room to move in the harness. When practicing landings up high, lean forward into the chest strap during the practice flare.

Planting both feet upon landing

Rather than stepping out the landing, some people put both feet down at the same time, often resulting in a face-plant. The solution to this is to step out of the landing; practice by landing with the feet split, one in front of the other, and by leaning forward into the chest strap during the flare.

Inappropriate low turn

In the first jump course, it should be emphasized to NEVER turn close to the ground. However, there are times when it is necessary to turn to avoid an obstacle or another jumper landing in the same area. The appropriate turn to use is the Flat Turn. Inexperienced jumpers will sometimes over-react and turn too hard, too low to the ground. This panic behaviour can have catastrophic results.

As part of the standard canopy skill progression, one should learn, practice and USE the Flat Turn. When landing, the canopy should always remain over the head, and never off to the side. To Flat Turn, pull both steering toggles to the ½-brake or ¾-brake position, the lift slowly to turn the canopy away from an obstacle; alternatively, a harness turn can be used. While it is important to avoid body-to-body contact (collision), a hard turn close to the ground can result in broken femur or head injury or death.

USPA statistics from 2007, there was 1 fatality from an Intentional Low Turn (e.g. a Swoop, Hook turn or High performance landing and misjudging the turn), and 2 fatalities from Unintentional Low turns (e.g. trying to avoid an obstacle, trying to turn to face directly into the wind at the last moment). In 2008, USPA Stats show 3 fatalities from Intentional low turn and 4 from Unintentional low turn. In 2008, the CSPA had 1 fatality from an Intentional low turn, 1 from an Unintentional low turn, and 1 from a Canopy Collision.

6.17.6 Problems on the Ground:

Should you encounter a problem while working with your gear or getting ready for a jump consult a coach/instructor/rigger as necessary. Always feel free to seek help. It is in your best interest to maintain a solid working relationship with your coaches/instructors/riggers. Clear up misunderstandings before they become problems. This helps prevent incidents, accidents or malfunctions.

i) Injury on Landing

If you are injured, you should stay laying down on the ground as that is the signal for someone to come and help you. If you do this, others will see that appropriate action is taken immediately. If you are not hurt then you should stand up as the signal that you are OK. If someone else is injured because of landing, look after that person. This means that you should ensure that first aid is provided; that the gear is collected and brought back; that, if necessary, an ambulance is called; and that they are kept warm and dry. If you are not first aid trained or certified, but you should ensure that a qualified person is recruited and supplied with the necessary material.

If serious injuries are suspected, such as head injuries or spinal/femur fractures, the person should not be moves, and gear and helmets should not be removed.

ii) Off DZ Landing

In the event of an off DZ landing, watch where others land so that they may be located quickly. Send help or a pick up vehicle. If you are the jumper landing off DZ, you should first avoid areas near roads or edges of fields as they usually contain obstacles like power lines, ditches and fences. You must then take action to:

1. Find a ram-air runway (long/narrow clear area) free of obstacles.
2. Face into the wind and land.

iii) Reserve Canopy Landing

If your landing is under a round reserve, you must prepare for a proper parachute-landing fall (PLF). The procedure is then as follows:

- face into the wind
- place feet & knees together, knees slightly bent,
- leg muscles should be tensed, but not rigid
- arms should be up along the risers, elbows pressed forward & together
- eyes must look at the horizon (not down at the ground)
- on contact with the ground, you should fall & roll, absorbing the impact with (in order): the balls of the feet, the calf, thigh, and butt, with legs in a pike position swinging across to finish opposite the side of first contact

Summary:
The procedures for unusual situations must be learned in advance and in detail. It is a process that should involve a senior instructor and your DZ's emergency procedures. The actions should be practiced on some occasion, whether during your initial training or as an early spring refresher, or some other time. Any problem that you identify that is not included here should be brought to the attention of the staff at your DZ. Should you feel inclined, a letter to the CSPA office, describing the situation, will help others to gain from your experience.

