CSPA

COACH 3

Canopy Piloting

Reference Manual

Canadian Sport Parachuting Association
(C.S.P.A.)
204 - 1468 Laurier Street
Rockland, ON
Canada
K4K 1C7
http://www.cspa.ca/

Last Updated: April 2022

FORWARD

This 2016 version of Coach 3: Canopy Piloting was the inaugural release. Please, send in your suggestions, updates, new ideas, and technical advancements that will help keep all of our manuals on the cutting edge. Submission of graphics is welcomed. This is a living document; it will only grow with your input.

This document is intended for electronic reading in PDF/online format. Click on resource links located throughout the document for additional information.

 Please, print only as necessary.

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

The Canadian Sport Parachuting Association (CSPA) provides these manuals to our Members and Registered Participants to ensure that standards and proven methods of training and skydiving are being followed across Canada. The sport of parachuting continues to grow around the world, and as the sport enlarges, so does our knowledge of the technical and training complexities. As new ideas and systems introduced to our sport are proven sound, they are adopted by the CSPA and new information is distributed. To ensure that the best available techniques are being utilised, it is your responsibility to keep abreast of them by participating in Coaching and Instructor programmes and seminars offered by both local organizations and the CSPA.

This manual will not answer all the questions regarding our sport. It is to be used as a guide only, and in conjunction with the CSPA coaching programme and CSPA qualified coaches and instructors. To guarantee the most enjoyment, remember to always…

THINK SAFETY - JUMP SAFELY - STAY CURRENT

Skydiving questions not answered in this manual, or in other CSPA publications, may be directed to CSPA's Coaching Working Committee cwc@cspa.ca or the National Office office@cspa.ca

ABOUT THIS MANUAL

The purpose of this part of the manual is to provide the Coach 3: Canopy Pilot with relevant information in preparation to become a certified C3. It follows from the Coach 2 program.

The manual is laid out in the standard skydiving progression format of preparation, equipment, in-flight, freefall, and canopy control. Technical knowledge and information for endorsements is associated with the appropriate skill section.

ACKNOWLEDGEMENTS

Technical parts of this document are based on the information contained with the "Canopy Piloting Manual: A BPA Guide to Canopy Piloting", reproduced by kind permission of British Parachute Association Ltd. The CSPA is grateful to the BPA for sharing their knowledge and experience.

Thank you to Scott McEown for editing the first version. Thanks for the keen eyes of our proofreaders.

We gratefully appreciate the specific contribution from past and present members of the CWC and from members of the Canadian Canopy Piloting Team.

DISCLAIMER AND COPYRIGHT

LIST OF UPDATES

2022 – revisions to currency requirements

2021 – updates to tasks/requirements, 2.3 inclusion of Flysight data, 2.4 additional safety considerations added, 4.2 revision of exit separation, 6.6 additional information, 6.7 revision of techniques, Appendix added.

2020 – updates to pre-course tasks/requirements

2016 – first release

CONTENTS

TASKS/REQUIREMENTS

Roles and Tasks
• Coach High-Performance canopy piloting programs
• Mentor aspiring Coach 3s
• Be recognized within CSPA (and on website) as a subject matter expert
• Administer the Sport Canopy Endorsement
• Sign off A, B, C, and D CoP accuracy requirements
Prerequisites
• SSE verification that the candidate is a subject matter expert in High-Performance Canopy Piloting with a safety orientated attitude
• DZO or DZSO verification that the candidate is a subject matter expert in High-Performance Canopy Piloting with a safety orientated attitude
• Submission of Technical Assessment Jump #1 and Jump #2 as per C3 – CP Portfolio (video and Flysight data required with submission) OR • Participate in two judged events or competitions (e.g. Nationals, Provincials, FLCPA)
• Coach 2 certified
• 500 jumps on a high-performance canopy verified by a SSE
• Complete the Coach 3 Common Exam (Open Book)
• Complete the Sport Canopy Endorsement and High-Performance Canopy Piloting Safety Exam (Open Book)
Currency Requirements
• Coach at least 5 candidates (1:1 or in seminars)
• 25 High-Performance canopy landings in previous 12 months

SECTION 1: INTRODUCTION

This manual contains information to help prepare the Coach 3: Canopy Piloting candidate for coach training and to provide the requisite information to complete the CSPA's examination for qualification as a Coach 3: Canopy Piloting.

High-Performance landings are inherently dangerous. As a Coach, you must instruct and / or coach new canopy pilots using the necessary progression and techniques given. As such, you should become a properly qualified Canopy Piloting Coach before attempting to coach any of the techniques described in this manual. This manual is designed to supplement your existing Coach 2 knowledge; it does not replace proper training and instruction.

The information in this manual is based on the information collected from experienced sources. While all efforts have been made to ensure that it is correct and up-to-date, it may contain information that is incorrect and / or out of date.

The techniques discussed in this manual are dangerous, even if carried out correctly, and under the direct supervision of a C3: Canopy Coach, and may still result in serious injury or death.

Resources:

http://www.uspa.org/USPAMembers/Safety/CanopySafetyDiscussion/tabid/495/Default.aspx "Canopy Safety Discussion"

http://www.performancedesigns.com/docs/flyInd.pdf "Flying and Landing High-Performance Parachutes Safely"

http://parachutistonline.com/category/tags/canopy-piloting Canopy Piloting: On the Cutting Edge
http://www.uspa.org/tabid/81/Default.aspx?Cat=LT , Accident Reports, filter by "Low Turn", "Landing Problem"

http://www.performancedesigns.com/docs/wingload.pdf PD "Wing Loading and its Effects"

http://www.youtube.com/watch?v=eGK4eSmvlaw&index=8&list=PL45E3B7998E49283E "Downsizing: with Jay Moledzki"

http://www.performancedesigns.com/docs/98_low.pdf "Low Down on Low Turns"

http://flight-1.com/sport/documents/safety-code-how-to-avoid-a-canopy-collision Canopy Collision

CANDIDATE PREVIOUS EXPERIENCE

State your previous parachuting and/or coaching experience.

Detail your educational background.

List any canopy courses you have attended, including coach courses:

List any parachuting or other relevant athletic experience you may have:

List any certifications you have achieved, include where/from whom, and when you received them:

List any other achievements:

SECTION 2: PREPARATION

What goes into the preparation and planning for a High-Performance Canopy Pilot?

2.1 PHYSIOLOGY

- Advanced Stretching
  - Pilates, Yoga, Warm up, partner stretching, visualization, progressive muscle relaxation, stretch, cardio, strength, diet, daily plan
- Morning Briefing
- Nutrition

2.2 PSYCHOLOGY

1. Mental Training
2. Conflict Resolution
3. Team Building
4. Emotional Control
5. Visualization Training and Techniques
6. Distraction control: internal and external and action plan w/implementation
7. Progressive muscle relaxation
8. Meditation
9. Strengthen visualization (strengths and weaknesses) training plan
10. Team building, develop a supportive network
11. Annual planning meeting
12. Situation analysis
13. Arousal identification and control
14. Visualization for arousal control
15. Cross brain exercises
16. Focus: personal best

In sport parachuting, development of mental training is equally as important as physical skill development, and commences from the very first training session. There is a saying in this sport: “99% Mental, 1% whatever”. This sport is like few others for the intensity and emotional rush for a beginner or novice skydiver. The “fight-or-flight” response is very apparent in the first- (or second-) time jumper. Even the advanced athlete can experience a new rush when performing a new sequence of dives, evaluation jumps (for certificate levels), performance during a ratings (Coach or Instructor) course, or during a competition event, whether for fun or challenge.

As the athlete becomes more experienced and performing at a higher level, this initial anxiety starts to dissipate. In time, the coach will need to work to bring up the arousal / activation level to an ideal state of being. Too relaxed, the athlete will not perform at peak efficiency (under-activation). Sleeping on the plane for the ½ hour ride to altitude can lower the energy level such that performance will not be at a prime. Advanced skydiver mental training skills include anticipation of the events, forward thinking (while performing move “A”, think about what needs to happen during move “B”); concentration on the task that is about to happen (not letting the mind wander). The sequence of introduction of the various techniques are shown in the attachment “Skydiving Skills Grid”.

For the advanced skydiver, use of **Visualization** and **Imagery** play an important role. The ability to practice on the ground will simulate what will happen in the air. It is important that the individual athlete can see both their own physical placement, and potentially, their placement in relation to others in the air around them. Development of Visualization starts with physically seeing the small (self) and big (group) picture. This visualization training will lead into a stronger ability to produce a mental picture. This Imagery is used during the ride to altitude where, obviously, physical rehearsal is now impossible. The athlete focuses on their mental picture of what will happen, both in their own position (self) and the bigger picture of the group. After seeing enough video footage (during debrief), the athlete can develop a sense of seeing the formation from the view of the Cameraman. Seeing this big picture from above will help the athlete to then focus and concentrate on where they need to be positioned.

Wherever the skydiver is in their level of development, performing at or near potential on each jump will not only enhance the learning process and skill development, but will save the jumper money (learning more in fewer jumps). These skills need to be taught from the start, and continued practice and development of the mental training skills throughout the skydiving career. With one's maturity in the sport, the strength of use of these techniques will continue to flourish, and thus, performance can only improve.

At each phase of the training, mental training concepts are introduced and practiced with the athlete, then monitored for continued, correct usage throughout their progression.

