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**Australian Parachute Federation Incorporated**

**INTRODUCTION TO  
CANOPY RELATIVE WORK**

# **CRW TRAINING MANUAL**



**A GUIDE FOR TUTORS  
AND  
NOVICE CANOPY RELATIVE WORKERS**

Date adopted by APF Board: -

Effective Date: 10 Aug 2010

Revision Date 28 Sept 2011

**STATUS: EDUCATIONAL**

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## Colophon

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### 1.1. Warning

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Parachuting is dangerous.

### 1.2. Price

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This handbook is offered free to APF Members.

### 1.3. About this publication

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This Handbook is produced by The Australian Parachute Federation (APF) for the information of APF members. If you want more information or copies of this manual (or others listed above) for yourself or your friends, please ask the instructional staff at your DZ or contact the APF Office.

### 1.4. Disclaimer

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Skydiving and Parachuting are dangerous. Performance of some of the actions described in this manual may result in injury or death, even if performed as described.

This Handbook is intended as a supplement to a formal Canopy Relative Work (CRW) or Canopy Formation (CF) lesson / course of instruction with a qualified CRW or CF Tutor and must only be used in accordance with this training. Information in this manual may not be applicable to all types of manoeuvres, freefall operations or canopy descents.

This manual has been produced for the information and assistance of APF members. It is not a do-it-yourself guide to skydiving but should only be used while under the supervision of a qualified APF AFF instructor or RW tutor.

Individual skydivers should check the information in this manual and assess the risks involved before carrying out any of the manoeuvres described.

### 1.5. Copyright

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### 1.6. Revision

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Updated (Jules McConnel) 19 Mar 2010. This revision (National Office) was published on 28 Sept 2011.

### 1.7. Credits

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Written by Jules McConnel. Jules would like to thank Chris Gay, Brett (Higgo) Higgins, Mitch McMartin, Andrew "Sarge" Preston, Michael Vaughan, and Shaunn Segon for getting me into CRW all those years ago!

### 1.8. Contact the APF

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## Index

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2. References .....	4
3. Notes for Tutors .....	5
4. Equipment .....	6
5. Basic Safety .....	7
6. Glossary / Terminology .....	9
7. Learning Basic Flight Concepts and Controls .....	11
8. Communication / Signals .....	13
9. CRW Emergency Procedures .....	15
10. Skill Levels .....	17
1. Skill 1 – Learning Basic Flight Controls.....	18
2. Skill 2 – Flying As A Pilot.....	20
3. Skill 3 – Docking As Pin.....	22
4. Skill 4 – Exiting 2 <sup>nd</sup> .....	24
5. Skill 5 – Rotations (Through The Burble).....	26
6. Skill 6 – Rotations (To The Side) .....	29
7. Skill 7 – Docking third or fourth.....	31
8. Skill 8 – Stairsteps / Wings.....	33
9. Solo Drills.....	34
10. Advanced CRW Training .....	35
11. CRW Training Descent Table .....	36

## 2. References

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*For more information on CRW:*

[www.ozcrw.tripod.com](http://www.ozcrw.tripod.com)

[www.diamondquest.org](http://www.diamondquest.org)

*For current Canopy Formation competition dive pools go to the APF web site [www.apf.asn.au](http://www.apf.asn.au)*

### 2.1. Bibliography

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Mike Lewis, CRW Emergency Procedures article

Tom Begic, information from

[www.ozcrw.tripod.com](http://www.ozcrw.tripod.com)

[www.diamondquest.org](http://www.diamondquest.org)

### 3. Notes for Tutors

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This Handbook is written as an informative guide to assist skydivers during their first stages of learning Canopy Relative Work. It also acts as a course guideline for tutors to use as a reference when teaching CRW to novices.



#### **Do Not Rush Your Learning Progression**

..."you have the rest of your life to get it right"

#### **3.1. Accident Prevention for the Canopy Pilot**

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If the novice has recently transitioned to their own equipment, be sure that they are fully conversant with any new drills and have completed all the required conversion jumps.