SECTION 7 SOLO Certificate CHECK OUT

Previous – Section 6 Canopy.....Next – Section 8 Medical

7.1 INTRODUCTION

To graduate from Instructor supervision to Self Supervision is possibly the biggest achievement you can have is. You become your own skydiver and no matter what happens in your life you have accomplished something few have done. You have earned the privileges and responsibilities of a solo skydiver. From here, you work with Coaches to set goals and you have far greater flexibility in what you choose to do next. You are also accepting soul responsibility for your safety. Consequently, both you and your Coach and Instructor need to be sure a thorough assessment of your safety procedures and skydiving skills occurs.

The skills and knowledge being assessed requires a sound, basic understanding of the sport, and a mature attitude toward safety rules, regulations and recommendations. This will require you to have a knowledge of the five skill areas plus technical knowledge, an understanding of their responsibilities, knowledge of your abilities (capabilities and limitations), and the common sense to ask questions of your Coach when required. CSPA's technical network (Instructors, Coaches, Riggers, Course Facilitators and Safety Officers) is maintained to assist novice and intermediate parachutists, among other functions. The student must be aware of its existence, the local members of that network, and their availability should you wish to consult someone about anything related to parachuting. It is recommended to pair up with a Coach 1 at this time to help ensure continued, logical progression.

Please review PIM 1 – Section 6 Part 2 (How you are evaluated) and 6.1 Solo Certification

7.2. Emergency Procedures Review (EPR)

Emergency Procedures Review (EPR) SOLO should be appropriate to the equipment used or to be used. Address the five areas of the Skills Grid:

Preparation
- ✓ Weather
- ✓ Forgotten equipment (i.e. don't find yourself at the plane with no alti, develop a gear up routine)

In-flight
- ✓ Aircraft emergencies
- ✓ Emergency exit altitudes for main & reserve
- ✓ When to shut off AAD's on an unplanned descent in the aircraft
- ✓ Sickness
- ✓ Main/reserve deployments in aircraft or on climb out

Freefall

- ✓ Malfunctions
- ✓ Other equipment (altimeter, goggles)
- ✓ Stability around pull
- ✓ Traffic problems

Canopy Control

- ✓ Correctible situations
- ✓ Low speed malfunctions
- ✓ Two canopies out scenarios
- ✓ Traffic on opening, traffic on landing
- ✓ Obstacles
- ✓ Turbulence
- ✓ Landing in the wrong direction
- ✓ Who to talk to when you want to learn to 'swoop'

Equipment

- ✓ Poorly fitting gear
- ✓ Damage on opening
- ✓ AAD misfire

7.3 CHECKOUT JUMP

Once you are fully trained, you should take an instructor through a complete jump, to demonstrate to that instructor that you can jumpmaster yourself. You will be expected to complete a jump similar to the following 25-point jump, or one similar to this, with an >80% pass and passing the mandatory parts.

All skills listed in the paragraphs on Training and Content, Testing and the Checkout Jump are to be logged accurately in your logbook and signed by the appropriate CSPA Instructor. Make sure that your endorsement card is signed for self supervision by the CSPA Instructor when you have successfully passed. At this time, refer to the PIM 1 for information on how to follow through with getting an "A" Certificate of Proficiency (and a CSPA membership if you happen to not have one already).

Solo Checkout Jump Jump # _____	
1. Plan your dive – you may use a Coach as reference	
2. Practice your dive	
3. Get manifested	
4. Assess weather conditions (canopy/spotting)	
5. Check your equipment	
6. Don your equipment	
7. Arrange and receive a safety check and give one to another jumper	*
8. Final rehearsal at mock-up/ aircraft	
9. Board aircraft safely and brief pilot	
10. Take off routine – helmets, seatbelts, conduct	
11. In-flight mental rehearsal	
12. Pre-exit handles check	*
13. Arrange for and receive a pin check	*
14. Spot the aircraft (includes determining the spot)	
15. Exit without assistance	
16. Stable exit	
17. Figure 8 on heading (may already be completed)	
18. Altitude awareness	*
19. Activate on a heading, stable, at prescribed altitude	*
20. Complete canopy checks	
21. Fly a pattern to the landing area	
22. Safe landing facing into wind within target area	
23. Return all gear to appropriate places	
24. Demonstrate awareness and recall of jumps events	
25. Fill in logbook accurately and completely	
Total Mark: Pass = 20 / 25, including * **Mandatory** to pass checkout jump	

Obtain a PIM 2 Part B for more advanced information and for continued progression.