STRESS CONTROL

"The stress is not in the situation but how a person perceives the situation." There is an optimal level of stress that will compliment or heighten the quality or level of performance. When the level of stress is too high or too low, the quality of the performance suffers. Stress may be controlled in the following ways:

- relaxation techniques
- arousal techniques
- mental preparation (rehearsal and practice)
- concentration on what is occurring rather than what might or did go wrong

REHEARSAL WITH RELAXATION

Both activities will improve performance, therefore it would seem worthwhile to combine these in the time period immediately before the skydive, that is during the climb to altitude. The three steps in sequence are:

- mentally rehearse the performance 3 times through correctly , after the take-off; should take no more than 3 minutes
- plan to mentally rehearse the performance at pre-set altitudes (e.g. 3000', 8000')
- perform the relaxation exercise for the duration of the climb to altitude between mental rehearsals

- about 2 minutes prior to exit (1000’ below jump run) repeat the mental rehearsal (once or twice through)

CONCENTRATION

You are encouraged to concentrate on the skills presented to you as much as possible. Get a simple explanation of an activity, then practice it undisturbed. You should then be able to perform the skill without constant repetition of instructions or encouragement. Activities that require a large amount of concentration should only be done when you are well rested. Shift focus occasionally between the overall activity and key details. Improving your concentration skills will decrease the number of repetitions required to master the correct procedures for a skill, on the ground and in the air. Using a good level of concentration during your skydive training will ensure that you get maximum air time and progression. Establish self-reminders about safety; this is particularly important for the few seconds prior to landing the canopy.

ANTICIPATION

This title is a shorter version of the perhaps more appropriate label of “keeping pace with the action during the jump”. The skill is simply that of being of ready to act when the moment arrives. Your anticipatory skills can be improved if you learn and practice skydiving skills in the sequence in which they occur, and rehearse the skydive without being prompted or encouraged by your coach prior to the jump.

BRAINLOCK

Although the “brainlock” phenomenon is common to us all, it is not something that we want to happen often. We have responsibility to ourselves not to waste precious freefall time and we have a responsibility to the other jumpers not to be the cause of them wasting their freefall time.

Preparation is the key to avoiding “brainlock”. As with any memory task or concentration effort, some simple techniques and standard practices can help to make the job easier and more reliable. Skydivers should learn to use these procedures and apply them on every jump. A little discipline and thoroughness in preparation will easily reduce “brainlock” problems.

Some techniques for avoiding the “brainlock are:

- get the big picture
- become fluent with the terminology of skydiving (names of manoeuvres)
- look for the rhythm and flow in the sequence of formations and manoeuvres
- do a realistic dirt dive to learn your moves, especially for your eyes
- use the time before the jump to mentally rehearse the proper sequence of the jump and the correct execution of your role
- use mental practice on the way to altitude

It is important that you go through mental practice after instruction so the lesson is reinforced. This is also true when you have decided on the actual methods during the dirt dive. Sometimes jumpers will take a break after designing a skydive so that each jumper can think about their role in the final version. There is also time to use mental practice after the dirt diving is completed and before the jump.

E.g. while you are gearing up and especially on the climb to altitude in the plane.

Mental practice should consist of going through the skydive in the proper sequence. Imagine the events as they will happen, one after the other. The mental rehearsal can be done in the same manner as the dirt dive. The sequence of tasks can be reviewed by suing key words for the actions to be performed. These key words should be Big Picture flashes of what is about to be performed. Then imagine the exact physical actions as the events take place. Do this reviewing in as much detail as can be imagined. Fine points like the direction to look, what to grip, which colour to follow or dock on, and the keys should all be reviewed. Think: when 'This' happens, I will do 'That'. Always focus on the correct execution. Carry a positive approach and do not think of possible errors or miscues. One of the biggest obstacles to curing "brainlock" is negative thoughts and worrying about "brainlocking". As you concentrate, think of your job in the skydive going as planned and feel yourself doing it.

EXERCISE:

Describe four ways you can incorporate mental training into your practices.

2.3 PLAN A PRACTICE – TRAINING DAY

Plan activities and Plan dives

Technical: Skill analysis (video. 1:1 and group), briefing (observation), understanding Flysight data and reviewing it after each jump.

Tactical: Dirt diving, dive planning, seasonal, periodization, recovery, competition plan, competition rules, Long Term Athlete Development (LTAD)

- Experimentation rebuild technique, new ideas
- Competition simulation
- Speed drills
- Strengthen basics
- Technique stretch
- Exit training
- Sub-terminal training
- Assess limitations

The Coach should provide support to Athletes in Training by implementing an appropriately structured and organized practice. As a result of appropriate training, athletes are actively engaged in maintaining a high degree of structure, organization, and efficiency for the practice. Coaches use creative and innovative methods or strategies, organization, transitions between activities, use of space and equipment, and effective use of time are all optimal. The structure and organization of the coach's practices are used as a model for other coaches. Coaches provide opportunities for athletes to apply creative solution and to offer suggestions that enhance the learning environment. Coaches work with other coaches to define appropriate roles in the organization and structure of practice.

2.4 SAFETY PREPARATION

Provide Support to Athletes in Training, the Coach must *Ensure that the practice environment is safe.*

- Coach implements safety measures and preventative actions that reflect learning from past experiences.
- Coach recommends actions or procedures that can contribute to enhancing established safety practices.
- Coach can teach others how to implement effective safety measures and preventative actions.
- The coach's safety measures and preventative actions are used as a model within the sport.
- Coach critically reflects on safety concerns prior to and following practice.
- Coach can effectively implement an emergency procedure adapted to the sport in case of injury or accident.
- Coach is able to present an emergency action plan with **all (6)** of the following critical elements.
    i. Location of telephones are identified (cell or land lines)
    ii. Emergency telephone numbers are listed
    iii. Location of medical profiles for each athlete under the coach's care is identified
    iv. Location of Fully-stocked first-aid kit identified
    v. Advance "call person" and "control person" are designated
    vi. Directions to reach the activity site are provided

PREBOARDING CONSIDERATIONS FOR A HIGH-PERFORMANCE CANOPY TRAINING

- Determine number of people doing hop n pops and find out their objective for the jump.
- Ensure the exit order is set correctly.
- Determine colours of the other canopies around you on the jump.
- Ensure all jumpers are aware of jump run.
- Ensure all jumpers are aware of wind conditions from exit to ground.
- Ensure all HP pilots are aware of what turn each jumper is performing and which direction they will be executing the turn (right/left hand pattern/turn).

CONSIDERATIONS WHEN TRAINING AT A DZ THAT DOES NOT HAVE A POND

- Have your candidates jumping on a "low" load,
- Create a designated HP landing area that is not in conflict with others.
- Ensure they understand there is no "Safety net" (water to protect them)

TRAFFIC AWARENESS MUST ALSO BE BRIEFED TO ALL CANOPY PILOTS – T.A.P.

- Traffic:
    - Know who is on your load,
    - Know what colour canopy they are flying,

    - Know what direction they are coming from,
    - Know where everyone is on your load at all times when in the air
- Altitude:
    - Am I hitting my predetermined turn points at the correct height
    - Do I need to cut corners or change my flight mode to correct for my present altitude
    - Do I have the right amount of altitude to execute my turn above my hard deck
- Position:
    - Am I maintaining my “slot” among the group
    - Am I in a good position for my turns
    - What is the wind doing as it pertains to the plan and actual winds

http://parachutistonline.com/feature/25-ways-become-better-canopy-pilot or

http://www.uspa.org/portals/0/downloads/02-11canopytips.pdf Twenty-five ways to become a better canopy pilot, ALAN MARTINEZ.

SECTION 3: EQUIPMENT

The Coach 3 should be prepared to discuss different equipment (canopy, harness, and accessory items) with a high degree of competency. Novice canopy pilots will be looking to you for unbiased recommendations that will benefit that individual. Simply because you jump canopy X and use harness Y, it may not be the best for the individual you are coaching. You must consider only what is best for that individual.

3.1 CANOPY TYPE

The Coach 3 should be able to have a discussion with your novice about the pros and cons for each different type of canopy available on the market.

Heavily loaded elliptical canopies are High-Performance products that have fast turn rates and are not designed for low experience jumpers. It is not recommended that you move onto a highly elliptical canopy at this stage. There are many modern designs known as “semi elliptical,” which means that the canopy will be fairly High-Performance, but not too radical.

One of the disadvantages of highly elliptical canopies is that they have a higher potential to produce a turn during opening. This can cause problems with other canopy traffic, especially when associated with line twists. In certain situations, twists can mean a cutaway on an elliptical, as the canopy may dive towards the ground during its turn, which in some circumstances can be quite violent. This latter problem is less severe if the canopy has a reasonably conservative wing loading (see wing loading section later on).

Canopy manufacturers generally claim that their product opens softly and on heading. If we factor in the low experienced jumper who may not always be in the best body position at opening time and possibly also a relatively inexperienced packer, soft, on heading openings will not always be achievable. Canopies can develop less than ideal opening characteristics as they grow older. Any canopy displaying such characteristics should be inspected by a rigger.

Cross braces give the canopy a more ridged feel. Pack volume and price are disadvantages to Cross Brace. “Cross-braces are extra diagonal ribs that keep the canopy more rigid, allowing thinner airfoils and fewer lines to be used…These canopies are generally faster, and create more lift on landing, than non-cross-braced canopies of the same size. Because they are only available in smaller sizes, and require a good amount of skill to be flown safely, they are only recommended for pilots who already have experience jumping small elliptical canopies.” (Retrieved from http://www.performancedesigns.com/docs/choosing2.pdf)

“Cross Brace Tri-cell means the cell is divided into three chambers instead of two, with the chambers diagonally braced to force each cell back into shape…the cells are 'locked' into position rather than being free floating and able to breathe.“

http://www.nzaerosports.com/massive-information/crossbraced-info
http://parachutistonline.com/safety_training/ask_a_rigger/cross-braced-canopies
http://www.precision.aero/xaos-27.htm

“Airlocks, patented by Brian Germain in the mid 1990’s, are fabric valves sewn into the openings at the nose of a canopy. They allow air to enter the cells, but make it difficult for the air to escape. Like cross-

braces, airlocks make a canopy more rigid and improve performance…Because airlocks help a canopy stay pressurized, these canopies have a reputation for being very stable in turbulence." (Retrieved from http://www.performancedesigns.com/docs/choosing2.pdf)

EXERCISE:

Create a grid of pros and cons pertaining to the different types of canopies for different experience levels (e.g. novice vs. expert vs. competitor). Use this to build a knowledge-base to discuss with novice canopy pilots.