SECTION 8 MEDICAL

8.1 RECOMMENDATIONS

A valid medical should be obtained every two years. If over the age of 35, a medical and electrocardiogram should be obtained every year.

The following diseases may disqualify a person from parachuting. If a student or any parachutist is known to have any of these diseases, they must obtain a yearly statement of medical fitness from a doctor.

Note: It is the Doctor's responsibility, as a professional, to determine an individual's ability to "participate" in sport parachuting activities.

a. Epilepsy – if a person has been seizure free for two (2) years or more, they should be able to jump as long as they wear an Automatic Activation Device (AAD).

b. Insulin Dependent Diabetes Mellitus -- if the diabetes is under good control, one can jump, as long as one wears an Automatic Activation Device (AAD), and has a medical examination every year.

c. Heart Disease -- medical examination every year and Automatic Activation Device (AAD).

d. Alcoholism and Drug Addiction -- *must not be allowed to jump*.

e. Obesity -- depending on extent, this may impair a jumper's ability and safety.

f. Chronic Kidney Disease -- medical examination every year and Automatic Activation Device (AAD).

g. Chronic Ear or Sinus Problems – may cause problems if severe. Should be briefed on the problems involved in freefall and canopy opening. If disoriented by height they should not jump.

h. Congenital or Physical Deformities -- depending on the type and severity, a specific medical certificate may be required.

i. Chronic Back Problems – medical assessment is required and the decision will depend on severity.

j. Chronic Shoulder Dislocation -- participation depends on severity. The “Hanging” exit should not be performed. Some Formation Skydiving may aggravate this condition.

k. Mental Illness -- medical every year, should wear an Automatic Activation Device (AAD). If a person has had a mental illness, that person is not a good candidate for parachuting.

l. Lung Disease-- asthma or chronic lung disease should be identified by a physician by a medical exam yearly.

Note: Where you are in doubt as to the ability of an individual, you may request a medical specifying the "problem", along with a Doctor's statement of the individual's capability to participate in sport parachute activities.

8.2 PHYSIOLOGY AND EFFECTS OF DRUGS

A) PHYSIOLOGY

Definitions:

a. Arterial Oxygen Saturation -- the percentage of haemoglobin in the arterial blood that is completely saturated with oxygen.

b. Haemoglobin -- the red coloured protein contained in red blood cells, which binds and carries oxygen in the blood stream.

c. Arterial Blood -- blood contained in arteries that flow from the heart to peripheral tissues.

d. Hypoxia -- a decrease in arterial oxygen saturation, causing decreased oxygen supply to the brain. Occurs at high altitudes to the lower air pressure.

e. Rods of the Retina -- specifically evolved cells of the retina of the eye that are able to respond to very low levels of light (i.e., at night).

The two main factors in aviation physiology are Arterial Oxygen Saturation and length of exposure to low oxygen levels. As one ascends in an airplane, the atmospheric pressure decreases with a corresponding decrease in arterial oxygen saturation. Because of various factors, however, this is not a straight-line relationship. Oxygen Saturation at various altitudes, both breathing air and breathing 100% oxygen. The first effect of hypoxia is a decrease in night vision because the rods of the retina are very sensitive to lowered oxygen levels. Effects start at 1,500m (5,000 ft).

At 4,000m (12,000 ft), or about 91% oxygen saturation, drowsiness, lassitude, mental fatigue, headache, and sometimes euphoria set in. These increase until an altitude of 7,000m (23,000 ft) is reached, where convulsions and coma may begin. However, here the second factor -- the time of exposure to altitude -- becomes especially important for sport parachutists.

A parachutist can maintain almost completely, normal mental and motor proficiency up to altitudes of 5,000m (15,000 ft), as long as one is there for only 10-15 minutes. At one hour, this proficiency has fallen to approximately 50% and after 18 hours, one will be 80% below normal.

From the graph in Figure 1 we can see the effects of breathing pure oxygen. If one wears a proper mask, attached to an oxygen supply, altitudes of 11,000m (35,000 ft) should be achieved with no real problems. It is for these reasons that it is recommended that 5,000m (16,000 ft) be the maximum altitude for any jumps made without the use of oxygen equipment. Another factor that should be mentioned is cigarette smoking. Cigarette smoke contains carbon monoxide, which combines easily with the haemoglobin of your blood. Thus, if you smoke immediately before a jump, your oxygen saturation will already be equivalent to that at 1,500m (5,000 ft). When you reach 5,000m (15,000 ft) your oxygen saturation level will be approximately equivalent to being at 5,500m (18,000 ft).

B) EFFECTS OF DRUGS

DRUGS: drugs both legal and illegal, can be divided generally into four classes. The following list includes various common members of each class of drug.

Depressants

- Narcotics -- codeine, morphine, Demerol, heroin
- Minor Tranquillisers -- valium, vivol, diazepam, Librium, serax dalmane
- Major Tranquillisers -- largactil, mellaril, chlorpromazine
- Barbiturates -- seconal, Nembutal, phenol-barbital, noludar
- Alcohol -- beer, liquor, wine
- Antihistamines and Anti-Emetics (Anti-nausea) -- chlortripilon, Benadryl, brompheniramine, gravol, Dramamine, stemetil. These are found in most over-the-counter cold remedies.

Effects -- depressants depress brain function, cause drowsiness and interfere with balance, coordination and reaction time. They should not be taken in conjunction with sport parachuting.

Stimulants

- Amphetamines -- speed, Dexedrine, methamphetamine, etc. (formerly diet pills)
- Nicotine -- found in cigarettes
- Decongestants -- phenylephine, pseudo-ephedrine, ephedrine (found in most cold remedies)
- Cocaine
- Adrenalin family -- adrenalin, isuprel, salbutoamol, vetolin (commonly used in treatment of Caffeine family -- caffeine, theophyline, amino-phyline, etc. (found in coffee, tea, coca cola -- also used in the treatment of asthma)

Effects - stimulants produce a sense of euphoria, wakefulness, and false confidence. They also affect balance, coordination and reaction time. Do not parachute if using these. The decongestant, phenylephine is especially dangerous and is not to be used at all in parachuting as it causes an extreme rise in blood pressure.

c)Hallucinogens -- these are mostly illegal drugs

- LSD
- Marijuana -- pot, hashish, grass, cannabis
- Psilocybin -- magic mushrooms
- Mescaline -- peyote, cactus
- Atropine -- belladonna alkaloids (found in certain mushrooms)
- Muscarine -- found in certain mushrooms
- DMT, STP, MDA, etc. -- all are related to LSD and have similar effects.

Effects - hallucinogens produce a feeling of euphoria, distant reality and may cause frank hallucinations. They also distort the sense of balance, coordination and reaction time. Do not parachute if using these.

Others

- aspirin
- laxatives
- antibiotics
- antacids
- plus many others

Effects - Others may not interfere with brain function. However, it is probably a good idea to avoid any medication of any kind prior to sport parachuting.

8.3 FIRST AID

Risk of injury is associated with many sporting activities, including parachuting. These risks can be minimized by making a personal commitment to safety. This would include such things as assessing risks and accident potentials; planning the activity; training for the job; using personal protective equipment and taking a St. John Ambulance First Aid course. Do not administer first aid in a major injury situation unless you are properly trained.

Injuries in parachuting can generally be divided into two classes: major and minor.

- Major injuries are defined as injuries were there is a significant threat to life or function.
- Minor injuries are those that pose no such threat.

First Aid at the Drop Zone [2]

Someone on the drop zone is likely familiar with the basic medical requirements. It is strongly encouraged for *everyone* to get first aid training – certified via any of the ambulance groups.

First Aid Situations on a Drop Zone:

1. Low impact injury
2. High impact injury
3. Unusual situations leading to injury

Low Impact Injury

This will be the majority of all injuries, and the basic approach is just COMMON SENSE. Minor injuries make up approximately 95% of all injuries sustained in parachuting. Most injuries occur to the lower limbs.