Pilot level	Canopy type	Pros	Cons
Novice	Elliptical		
	Cross-braced		
	Airlock		
Expert	…		
Competitor	…		

3.2 WING LOADING

Wing loading is a subject that is often misunderstood and has many interpretations. Put simply, the higher the wing loading the more radical the canopy. By radical we mean that it will go faster in almost all respects. For example, when turned, a canopy will lose a great deal of height compared to a similar design and size with less weight under it. The basic advice is not to load up a canopy too highly initially, especially when you only have a low number of jumps. Nearly all manufacturers have recommended wing loading criteria and we advise that you do not exceed these.

When we talk about wing loading we are referring to exit weight, which means a person wearing all their equipment including jumpsuit, rig, helmet, camera, goggles, and weight belt if applicable. It is indeed wrong to say that someone weigh 140lbs (65.5 kg) so to give a wing loading of 1 to 1 (1 lb to 1 square foot) one will need a 140 square foot canopy. With equipment added in, one will be more like 175lbs (80 kg) which, with a 140 square foot canopy, will actually give a wing loading of 1.25.

Note: First jump students in Canada typically fly a parachute with a wing loading less than 0.90. By comparison, a wing loading of 1.4 is considered to be very high, and should only be used by the very experienced.

To work out your own wing loading use the following calculation: Take your exit weight (wearing all gear), take the canopy size in square feet and divide your weight into the square footage of the canopy, e.g. Exit weight of 175 lbs, divided by canopy size of 140 square feet, equals a wing loading of 1.25.

$$EXIT\ WEIGHT\ (jumper\ weight + gear) \div\ CANOPY(square\ feet) =\ Wingloading$$

Resource: http://www.performancedesigns.com/docs/wingload.pdf "Wing Loading and its Effects", Performance Designs Inc., John Leblanc. See Section III - More advanced concepts about wing loading.

3.3 DOWNSIZING

At some stage, the novice will no doubt ask about downsizing their canopy. There are two points to think about before advising to doing so:

1. when
2. by how much?

As a minimum, one should only consider downsizing when the person can comfortably perform accurate, stand-up landings, in all types of wind conditions, and are at ease with the turn rate and slow flight characteristics of their current canopy. In terms of how much one should downsize by, the coach should advocate an absolute maximum of 15% smaller than your current canopy size. (e.g. 170 → 150)

Keeping things in Reserve: Overloading a main parachute is asking for trouble. However, overloading a Reserve Parachute is potentially suicidal. When choosing a reserve parachute, consider what type of performance it will produce, given the wing loading to which it will be subjected. Although one is less likely to use the reserve parachute, the circumstances that for having to use it can be far worse than on a normal descent. Generally, one will be a lot lower than normal, reducing the time available to plan the flight, and also far more likely to miss the dropzone, meaning that the novice will have to steer and land a canopy that *they have never jumped before*, into an area that has the potential to be a lot smaller than they are used to, with new obstacles. The results can be disastrous.

When buying canopies remember this basic advice "The smaller the canopy the faster you can get into trouble." Be conservative and do not succumb to peer pressure from others. Listen and talk to those who have lots of experience and we mean thousands of jumps not hundreds, before to deciding which canopies will be best for you.

See PIM2B Parachute Downsizing Criterion.

Exercise: The Coach 3 should be ready with a list of Why/Why Not answers to downsizing question posed by a novice. Create a list of standard questions, or excuses, that you have heard, or anticipate hearing from a novice pilot, and your reasons against/for an individual to safely downsize. Come up with a minimum of five additional reasons/excuses that you have experienced/heard.

Typical questions or reasons for wanting to downsize…	**Coach's response…**
e.g. I can't swoop my current canopy	Any canopy can be swooped if one knows how to fly it. It's all about technique. http://www.performancedesigns.com/docs/flyInd.pdf
e.g. I can handle a much smaller canopy	"I learned when you're jumping a small canopy, if things go wrong, they go very wrong very fast" (Stuart Schoenfeld)
e.g. I'm bored on my current canopy	

Resource:

http://parachutistonline.com/feature/confessions-canopy-coach "Confessions of a Canopy Coach"

http://www.performancedesigns.com/docs/choosing1.pdf "Downsizing Intelligently: Choosing the Best Canopy Size", Scott Miller

3.4 COLLAPSIBLE SLIDERS AND PILOT CHUTES

Collapsible sliders and pilot chutes have been developed to allow equipment to perform more efficiently and we will endeavour to explain the reason behind these developments. Collapsible sliders and pilot chutes are designed to reduce drag and allow the canopy to travel through the air more quickly. Collapsing the slider will reduce its size and therefore reduce drag. Most collapsible sliders have a standard draw cord system that is simple and works quite well. It may be possible to pull the slider down over the brakes, depending upon the equipment you are jumping. If you have the right equipment and wish to pull the slider down over the brake toggles, it must be done **before releasing the brakes**, because once unstowed, it is difficult to pass the slider grommets over the toggles (in fact, you can snag one or both on the way by which can make for a tricky situation). Toggles should stow safely both upwards and downwards, so that the rings on the RDS slide over easily. Be aware, pulling the slider over the brakes can cause a brake to fire if you are not careful. Should a brake fire, simply release the other one and carry out a control check. Pulling the slider down should not take too long; do not waste too much time doing this because it would be a problem to discover you have a stuck toggle, and be too low.

One must be careful when first attempting to collapse the slider, as it will require some attention. Beware of other traffic while completing the collapse and take action to avoid if required. The manoeuvre should be completed above 2000 feet. Just because one has a collapsible slider does not mean you have to use it. Become acquainted with the new canopy before attempting to collapse the slider. Make sure to get a proper brief before having a go at collapsing the slider for the first time.

> Note: remember to use the three A's: **Altitude** (have you got enough), **Airspace** (other canopies), and **Area** (location in relation to the holding area and Planned Landing Area) before collapsing sliders, removing booties etc.

Collapsible pilot chutes reduce drag and help to stop the pilot chute pulling on the top skin of the canopy, causing it to distort. Generally, the system used is known as a “kill line” which extracts a line causing the pilot chute to invert; there is also a bungee version used by certain manufacturers, but it requires near-terminal speed to activate. The systems are automatic in that as the bag comes off the canopy they retract and collapse the pilot chute. One of the downsides to the “kill line” system is that it must be cocked prior to use. If the pilot chute is not cocked, it will not/may not work! If you purchase or use a “kill line” system, seek advice prior to packing and remember to check to make sure it is cocked before jumping. Conversely, the bungee system relies on the pilot chute fabric being strong enough to open against the pull of the bungee. Make sure to check the serviceability of the pilot chute fabric before each jump.

An RDS (Removable Deployment System) comes standard on certain canopies, such as the Competition Velocity from PD, and on some Icarus Higher Performance Canopies. It is a system that lets the canopy pilot remove the slider, deployment bag, and pilot chute after opening, to help increase flying speed and distance by reducing drag. An RDS can be fitted to other wings at the manufacturer’s recommendations, for instance the standard Velocity. Each one is made specifically to the type and size of the wing; never just buy one and putting it on any canopy without first referring to the manufacturer of the canopy you are flying. The RDS slider system is designed to be used only at sub-terminal canopy deployment speeds.

Problems: There are several ways that an RDS can contribute to malfunctions. Once the RDS is off, the attachment rings remain on the parachute lines. One malfunction is improper mounting, causing the slider to remain at the top, a slider hang-up. Another malfunction is a brake line hang up on one of the RDS rings; when excess brake line loops over these rings, it can lock the toggle into one position, causing a serious steering issue (high-speed spin) once the pilot releases the toggles. Pilots who are loading their canopies at 1.8:1 or above create an entanglement that is virtually impossible to clear due to line tension. RDS is designed with sub-terminal openings in mind, because "Sometimes the canopy can deploy strangely at terminal velocity. The lanyard can come out of the pack job out of sequence and wrap around one side of the canopy, which pinches off an end cell or two. It comes out violently and spins. Even after clearing the mess using a few rear-riser inputs, it pulls the nose through the cascades, and it looks like a mini-step-through. The canopy will keep spinning on its own!" To help combat this problem, Mirage Systems offers an interior pouch on the deployment bag for storing excess lanyard." retrieved from:

http://parachutistonline.com/safety_training/safety_check/removable-deployment-systems

http://www.performancedesigns.com/docs/RDS_operational_instructions.pdf

http://www.nzaerosports.com/canopies/rds

3.5 SAFETY DEVICES

Chest Strap. To help lean into the harness to increase speed and canopy pitch, pilots will often loosen, or completely remove, the chest strap. "Sun Path products does not recommend the removal of the chest strap on the Javelin series of harness and container systems." (Retrieved from http://www.skydivemag.com/article/20131030-canopy-piloting-belly-band). Without the chest strap routed, it is still possible for the parachutist to lean too far forward and fall out of their harness. For this reason, there are two alternatives. First is an extra-long chest strap, or a chest strap extender, which can remain routed through the lift web, but allows the pilot to lean as far forward in the harness as they wish.

Belly band. As an alternative to a longer chests strap, the belly band can be clipped onto the lower rings of the harness to provide competitors lateral support across the belly after loosening / removing the chest strap.

AAD. It should be mentioned that during a High-Performance landing in Swooping that it is possible to reach vertical speeds high enough to fire your standard AAD and that there are AAD's on the market designed specifically to prevent this possibly catastrophic event.

http://www.skydivemag.com/article/rsl-skyhook-or-faith Skyhook/RSL article.

http://www.unitedparachutetechnologies.com/index.php/sh/item/skyhook-rsl Skyhook

Altimeter: Both a digital and audible, capable of indicating canopy altitude, should be worn.