- 37.7% of all military parachuting injuries were Sprains or Strains
- 30.1% contusions
- 14.7% lacerations

Sprain/Strain Management

- Assess the injury for severity.
- If the jumper is able to walk without too much discomfort, assist that person to clubhouse
- RICE: Rest, Ice, Compress, Elevate
- Splint the affected limb, put ice on, bandage the area, lift it up and then advise the jumper to obtain a medical opinion.

Contusion:

[2] Some of the following information provided by Dr. Werner Oberholzer, Skydive South Saskatchewan. Used with permission, and Thanks.

- This will apply to “lumps and bumps”
- Treat as sprain or strain
- RICE

Lacerations:

- Evaluate for severity – if the blood is gushing out of any major artery, AKA bleeding like a stuck pig – both you and the jumper are in trouble. You will be required to stop the bleeding by applying firm pressure directly to the source of the bleeding, and do not stop doing that until you are advised to by a medical professional. If this means that you have to travel to the ER with the jumper, then do it.
- Any other cut of less severity, you take a sterile gauze pad, apply pressure and bandage if need be.
- Then refer the injured jumper to a medical facility – even if the wound does not require sutures, there are other factors like tetanus injections, antibiotics for infection etc that will need to be addressed

Minor Fractures:
This would include wrist, forearm, ankle, finger toes and feet.

- Make sure that the pain of the injury is not distracting the jumper from another more serious injury elsewhere on the body.
- Apply a splint with a bandage.
- Do not try to straighten any deformity.
- If the ankle or foot is involved, and obviously fractured, do not remove the shoe or boot. Use your cutaway knife to cut the laces and allow for swelling.
- Do not give the jumper water, pills or alcohol (They may need surgery)

Major Fractures:
This will include lower leg, upper leg, upper arm, pelvis and the spine (spine will be dealt with under high impact injuries)

- Once again do not get distracted by the obvious – make sure that there is no other more serious injury!
- If legs are involved – do not move the jumper, unless the location has a serious and immediate threat to life. Make that person as comfortable as possible, and call for EMS.
- Position pillows or support around the injured area, to support but not move.
- No medication or drinks should be given
- Sit quietly with the person and obtain as much information (preferably write it down) regarding name, address, contact numbers, medication, allergies etc. Present this to EMS upon arrival.

High Impact Injury

By far the most injuries occur under a fully inflated canopy by licensed jumpers. Most injuries will occur with high-speed manoeuvres close to the ground, and most commonly near the landing area.

Initial response:

- Call for help and phone 911 **right away**. The high impact injury is usually witnessed and shocking to bystanders, so the commotion will be a measure of response required.
- At first – stay calm. At the side of the injured jumper, go on your knees and ask – "are you OK?"
- If there is no response or limited response, once again call for help, and alert the person who called 911 that there is no/limited response

Assessment:
Look at the injured person from top to bottom before you touch anything:

- Is the jumper breathing?
- Are there any obvious physical deformities?
- Which area appears the most injured?

ABC's of High-Speed injuries:

A = Airway
B = Breathing
C = Circulation
D = Delicate spine injury

Airway:

- Is the jumper breathing? – look at the chest raising up and down, the mouth and throat area
- Clear away anything that may obstruct the airway – any blood, debris or vomiting
- There is always discussion whether the injured person should be turned on the side to assist with breathing
    - if a neck fracture is present it may potentially be damaged, but then again
    - if the injured person cannot breathe, it is also useless!
- Where there is risk of C-spine (Cervical – the neck) injury, such as a patient who is unconscious as a result of a head injury, the airway should be opened using a manoeuvre that does *not* require neck movement, known as the "jaw-thrust"

Breathing:

- If there is no breathing, commence with basic CPR
- For this purpose, either the coach should be CPR certified or the designated medical officer on the DZ should take over the management
- The simple jaw-thrust manoeuvre may be sufficient to assist in breathing

Circulation:
This refers to ability of the heart to circulate blood.