Chest-mount Altimeter: In addition to a wrist-mounted altimeter, which allows the pilot to read the altitude in their hand when looking up at the toggles/canopy, the chest-mounted altimeter allows the pilot to see the altitude while viewing the ground, particularly during the swoop turn. Lots of people are using mudflap or hip-mounted altimeters. The most important thing, though, is to have one that is accurate (digital) and an audible with low-speed alarms, specifically designed for the canopy pilot.

http://www.l-and-b.dk/products/visual/viso_ii

http://www.l-and-b.dk/products/audible/quattro

http://www.l-and-b.dk/products/visual/altitrack

http://forum.altimaster.com/content.php?144-N3_Product_Page

3.6 DRESS

Swoop pants with an RDS pocket and possibly some padding in the butt for landings (you land on your butt A LOT) are necessary. Ankle protection in the form of a Figure 8 ankle brace that would provide suitable support for the ankle, overall clothing should be relatively snug fitting to help reduce parasitic drag.

http://reviews.protherapysupplies.com/review/18759/Mueller-Hg80-Ankle-Brace-wStraps

Shoes with smooth soles are recommended for sliding. If using an RDS, one needs a pocket to stow it safely. Cordura pants/shorts are useful due to the frequency of sliding over the ground.

3.7 GIVING ADVICE

When considering what to buy, novices should keep at the forefront of their mind that they are purchasing a *life and limb saving device*. Cheapest is not always best; quality, fit and suitability is paramount. Advise your novice to always seek advice from independent instructors / riggers prior to making a final decision on what to buy, and to always get a second, third, fourth…opinion. As well as getting canopies that are the correct size and type for their skill level, it is also very important to get a correctly fitted harness. This should not be an issue if buying new, providing one is measured correctly, because the harness will be made to specific measurements. Note that a second-hand harness that feels relatively comfortable on the ground can be a completely different story in the air. If buying second hand, an instructor, or rigger should check the equipment over with the novice canopy pilot before they test jump it. One would not buy a second-hand car without taking it for a test drive, so why should second hand parachute equipment be any different. If the seller will not allow you to test jump their second-hand equipment before purchase, then walk away. Always choose favourable weather conditions for the first couple of jumps on any new / unfamiliar or second-hand equipment.

SECTION 4: IN-FLIGHT

4.1 VISUALISATION: SET UP POINTS

During the ride to altitude, the canopy pilot should visualize the set up points, and the altitudes that they will arrive at each point.

Downwind, Crosswind and Point of Initiation. If most of your training is done at one DZ and you have a pond or swoop lane, than most times you are going the same way on landing, if this is the case then having ground reference points (meaning looking straight down between your feet at each altitude) to go along with the altitudes for each of the above mentioned is a good idea. Some of these ground points will obviously need to be adjusted depending on wind direction and strength but setting up a benchmark of them in a no wind situation is a good place to start in your training

4.2 EXIT: SEPARATE PASS

One thing to keep in mind is separation when training with others exiting on the same pass. It is common to have Canopy Pilots too close to one another to allow for a proper set up to perform their swoop if they are both running the same lane. Typically, 5-6 seconds between exits is enough separation, and should not be any less (depending on winds). The responsibility to maintain this separation does not stop with the exit; the first person out should remove their RDS, stow it and begin flying as early as possible. This first person would then do some turns to increase the vertical separation. On the other side, the second person out should always know where the person in front of is, and if is gaining proximity, should fly in brakes to allow the vertical separation to increase. 1000' vertical is recommended for this separation. These are guidelines and will depend greatly on wing loading, style of canopy, and how each pilot flies.

SECTION 5: FREEFALL

During the exit and deployment sequence, it is very important to stay square to the relative wind. High-Performance canopies with high wing loadings can react to a person not being even/balanced within the harness during the deployment and the snatch force, causing line twists that may end up with the pilot on their back spinning at a high rate of speed and decent. The G-Forces will build quickly, so a decision on what to do, whether it is cutaway and go reserve or try to get out of the line twists, must be made quickly.

5.1 DEPLOYMENT AND AIRSPEED

Most of the more experienced Canopy Pilots will tell you that it is important to deploy with a substantial amount of airspeed. Typically, the airspeed when exiting a C182 is not sufficient and can cause unusual things to happen to your D-bag when it is coming off your back if you do not allow airspeed to build. It is recommended to wait approximately 6 seconds before deployment in this scenario.

5.2 DEDICATE THE JUMP TO PRACTICING CP

Novice pilots should only practice swooping, or other canopy piloting skills, on dedicated hop-n-pops. This allows the pilot to concentrate on the specific canopy skill they are doing, and will lessen the amount traffic from a regular high load.

As a note, there are a growing number of DZ's that will not allow turns greater than 180 degrees on normal high loads where many canopies are in the air at the same time.

SECTION 6: CANOPY CONTROL

Use of Video for Evaluation Purposes: In circumstances where video/images are taken for the purpose of training, it is recommended that the participants be informed that they will be filmed and the reasons why. Participants should be informed that the video will be used to evaluate the coach / instructor and that it will have no other purpose and will not be reproduced. Written consent is only required when the material will be used for commercial/public ends.

6.1 WHAT IS A HIGH-PERFORMANCE LANDING?

A high-performance landing is when the canopy's air speed is deliberately increased for landing. This increased speed, when achieved at the correct height above the ground, can be converted into a high-speed "surf" across the ground with the canopy flying level for several metres, commonly known as a "swoop". There are many ways of achieving this and the coach will give information on the most commonly used techniques.

All methods of **increase in canopy speed** also include an **increase in descent rate**. These two factors make swooping very dangerous and if attempted at the wrong height or in the wrong conditions can result in serious injury or even death.

6.2 THE SWOOP EXPLAINED

The aim of swooping is to cover as much ground as possible with the canopy in full flight. To increase the speed of the canopy, the pilot initiates a turn using a front riser or toggle. This turn must be completed at a height that allows the canopy to recover from the turn, ideally without the pilot needing to give any input. The speed generated while the canopy is recovering is then converted into lift, allowing the canopy to maintain a flat and level flight above the ground.

In summary, a smooth turn initiated at the correct altitude will allow the canopy to recover efficiently to create a long, and safe swoop.

6.3 THE "CORNER" EXPLAINED

John Leblanc, of Performance Designs Inc., introduced the concept of the "Corner" to explain the difference between swoops that are initiated at the correct, and incorrect altitudes. Turns that are initiated too low are not only very dangerous, but also inefficient and result in a much shorter swoop.

The following diagram shows two swoops: one initiated at the correct altitude (**black**), and the other at an altitude that is too low (**red**) to allow the canopy to recover of its own accord.

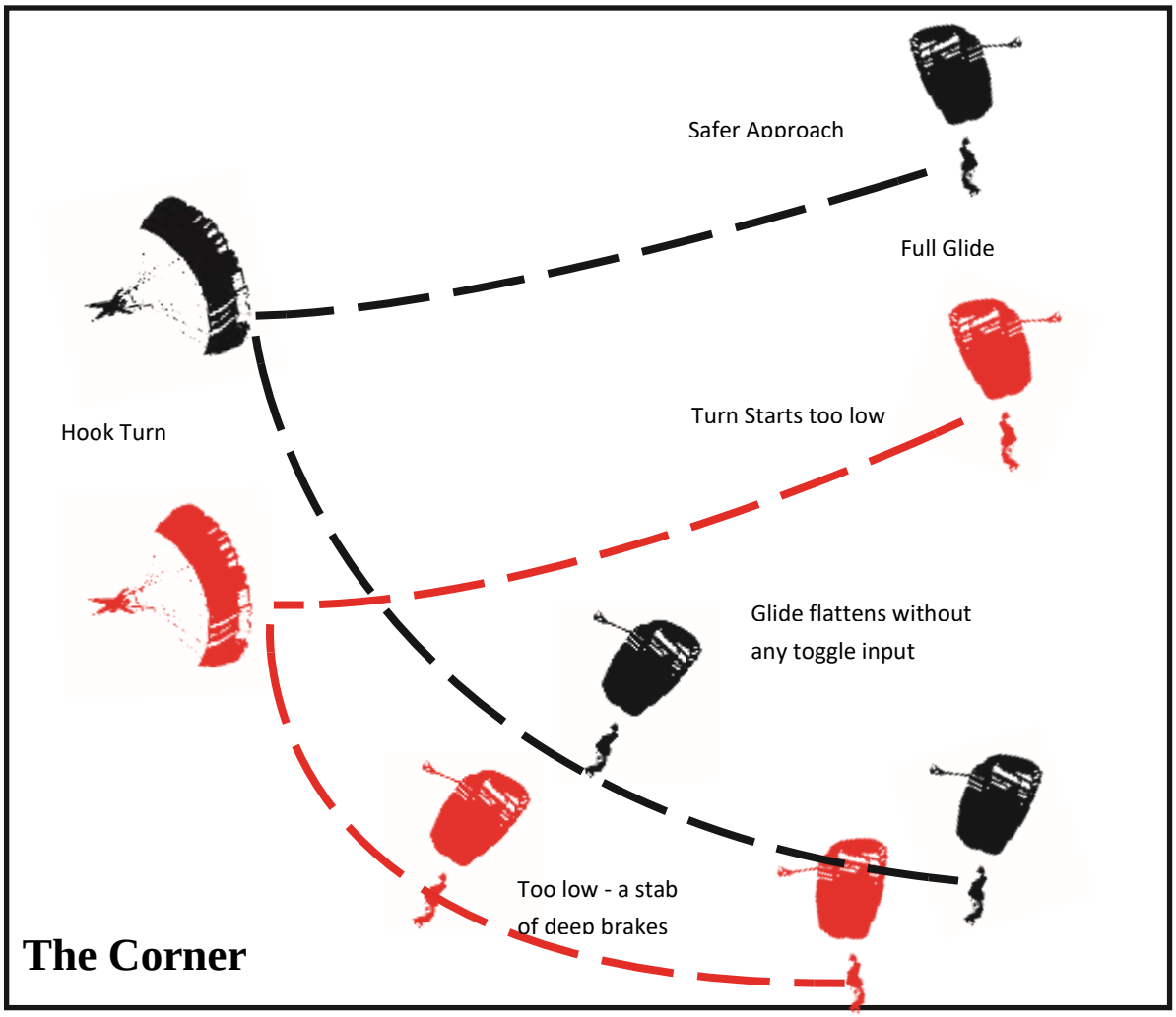


Figure 1 Diagram kindly supplied by John Leblanc of Performance Designs

The **black** canopy begins its final turn at the correct altitude. The canopy is allowed to fly out of the turn and recover with no input from the pilot. As it does so, it accelerates and reaches a speed that is far in excess of the canopies normal full drive speed. This higher speed generates more lift from the canopy and allows it to recover from the dive and regain level flight. Because no input has been applied by the pilot, the canopy maintains its higher speed across the ground and creates a swoop that is faster, covers a farther distance, and is safer.

The **red** canopy initiates the last turn too low (also see picture below). Because the canopy is still in a dive, the pilot has to pull down on the brakes sharply to avoid a collision with the ground. The toggle input required to save the jumpers life has taken off all the extra speed that was generated for the swoop. In the end, the length of the swoop is very short, unimpressive, and dangerous. This is known as being “in the corner”. A turn initiated any lower than this will no doubt result in serious injury or death.

Resource: http://www.performancedesigns.com/docs/flylnd.pdf “Flying and Landing High-Performance Parachutes Safely”, Performance Designs Inc.

Resource: http://www.bpa.org.uk/assets/Training/Canopy-handling/Corners-Kill-p33-Dec-03.pdf
"Corners can Kill"

6.4 METHODS OF TURNING THE CANOPY

The canopy can be turned using the steering toggles, risers, or by adjusting the distribution of weight in the harness.

TOGGLES

From our first jump, we are taught to manoeuvre the canopy using the steering toggles. For normal flight, the toggles will still be the standard method of control. When carrying out a swoop, however, the toggles are not necessarily the most efficient way of steering.

When we pull down on a steering toggle, the tail of the canopy deflects air, slowing it down and creating a turn. For the "swooper", this has two negative effects:

1. Because the turn is caused by slowing down almost half of the canopy, speed generated for the swoop is reduced.
2. If the turn has been initiated too low, recovery options are reduced to pulling the toggle that is in full flight in an effort to stop the turn and get the canopy back to level flight. E.g. for a right turn you would have your right hand down, and left hand up. All you can do is pull your left hand down to meet the right. This could have disastrous consequences.

REAR RISERS

You will have practiced using rear riser steering during student and Solo progression (Rear riser turn, rear riser spiral, rear riser flare). Although it is an effective method of steering the canopy, it also slows down the canopy and is therefore not an effective way to generate speed for landing.

HARNESS INPUT

By shifting our weight in the harness, we can steer the canopy. The ease of steering is dependent on the wing loading and the type of canopy. The higher the wing loading, the more susceptible the canopy will be to steered in this manner. Harness turns produce a relatively slow turn, but do have the advantage of leaving your hands free to operate toggles / risers.

You should coach Harness Input as one of the ways to turn the canopy. By shifting your weight one way or the other, you can induce a pretty aggressive turn rate under some High-Performance wings.

FRONT RISERS

Use of front risers is currently the most common way to speed the canopy up for a high-performance landing. They can be used in a straight-line by pulling both risers down equally, or by pulling one down more than the other to create a turn. Be aware, any input of the front risers increases the descent rate and airspeed of the canopy. As the canopy speeds up, pressure inside the cells increases, causing the canopy to want to regain its normal shape. This increases the pressure on the risers as the canopy gains lift. For the "swooper", this is good news, as this speed and lift increases horizontal flight. Front riser use

for swooping offers an added advantage over a toggle turn as the canopy can be levelled off relatively quickly if the manoeuvre needs to be aborted

Exercises designed to help you find which methods work best for you and your canopy will be explained later in this manual. It should be noted at this stage that not all canopy manufacturers recommend the use of riser input on their equipment, as it may be dangerous to do so. Check your manufacturer's recommendations before attempting to use your front risers.

> **Warning**: Just because some methods may allow you to right the canopy quickly, it is *not* an excuse to turn low.

Converse to using your rear risers to increase the range of the canopy when you are upwind, if you find yourself **downwind**, you can use the front risers in an attempt to increase the range of the canopy. Please note that when you pull down on front risers you change the canopy's *angle of incidence*. Essentially, you are swapping lift for forward speed. This means that, although your penetration into the wind should be better, you will also lose altitude faster. When you are facing into wind, the ideal viewpoint is changed so that the steady point is actually the place where you want to land e.g. the place on the **PLA** (**P**lanned **L**anding **A**rea) that you have chosen for your landing. If this point remains steady in your view, then you will not need to use your front risers to get back. If this point is getting steeper in your view, you also will not need to use front risers to get back.

STAY OUT OF THE CORNER!

If it is getting shallower in your viewpoint, then you will need to use front risers to see if it will gain you enough ground to make it back. Obviously, if using the front risers is not working then you will need to choose somewhere else to land. Therefore, you have opened downwind of the PLA, have used the accuracy trick and found that the PLA is getting shallower in your view. You now wish to try to increase the range of the canopy using front risers. The technique to use is similar to using rear risers. Reach up and take hold of your front risers. Pull down evenly for a couple of inches. Review the steady point, if it is getting steeper you have just increased the range of the canopy and will make it past that point if you keep the current settings. Pick a new steady point and pull down a little more. You will eventually find a point where the steady point gets shallower. When this happens you have used too much input on the front risers, go back to the setting that gave the best glide angle.

A couple of points to note:

- If you have to make an avoiding manoeuvre, you will not want to lose time relocating your steering toggles, so keep your hands in your steering toggles when using the front risers.
- There are a number of factors involved, but as a general guideline about 6 inches of front riser input is the most you will need to increase the range of the canopy when downwind.
- Check whether the equipment you are using has front riser bars / handles / loops, or not. Either way, before jumping, get a proper brief on how to take hold of the risers / riser bars / handles / loops on the equipment you are going to use.
- Remember; when you pull down on the front risers, your descent rate will increase. Obviously, this could be potentially hazardous near to the ground. Avoid using your front risers at any stage during your landing pattern and / or near to the ground.

6.5 CANOPY DRILLS AT ALTITUDE

The following drills should be carried out at a safe altitude and in a clear sky. It is recommended that you dedicate some jumps specifically to learning these skills, exiting alone at 5000 to 7000 ft. None of the exercises should be carried out until proficient below 3000 ft.

All jumps should follow the same sequence

- Liaise with DZ control and inform them of your jump
- Immediately after opening check the 3 A's, Altitude (have you got enough), Airspace (other canopies) and Area (location in relation to the holding area and PLA).
- Carry out set exercises above 3000 ft.
- Below 3000 ft. forget new skills and concentrate on a smooth, safe, accurate approach and landing

360 DEGREE TURNS

Practiced on high (well above 2000'), the aim of these drills is to become more familiar with the canopy (how much it dives, turn, recovery arc, etc.). If one is learning input/responses of the canopy (earlier stages), when carrying out any high-performance landing practice, it is vital to be highly proficient at handling the canopy. This means knowing exactly how much toggle, riser, or harness input to use and the exact effect it will have on the canopy. We need to be aware of the speed that the canopy will turn for any given input, the height lost during that turn, and most importantly, the time and altitude needed for the canopy to recover.

Although your first actual High-Performance landings will be made in a straight line, it is preferable to start the altitude drills with 360 degree turns, as they will allow you to remain orientated to the landing area and provide enough time in the turn to get a feel for what you are actually trying to achieve.

Swooping takes a long time to learn properly, even those with thousands of jumps are still learning. Take your time carrying out these exercises, do not try to do too much on any one jump, but concentrate on each exercise and only move on to the next when both you and your Canopy Piloting Coach are happy to do so.

360's are awkward to set up for actual landings. Once you get to the point of timing your turns you should be practising the turn you are actually going to do. It is suggested that it is better to do a 270 so that you can fly a normal pattern. Progressing past a 270 is much more advanced and goes past the "normal progression". This should be avoided until proper coaching is received, or left to the professionals.

TIMING THE TURNS

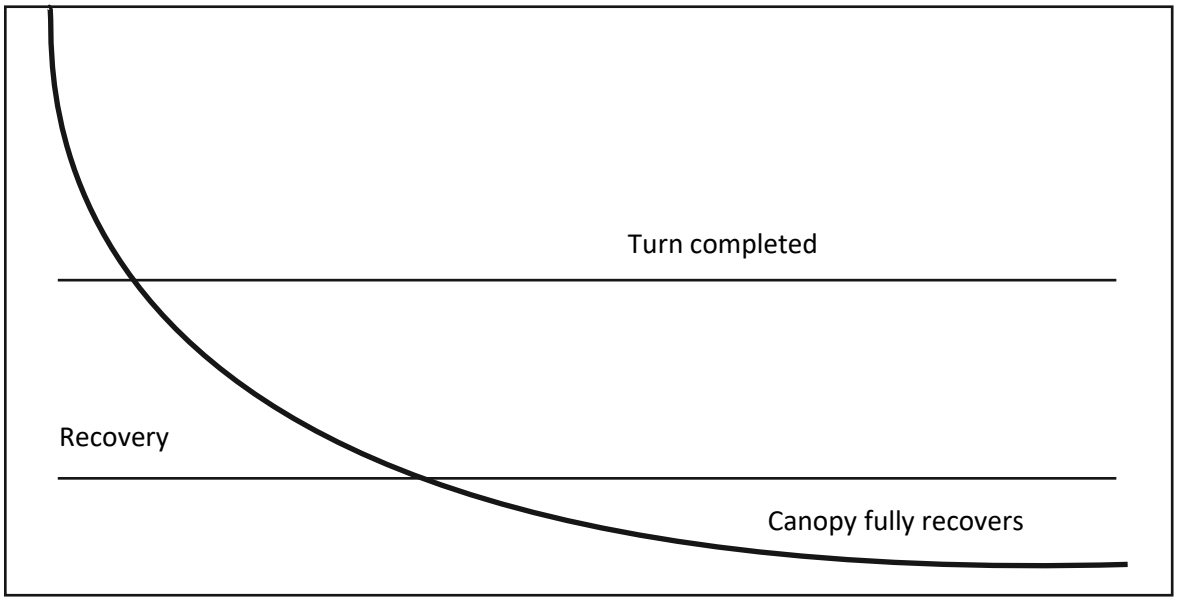
The first thing to get the feel for is how long we take to complete a turn. This is very easy to assess by counting in our head, just as we are taught as students. Pick a definite heading and check the 3A's before starting a turn.