- High impact injuries may be associated with severe internal injuries resulting in blood loss that can produce shock

Shock occurs when the heart is injured to the extent where it cannot complete the pumping action, or when the blood volume is not sufficient to fill the heart, and blood pressure cannot

be maintained. Shock can also be life-threatening and can result from any injury or illness which impairs circulation to the body tissues. Shock is characterized by:

- rapid shallow respirations;
- pale, cold, clammy skin;
- a rapid weak pulse;
- or restless, anxious behaviour.

Initial first aid consists of loosening any tight clothing, covering for warmth, and lying the casualty flat with the legs raised 12-18 inches (30-45cm).

- If there is no carotid pulse, and you are CPR certified, commence CPR as per protocol
- If you are not trained, once again assist the designated officer with the CPR.

Delicate Neck Injury:

- Always assume a neck injury during any high-speed accident
- *Do not remove helmets* unless you deem this necessary for breathing!
- The initial and best way to support the neck is to be positioned for the jaw-thrust manoeuvre and maintain position by gently holding the head and neck until EMS arrive
- Do not attempt to apply a neck brace unless you are qualified to do so!

Head Injuries:

- With the regulations for most CoP's to wear protective headgear, head injuries are rare.
- Do not remove the helmet unless essential for breathing
- Use your cutaway-knife to cut the chin strap without moving the head or neck.
- Stabilize the neck and wait for EMS
    - **Concussion** – if the injured jumper appears dazed, confused or have memory loss, blurry vision, headache and nausea/vomiting – refer for medical opinion.

Unusual Injuries

Electrocution:

- Call your electric supply authority with the exact location of the downed line or suspended parachutist.
- Keep back a minimum of 10 metres (33 feet) from wires or anything in contact with them and warn others of the danger.
- Always assume that the lines are live. It is difficult to distinguish between power lines and other utility lines (e.g. telephone or cable lines) and they carry sufficient power to cause harm.

The danger of Electricity:

- Depends on amount of current that passes through the body
- The duration of current
- tissues traversed by the current

Although the extent of injury is most directly related to amount of current (amperage) often only the voltage is known. In general, low voltage causes less injury but voltages as low as 50V have caused fatalities

- tissue damage usually due to generation of heat
- loss of consciousness usual in initial phase
- many survive and survival has been reported despite initial poor prognostic signs (e.g. fixed, dilated pupils)
- immediate death is usually due to cardiac arrest (a systole > VF)
- Be prepared to administer CPR

Water landing, Drowning, cold water:

- Remember that the skydiver may have collided with the water with some speed, so assume once again that a neck injury is present.
- The airway is most important and may need ongoing management.
- Treat any submersion for hypothermia
- The key recommendation for rescuers is not to give up prematurely on a person that appears to have drowned in frigid water. There is a phenomenon known as the "mammalian dive reflex" that appears to offer us protection from drowning in cold water. Anyone who has survived a submersion should be taken to a hospital for evaluation

Burns:

- Although rare, the occasional drunk skydiver may fall in the fire. Fireworks or aerial pyrotechnics may also present a problem
- STAY SAFE! Do not let the rescuer be burned trying to save the victim.
- Treating a burn begins with stopping the burning process. Cool the burned area with cool running water for several minutes. If an ambulance is coming, continue running water over the burned area until the ambulance arrives.
- Look for blistering, sloughing, or charred (blackened) skin. Blistering or sloughing (skin coming off) means the top layer of skin is completely damaged and complications are likely. Charring indicates even deeper damage to all three layers of skin

Eye Injury:

- Do not touch, press, or rub the eye itself
- Do not try to remove any foreign body except by flushing, because of the risk of scratching the surface of the eye, especially the cornea
- Tilt the person over a basin or sink with the affected eye down and gently pull down the lower lid, encouraging the person to open their eyes as wide as possible.
- Gently pour a steady stream of lukewarm water (do not heat the water) from a pitcher or faucet over the eye
- Flush for up to 15 minutes, checking the eye every 5 minutes to see if the foreign body has been flushed out
- Because a particle can scratch the cornea and cause an infection, the eye should be examined by a doctor if there continues to be any irritation afterward

- If a foreign body is not dislodged by flushing, it will probably be necessary for a trained medical professional to flush the eye.

Note: Since most drop zones are reasonably close to a hospital, remember that the individual will probably suffer less if you just make them comfortable and await the ambulance.

Follow through with:

- statements/ pictures of the victim, the gear and the general area
- equipment inspection by a qualified CSPA Rigger
- A.I.M. report filed with the CSPA within 10 calendar days (5 calendar days for a fatality)
- notification to the C.S.P.A.

It is strongly encouraged for *everyone* to get first aid training – certified via any of the ambulance groups.

Steps to Follow When an Injury Occurs

Step 1: Control the environment so that no further harm occurs

- Stop all participants
- Protect yourself if you suspect bleeding (put on gloves)
- If outdoors, shelter the injured participant from the elements and from any traffic

Step 2: Do a first assessment of the situation

If the participant:

- is not breathing
- does not have a pulse
- is bleeding profusely
- has impaired consciousness
- has injured the back, neck or head
- has a visible major trauma to a limb
- Cannot move arms or legs or has lost feeling in them

If the participant does not show the signs above, proceed to Step 3

Step 3: Do a second assessment of the situation

- Gather the facts by asking the injured participant as well as anyone who witnessed the incident
- Stay with the injured participant and try to keep them calm; your tone of voice and body language are critical
- If possible, have the participant move themself. Do not attempt to move an injured participant.

Step 4: Assess the injury

Have someone with first aid training complete an assessment of the injury and decide how to proceed.

If the person trained in first aid is not sure of the severity of the injury or there is no one available who has first aid training, activate EAP. If the assessor is sure the injury is minor, proceed to step 5.

Step 5: Control the return to activity

Allow a participant to return to activity after a minor injury only if there is no:

- Swelling
- Deformity
- Continued bleeding
- Reduced range of motion
- Pain when using the injured part

Step 6: Record the injury on an accident report form (AIM)

Emergency numbers should be clearly listed by the telephone:

- Ambulance
- fire department
- Police
- a medical doctor
- Power/Hydro Company

Ask your DZO or DZSO about the specific Emergency Activation Plan for your home drop zone.

First-Aid Kit

A complete first-aid kit is essential. This kit must be carefully prepared in order to treat the most common injuries. Furthermore, it must be accessible to those responsible for the team. Here is a list of what a first-aid kit should contain.

Content	Use
Medical record	° important information in case of an emergency
Disinfectants	
• soft antiseptic soap	° all skin lesions
• antiseptic cream	° laceration requiring cleaning before a dressing can be applied
• antiseptic solution	
• peroxide	
Dressings	
• ocular	° cover and close the eye
• aseptic (sterile gauze, 50, 75, 100mm rolls)	° dry compression
• adhesive bandages (“Band-Aid” type and butterfly closures)	° protection of minor lesions
• elastic bandages (100 and 150mm)	° compression
• triangular bandages and safety pins	° multiple uses but primarily to act as an arm support in case of a fracture
Drug products and ointments	
• zinc ointment	° scratches or blisters
• xylocaine spray	° sore burns
Other useful items	
• cleaning solution for foreign bodies	° dislodge foreign bodies
• scissors	° common use
• tongue depressor	° multiple uses
• body temperature thermometer	° check body temperature in case of trauma

- chemical cold bags
  (unless you have access to ice)
- plastic bags
  - for ice cubes
- phone number list
  (cell phone, pen, quarters, paper, participants' emergency records)
  - ensure quick response
- tools
  - minor repair of equipment
- adhesive tape (37.5mm)
  - support wounded joints

Appendix - BASIC SPORT SKILLS OVERVIEW

Preparation Skills:
1. physical rehearsal
2. relaxation
3. mental rehearsal
4. recall and awareness
5. self-directed skill development
6. warm-up
7. concentration
8. anticipation
9. sequence preparation

In-flight Skills:
1. seating and movement
2. in-flight handles check
3. verbal review
4. orientation
5. spotting progression
6. exit with heading control
7. pilot briefing
8. exit types
9. intentional unstable exit
10. throwing a WDI