THE 3A'S:
ALTITUDE
AIRSPACE
AREA

Begin counting at the same time as starting a smooth turn using a toggle and hold the turn until you reacquire your original heading.

During the turn, try to feel for the extra speed that is generated. This can normally be felt by an increase in wind speed on your face and clothing, the fluttering of your slider and general canopy noise.

Repeat this a few times, counting throughout each turn and feeling for the increased speed.
Once happy with the time taken to carry out a turn using toggles, then repeat a turn using a front riser. Remember to pick a heading and check the 3A's before starting the exercise. To make the turns, keep both hands in the steering toggles, reach up, and grasp the front risers. Ensure that you hold the risers in a fashion that will allow you to release the risers without letting go of the steering toggles.



To turn the canopy, pull down on one of the front risers. The more you pull down the sharper the canopy will turn. The best results are achieved by pulling the riser down smoothly and slowly until the canopy begins to turn. As before, carry out a 360-degree turn while counting. Repeat the exercise, as many times as needed, until you are able to carry out the turn consistently. Be aware, front riser turns create a dramatic loss of altitude compared to a toggle turn.

The speed of the turn will depend on your canopy type, wing loading, and how fast you want to turn. Try using different amounts of riser input to see how the canopy reacts and try to create a turn that you feel comfortable. You do not have to perform a radical turn to achieve a good landing. In general, a sharp

turn will feel faster, but a long smooth turn, carried out over four to five seconds, will allow the canopy to generate more forward speed as it recovers, which will eventually give us better landings.

Again, try to feel for the extra speed picked up during the turn. Remember, 3000 feet is your cut off altitude and make sure that you check the 3A's before each turn. It may well require several jumps to achieve consistent turns.

HEIGHT LOST IN THE TURN

When you are able to carry out a turn, repeatedly, that takes the same amount of time, you can move on to learning how much height is lost during a turn. To do this, you will need an accurate visual altimeter, normally digital, situated in a place that allows you to read it easily while still holding both risers and toggles. As before, pick up a heading and check your 3A's. This time, make a mental note of the exact altitude and then begin your turn. Try to carry out the same degree of turn as before and also feel for that extra speed. As you pick up your original heading, allow the canopy to recover and check your altitude to see how much height has been lost. Repeat several times, using both steering toggles and front risers, to get an accurate indication of the altitude loss for both.

THE RECOVERY

To ensure a safe swoop, it is essential that we first learn how long it takes for the canopy to recover. To do this, we need to know exactly how much height is lost, between the point that a turn is completed, to the point where the canopy has naturally (that is without applying brakes) slowed down to its normal speed.

IF YOU DO NOT HAVE THIS VITAL PIECE OF INFORMATION, YOU RISK SERIOUS INJURY OR DEATH, EVERY TIME YOU TURN A CANOPY FOR LANDING.

To learn the recovery time we will need to repeat the previous exercises. Again, make sure you start by checking the 3A's, then pick up a heading, note your altitude and start the turn. This time however, do not begin your count until you are back on your original heading with both hands all the way up. This is the start of the recovery. Feel for that extra speed dying off. Listen to the canopy quieten down and feel the canopy generating lift. Immediately the extra speed is lost, note how long it took and also the altitude lost. Be sure to carry out each turn consistently, so that you can accurately gauge the time and altitude needed for the canopy to recover. This will vary greatly depending on the type of canopy and the wing loading, but you should notice that it takes several seconds and possibly hundreds of feet.

REDUCING THE TURN

As stated earlier, our first actual attempts at a swoop landing will be made with a straight-line approach. To prepare for this, we need to repeat the above exercises, but with a lesser degree of turn. Following the same procedures as before, carry out a series of 180-degree turns, checking for height lost, time of turn and recovery time. Once you are proficient at measuring 180-degree turns, repeat the exercise

using 90-degree turns. You will no doubt find that the effects on height lost are less noticeable and therefore harder to measure with a lesser degree of turn. Sometimes it can be tempting to speed up a lesser degree of turn. Try not to do this, for two reasons*:*

- *Performance. The longer you are in the turn, the more time you spend accelerating. Even though you will not get out beside the canopy as much, you'll carry more speed at the end.*

- *Progression. For the reason above, every turn should begin slowly no matter what the degree of rotation.*

So basically, starting your turns quickly is just a bad habit. Even really big turns should start out very slowly and gradually wind up throughout.

Maintain the same speed of turn as you did throughout the 360-degree turns, as this will help you to achieve the aim and create much smoother and safer landings.

SLOW FLIGHT CHARACTERISTICS

By exploring and becoming comfortable at flying your canopy around in deep brakes, you will uncover a completely new range of control over the canopy and develop a much higher level of canopy awareness and skill.

STANDARD PRACTICES:

- On opening, if the canopy is fully inflated and without line twists, check your airspace and then use a rear riser to turn so that you are facing towards the Holding area / PLA then release the brakes as normal.
- Use the accuracy trick (see “MODEL FOR AN ACCURACY APPROACH—SPORT CANOPIES” Section 6.8.1 in the PIM2B manual) to ascertain whether you will make it back to the PLA.
- Ideally, this exercise will need to be performed into wind, assuming that you have opened upwind. Use the technique entitled “Increasing the Range of the Canopy Using Toggles”, on the way back to your holding area. Do not attempt this exercise if you have opened downwind of the PLA. Concentrate on getting back to the PLA / Holding and conduct the exercise only if it is appropriate to do so.

SLOW FLIGHT EXERCISE

Whilst increasing the range of the canopy on the way back to the Holding area. Try and concentrate on keeping the canopy in its deepest brake setting that you can. You will probably be quite surprised at how much brake you can actually apply before the canopies glide angle starts to decrease.

When you arrive back in the holding area, check the 3A's and turn back into wind. Carry out the flat turn exercise described above, but this time try applying ¾ brakes, which should mean that the toggles are at about waist level. Remember, you may be quite close to the stall point on the canopy (see “Finding The Stall Point” above) so only make your turns by lifting one toggle slightly.

6.6 SET UPS AND HOW TO USE THEM

The “Have a Plan” section used terminology (holding area, turning point etc.) that may have been alien to you. This section is designed to explain the “Set Up” method and allow you to link it in with the “Have a Plan” section.

Earlier in this manual, the importance of having a plan for your canopy flight was emphasized as an important aid to actually landing on the dropzone / PLA and thus contributing towards having a safe landing. Once you have become conversant with creating a plan before every jump, and being able to modify the plan as needed during your flight back to the landing area, it is then time to start working on landing where you want.

In order to do this you can introduce some set up points. These are points on the ground that you will fly through at set altitudes. Typically, these altitudes may be opening height, two thousand and one thousand feet.

Off set refers to the compensation that needs to happen left and right of the centerline of the gates to accommodate for atmospheric winds that will influence your canopy during the turn.

Depth refers to the compensation that needs to happen in front of or behind your turn point to accommodate for atmospheric winds that will influence your canopy during the turn.

6.7 HIGH-PERFORMANCE LANDINGS

THE STRAIGHT-LINE APPROACH

Once proficient at turning the canopy through 360, 180 and 90 degrees, it is then time to gauge the effect of pulling down on both front risers equally. Just as before, check the 3A’s, and note your altitude before starting the exercise. Pull down both front risers evenly until you feel the canopy speed increase, then hold for the same time it took to carry out a 360turn, then release smoothly and check your altitude. Repeat this until you are consistent with your riser input, then carry out the exercise again to measure the recovery. Be aware, the canopy will still lose height while recovering. You MUST make a note of this height and time, as this will indicate the height above the ground that you must allow the canopy to begin its recovery. As a general guideline, you should be allowing approximately ten seconds between the end of your riser input and the start of your flare.

On your first High-Performance landing, pick a suitable part of the PLA and ensure the following before commencing the approach:

- Check there are no hazards or other people in your chosen landing area. Remember that you may drop short or cover more distance over the ground than anticipated.
- Check the 3A’s. Do not attempt any new manoeuvre if at an inappropriate altitude, in busy airspace or in the wrong area.

Remember all canopies and people below you have priority.

IF IN DOUBT - DON'T!

THE PLAN

We must always plan our canopy flight before every jump. This is even more important whenever we are considering a High-Performance landing, as we must ensure that we are at the correct set up point, the correct altitude, facing the correct direction and that the chosen landing area is clear, before committing to a High-Performance landing.

To decide where your set up point for a straight-line approach should be, you will need to think back to the previous straight-line front riser altitude drills. You should also consider the following:

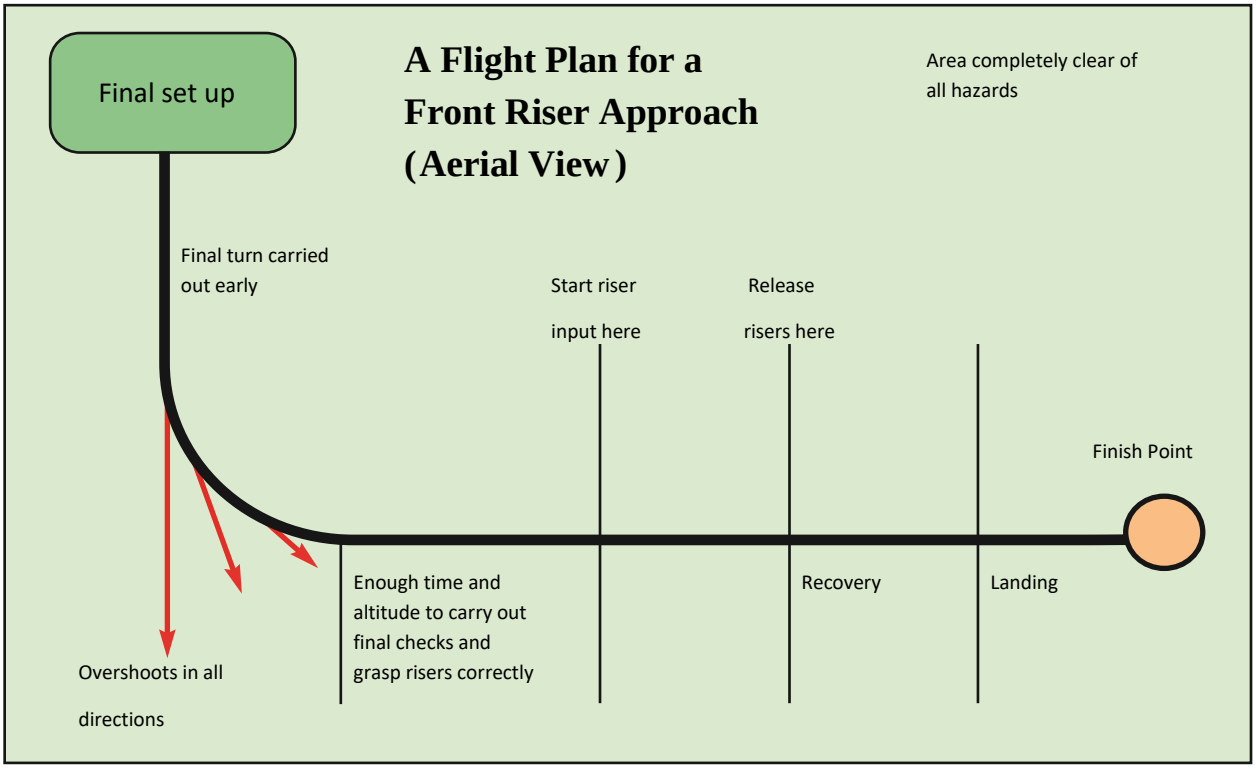
- How long the approach will take?
- How much height you expect to lose during the approach?
- How long does it takes the canopy to recover?
- How much height will be lost during the recovery phase?

With this information, we can plan the correct height to begin the approach, and when to release the risers in order to allow enough time for the canopy to recover.

Now we have a point at which to start our landing approach, we can plan how to get there, ensuring that our final turn is carried out with enough altitude to allow the canopy to recover fully prior to starting the landing approach. Think back to the toggle turns carried out earlier to work this out. It is important that this final turn is correct for two reasons.

1. Safety. You need enough time to ensure that you are at the correct height for the exercise. If you find yourself too low, then abandon the High-Performance landing.
2. You will find it much easier to pull smoothly down on both toggles if the canopy is at a slower speed. Straight after a turn, riser pressure can be very high, making it almost impossible to pull them down.

Although you may not know exactly where you will touch down, you should have a general idea. As stated earlier, make sure the whole of your chosen landing area is clear of hazards and people.



The Approach

Once you are in the right place and at the correct altitude, pull down on the front risers evenly, and by the same amount as you did during the exercises carried out earlier. While doing this, you will need to be constantly aware of your height above the ground. In gauging when to release the risers, try to allow approximately 10 seconds between riser release and the start of your flare.

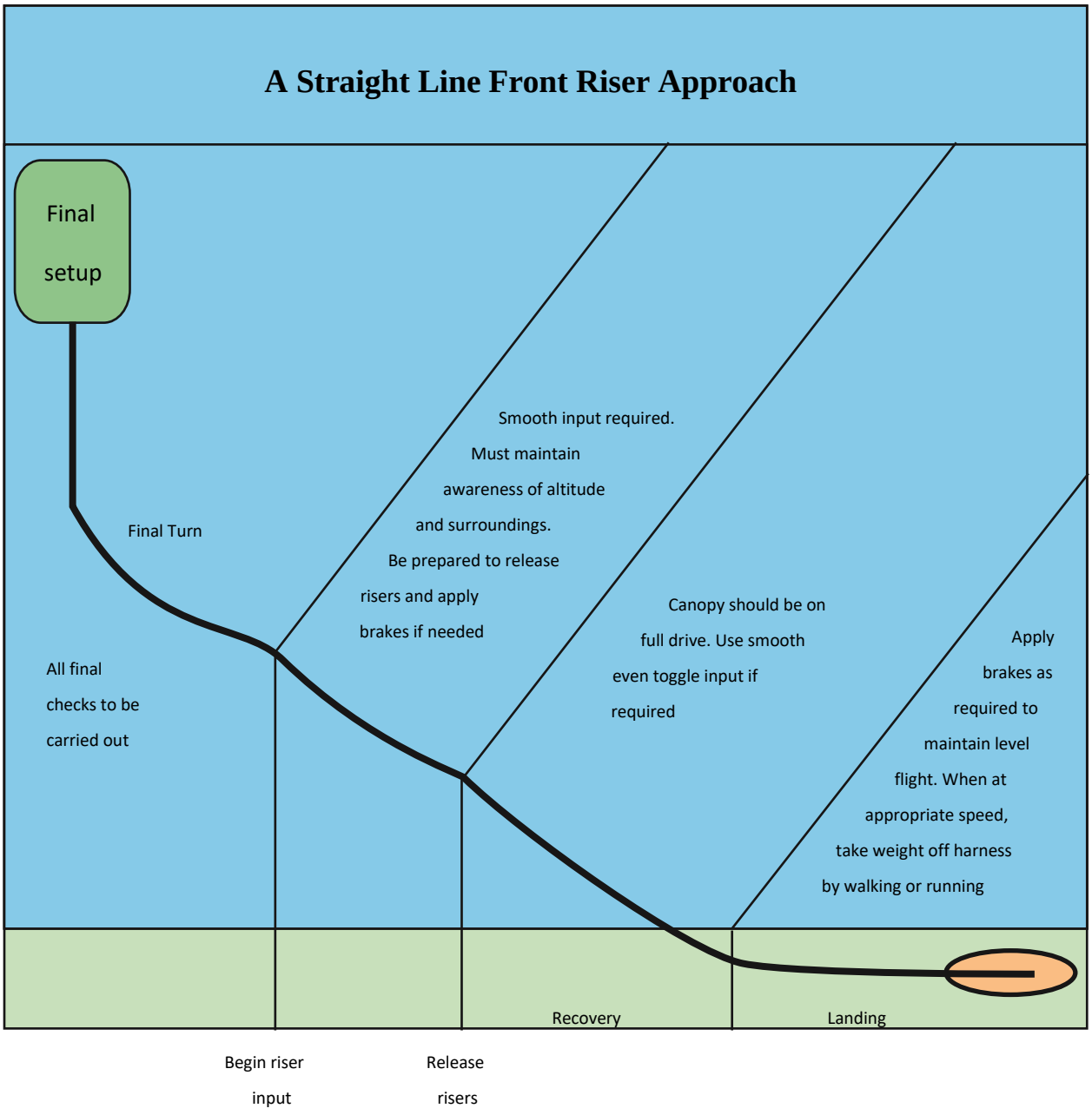
THE RECOVERY

As you reach your planned recovery height, release the risers smoothly and allow the canopy to recover naturally. At this point, your speed across the ground will have increased which is fine, but you certainly should **NOT** feel that your descent rate has increased. If you do, then you are **TOO LOW** and should **APPLY BRAKES IMMEDIATELY**. As you get closer to actually landing, the increased speed across the ground becomes more noticeable.

THE LANDING

Stay relaxed in the harness and concentrate on flying the canopy until the landing is complete. There can be a tendency to want to start running as soon as your feet are at ground level. Avoid this, as you will probably be travelling too fast. Just increase the toggle pressure as needed to keep the canopy flying level across the ground. As the canopy slows, it will lose lift and you will need to apply more toggle input to maintain level flight. The total amount and type of toggle input required is dependent upon a number

of factors but essentially, if flown correctly, the canopy should continue to provide lift throughout the whole of the landing phase and will stop creating lift when the weight is taken off the harness by putting your feet firmly on the ground. To this end, continue to fly the canopy until it has slowed down enough for you to comfortably walk or run, before attempting to take any weight off the harness.