Freefall Skills

1. stable spread
2. activation
3. altimeter
4. observation circle
5. box position
6. heading control
7. arm exercise
8. leg exercise
9. 90 - 180 turns
10. figure 8
11. altitude awareness
12. back loops
13. front loops
14. barrel rolls
15. delta
16. track

Canopy Control Skills:
1. canopy identification
2. flight control check
3. response to canopy guidance
4. flat turn
5. landing technique
6. full glide turns
7. observation of drift
8. stall practice
9. observation of surface winds
10. rear riser turns
11. landing approach
12. rear riser spirals
13. flight-line controlled approach
14. set-up assessment
15. front riser turns
16. set-up with flight-line control approach

Equipment Skills:
1. equipment components and function
2. activation of reserve canopy
3. setting and mounting the altimeter
4. gearing up and adjustments to gear
5. safety check
6. setting audio altimeter
7. packing
8. equipment inspection
9. clearing entanglements (canopy)

Technical Knowledge:
Part A: Unusual Situations
1) in-flight
2) under canopy
3) in freefall
4) on the ground

Part B: Theoretical Models
1) spotting
2) canopy flight
3) freefall math
4) freefall control

Appendix – Short Forms used in this manual

AAD..... Automatic Activation Device (e.g. Cypres, Vigil, Argus, etc.)
AFF ..... Accelerated Freefall (USPA)
AGL..... Above Ground Level
ASL ..... Above Sea Level
BOAT..... Break Off And Track
BSR..... Basic Safety Rule
C1..... Coach 1
C2..... Coach 2
C2DS ..... Coach 2 Discipline Specific (introduced 2009)
CAC..... Coaching Association of Canada
CFS ..... Canopy Formation Skydiving (previously referred to as CRW)
CoG..... Centre of Gravity
CoP ..... Certificate of Proficiency (sometimes incorrectly referred to as a “license”
CRW..... Canopy Relative Work
CSPA..... Canadian Sport Parachuting Association
Cypres..... Cybernetic Parachute Release System
DZ..... Drop Zone
FS ..... Formation Skydiving (previously referred to as RW)
GCI..... Ground Control Instructor
IB ..... Instructor B
JM..... Jump Master (IAD, SL dispatcher)
IAD..... Instructor Assisted Deployment
LZ..... Landing Zone
MetRep..... Meteorological Report
MPE..... Main Packing Endorsement
NOTAM ..... Notice to Airmen
PFF ..... Progressive Freefall (CSPA) (also referred to as AFF)
PIM ..... Parachutist Information Manual
PINT..... Packing Inspection Names Tangles
RSL..... Reserve Static Line
RW..... Relative Work
SL ..... Static Line
SMART..... Specific Measurable Achievable Relevant Timely
SOS..... Single Operating System (reserve activation system)
SSE..... Skydiving School Examiner
SSI ..... Skydiving School Instructor
TAS ..... Two Action System (reserve activation system)
USPA..... United States Parachuting Association
VFR ..... Visual Flight Rules
VFS ..... Vertical Formation Skydiving (also referred to as Free Flying)
WDI..... Wind Drift Indicator

AOA..... Angle of Attack: The angle at which the wing is presented to the apparent wind. With square parachutes this changes when the brakes are applied.

AOI..... Angle of Incidence: The angle at which a canopy is trimmed to glide through the air.

Aspect Ratio ..... The ratio of a canopy's width (side to side) to breadth (front to back). Seven cell canopies typically have an aspect ratio of about 2.2 to one, while nine cell canopies are usually between 2.8 and 3.0 to one.

Burble..... The area of turbulence behind an object going through the air, whether a person in freefall or a canopy in flight.

Flare ..... The act of pulling down the brakes of the canopy in order to slow it down, resulting in an increased Angle of Attack and reduced descent rate.

Stall ..... When the angle of attack of a wing becomes too high to sustain lift, the wing is said to be in a stall.

Wing loading..... The ratio of weight born by a wing to its surface area. In the US, divide your exit weight in pounds by the square footage of the canopy.

Appendix – Change Log

Original copy, 1993 version

Updated: 2009 (SM). RW/FS Materials brought forward from PIM 2B.

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