INCREASING THE DEGREE OF TURN

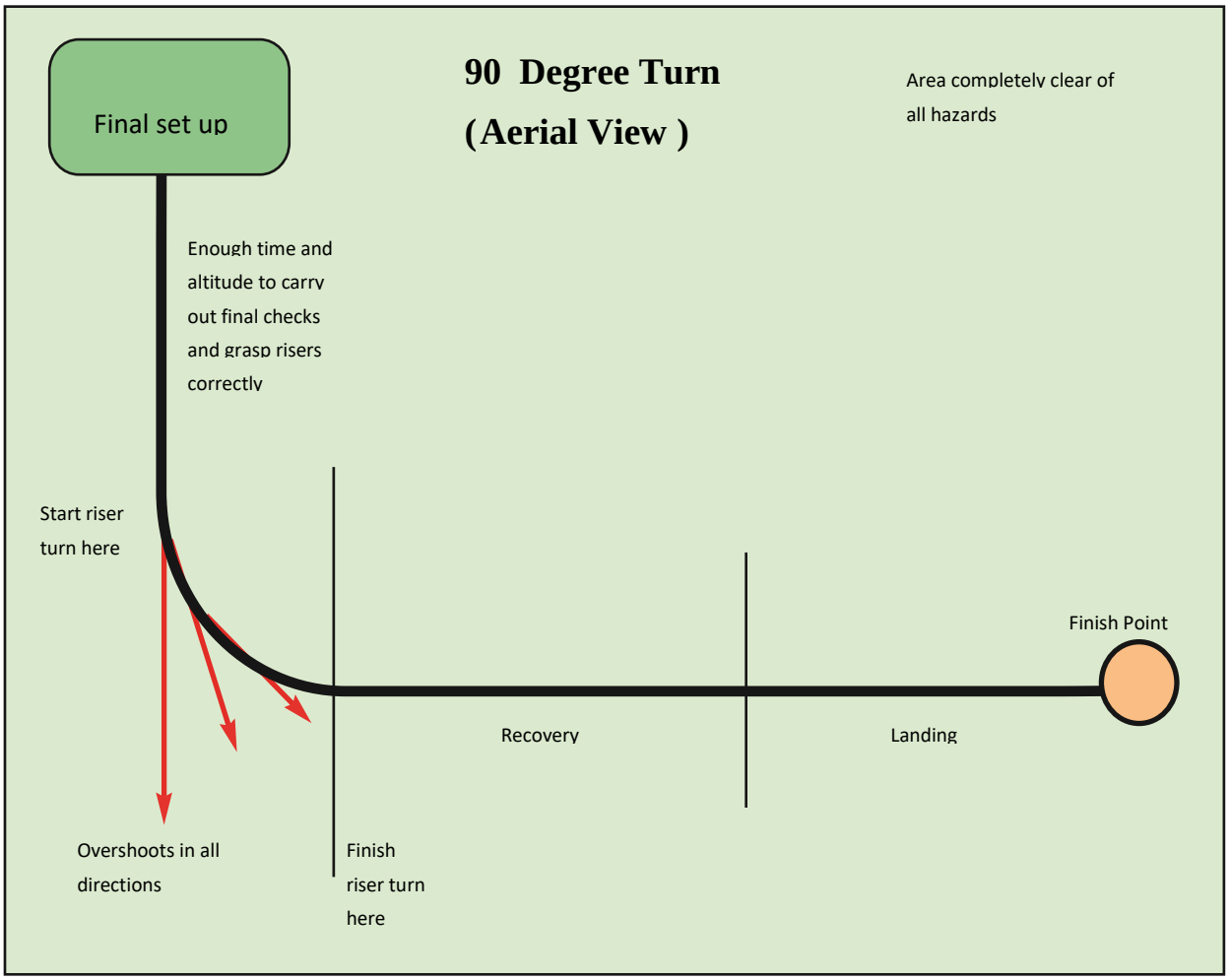
Having got to the stage where you are able to carry out safe, smooth straight on approaches repeatedly using front risers with little or no toggle input to recover the canopy then you can start to introduce a turn on the approach. This will allow the canopy to pick up more speed and result in a faster and longer swoop.

45 TO 90 DEGREE TRUNS

Thinking back to your earlier altitude drills, you must now plan to set up at the correct altitude, in the correct place and facing the correct way to enable you to make a 45 to 90 degree turn to land.

A practice at altitude of the exact turn that you intend to carry out prior to landing is a good way to confirm where the setup must be.

As for the straight in approach, ensure that your final turn onto your set up point is completed with enough altitude to allow the canopy to recover fully prior to beginning your front riser turn.



Before beginning your landing, it is essential that you check the following:

1. Am I in the correct set up?
2. Am I at the correct altitude?
3. Is the airspace around me clear?
4. Is the airspace below me clear?
5. Is the landing area clear?

If the answer to any one of these questions is **NO**, then you must not attempt a HIGH-PERFORMANCE LANDING. Instead, you should carry on with a conventional approach and land safely. Once you have decided that it is safe to carry on, perform a 45 to 90 degree turn exactly as practiced at altitude. As in the straight in approach, **IF AT ANY TIME YOU FEEL YOU ARE TOO LOW** then let go of the risers and **APPLY BRAKES IMMEDIATELY**.

A correctly executed turn will cause the canopy to pick up much more speed than a straight riser approach. Do not think that because some of the more experienced canopy pilots on your DZ are carrying out turns in excess of 270 degrees, that a 90-degree turn will not produce a lot of speed and distance, it will. If carried out correctly, a 90-degree turn can be very effective – if carried out incorrectly it can be disastrous.

The landing should be very similar to your straight on approach, but there are a few points that should be noted.

As mentioned earlier, you may be tempted to take your weight off the harness by running too soon. Do not do this! – The canopy will be travelling too fast and you probably will not keep up! Any movement of your body will also affect the weight distribution in the harness, in turn upsetting the canopy and normally resulting in a fall; this is not good, especially at high speed.

The faster the canopy is travelling, the more responsive it will be to any riser, toggle, or harness input. The added speed produced during a High-Performance landing can tempt you into applying more input than is required. You must therefore be very smooth with any input made, all the way through the landing and until you have stopped and the canopy is fully deflated.

The extra speed should result in more distance being covered across the ground. Make sure you have enough space ahead of you to allow this to happen. **COLLIDING WITH HAZARDS OR PEOPLE AT THESE SPEEDS IS NOT AN OPTION**. If you are at all worried, then steer away using the flat turn techniques taught and practiced.

Remember, **NO SHARP TURNS CLOSE TO THE GROUND**.

You should practice this type of landing until fully proficient. Before even considering increasing the degree of your final turn, you must be able to consistently:

1. Land, having carried out the correct degree of turn with the canopy being allowed to recover with little or no input from the pilot.

2. Control the extra speed with smooth, even toggle input, and take your weight off the harness at the appropriate time
3. Land with a good degree of accuracy, showing the ability to judge where you will reach ground level and where you will stop.

When you are ready, the CP coach will clear the athlete to increase the degree of turn. This should not be done all in one go but steadily over a number of jumps increasing the turn by no more than 90 degrees at each stage.

In the same way that you prepared for the 90 degree turn, use the altitude drills to work out where and at what height to set up for the landing, and carry out practice turns at a safe height to confirm.

The extra speed should be easy to deal with as you should not have progressed this far unless completely happy with all stages of your previous landings.

Complete awareness of your surroundings is imperative because it is this awareness and judgement that make you a safe canopy pilot.

The final checks prior to landing may well take longer, so make allowances for this when planning your set up. Get to the correct point with plenty of time, so that the canopy can fully recover without you having to make any sharp inputs.

When checking for other jumpers you must check in all directions, especially below and behind you. This can take some practice and requires a fair bit of movement in the harness to allow you a full 360-degree field of vision. Do not leave it until this point to practice this – practice at altitude.

It is possible to land safely in any direction, as long as the canopy is flat and level and there are no hazards in the way. The same is true of a High-Performance landing. However, fast it starts, providing you have good control of the toggles, and only take your weight off the harness at the correct canopy speed, landing in any direction can be controlled. You must however, be aware that the speed across the ground will feel very fast and you will cover a lot of distance.

To give you the option to abort a turn at any time, you should think carefully about your landing area. In anticipation of any need to abort your High-Performance landing, your set up should be over an area that allows overshoots in all directions.

As you carry out your final turn, it is important to remember that you must be constantly aware of your altitude and surroundings. At any time that you have any doubts, release the risers and keep control of the canopy, irrespective of which way you are facing and how high you are. Remember – there is only one way to land a canopy: FLAT, LEVEL AND WITHOUT HITTING ANYTHING.

TURBULENCE

Now you are able to jump in stronger wind conditions you may encounter turbulence at any time during your descent. Turbulence can be caused by a number of factors, the most common of which are thermal

activity or the result of the wind being deflected around, over, or through objects and from the wake turbulence produced by other canopies. A good indication of the degree of turbulence to expect under canopy is how smooth the ride to altitude in the aircraft is.

6.7 COMMON MISTAKES

One should be somewhat comfortable with landing crosswind when starting to learn to swoop. If not, that is where one should start. Students need to get used to the idea of landing on a "runway" with only 1 or 2 possible landing directions. **Landing crosswind** unintentionally can sometimes give the impression that the canopy is turning during landing. To overcome this problem, it is important to remember to keep flying the canopy until it has collapsed at the end of the landing. By thinking about the landing in this way, it becomes easier to assess what toggle input is required at every stage of the landing. Make sure you pick a heading for each landing and keep the canopy on that heading until the landing is complete. If the canopy feels as if it is turning, (either due to uneven toggle input, or being affected by the wind), continue the flare but increase toggle input in the direction needed to maintain the heading. Remember to keep your toggle inputs smooth and controlled throughout the whole landing.

For the flare, it is common to not finish flaring when you start learning to bring extra speed (just because you have levelled off, does not mean you should start running, and stop flying!).

Most other mistakes happen in the set-up - most people will find that their accuracy is poor when they are learning HP landings. Always remember to plan your “outs”, and when in doubt, use them (do not turn low!!).

6.8 LANDING PROBLEMS

Some landing problems are familiar to low experienced jumpers but can be easily rectified.

The following are the most common:

- Flare too high/low
- Uneven flare
- No flare

6.9 TRAFFIC AVOIDANCE

We can minimize the risk to ourselves and other jumpers by learning to avoid traffic. We can start this before we even take off by knowing the characteristics of our canopy and of the others on our lift. This does not have to be overcomplicated, but it is very useful to know how fast our canopy flies in comparison to those around us. Different people like to fly their canopies in different ways, some like to take their time while others prefer to race to the ground and all these factors will influence where you fit in to the flow of traffic.

Be predictable in the pattern!

6.10 LEARN WHEN TO SAY "NO"

This manual has predominantly lectured on the dynamics and physical aspects of how to execute a High-Performance landing. Regardless of whether you are first starting out on your swooping career or have thousands of High-Performance landings under your belt, the most important thing to learn is when to say no to a High-Performance landing.

High-Performance landings are without doubt impressive if carried out correctly, but please do not allow your ego to overrule common sense. A large majority of injuries and fatalities have been caused by a canopy pilot taking unnecessary risks in order to impress or land in a particular place, normally with an audience. Never carry out a high-performance landing if:

- there is traffic that might get in your way,
- landing in an unfamiliar area,
- the weather conditions are marginal,
- you are angry or disappointed with your performance in freefall,
- you are tired or distracted,
- something just does not feel right but you cannot identify what it is.

Having a nice soft landing will impress your peers far more than seeing you being driven off in an ambulance, or even worse, a hearse. Learn when to say no and live to swoop another day.

SECTION 7: TRAIN TO COMPETE

FAI Canopy Piloting: Competition information

Canopy Piloting | World Air Sports Federation (fai.org)

APPENDIX

TECHNICAL ASSESSMENT JUMPS

Please see the C3 – CP Portfolio located on the CSPA website.