It is the tutor's responsibility to ensure the novice's log book is endorsed by the DZSO if the novice is using equipment that isn't fitted with an RSL or AAD.

Referring to APF Operational Regulation 11.6.2 (a) before commencing CRW training the candidate should have at least an APF Parachutist Certificate 'A', and Op Reg 8.8 all freefall descents made by parachutists who do not hold a Certificate 'D' must be made with equipment fitted with a functional reserve static line or an operational automatic activation device. The DZSO, in writing, may permit exemptions to this rule for specific descents.

Consider your novice's experience, i.e. jump numbers under current parachute when organising parachutes for yourself and the novice to use, try to make your wing loadings similar whilst taking into account what size parachute the novice is currently using as a sports canopy and also what size they are comfortable/competent to use. Also take into consideration the novice's ability when adding any extra weight – have they landed with weight before? You might need to consider upsizing your parachute to make yourself and your novice compatible. Always consider the novice's safety before choosing equipment.

When choosing equipment, make sure canopies have similar line trim, including brake settings, and you have similar wing loading to your novice/s. If working with a group, try to keep wing loading similar within the group for ease of pairing people up or building larger formations.

This manual progresses in stages, not jumps. It can take several jumps to complete one stage; conversely several stages can be completed in one jump, depending on the rate of progression of the individual novice.

## 4. Equipment

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The following items are essential for safely doing CRW:

### 4.1. Rig

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- Reserve protector flap to minimize snagging lines.
- No SOS or RSL.
- Extra wide leg straps are advisable for comfort, make sure leg straps are even.
- Riser covers to accommodate large CRW toggles and trim tabs/grips on risers.

### 4.2. Canopy

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- 7-cell CRW specific canopy i.e. PD Lightning, CRW Triathlon, Matrix, PD Storm.
- Retractable Bridle/Pilot Chute system to reduce the danger of entanglement.
- Non-cascaded, marked centre lines and outside A-lines.
- Easily accessible, self opening soft toggles provide less possibility of entanglement than hard toggles and better flight control.
- Mesh or spider slider.
- Cross connectors – essential for building planes, should be connected between front and rear risers only.
- Front risers – dive loops/grippers (use vet wrap for better grip).

### 4.3. Clothing – Protection

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- Thick socks and gloves to prevent abrasion from canopy and/or lines.
- Cover arms and legs – no rel suits, as canopy can get snagged on grippers.
- Fully enclosed shoes that can come off fairly easily – no boots or hooks.
- Protective headgear – must allow adequate hearing capability for voice commands, in addition to collision protection.

### 4.4. Accessories

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- Easily accessible hook knife/s on lanyard/s for resolving entanglements.
- Altimeter – provides altitude information for dock, abort and entanglement decisions. Refer to Op Reg 8.5 “An approved and functioning visual altimeter set to indicate height above the DZ shall be worn on all descents.”

## 5. Basic Safety

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### 5.1. General

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- Always keep sight of the “Big Picture” – keep an eye on heading throughout the skydive to make it back to Drop Zone.
- Never lose sight of formation.
- Never fly below and/or in front of formation.
- No more “builds” under 2,000 ft. Refer to Op Reg 11.6.5 “During CRW Training descents, the minimum working height shall be 2000 feet.”
- Communicate when problem occurs.
- In case of a cutaway, follow person(s) under reserve and equipment.
- When landing out, land together near a main road. Check in at manifest on return to DZ.

### 5.2. Pre-jump

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- Make sure DZSO, manifest, aircraft pilot, and other jumpers know you are doing CRW – if multiple aircrafts are used on the drop zone, you may need to coordinate with pilots to have separate airspace to freefallers (for example plane 1 drops CRW on left side of landing zone, plane 2 drops freefallers over right side of landing zone – so freefall groups don’t fall through CRW groups), this should also be discussed with all skydivers so groups stay on their respective sides of drop zone both in freefall and under canopy to avoid unnecessary collisions.
- Find out the winds aloft from manifest or aircraft pilot and determine the spot accordingly.
- Know the direction of prevailing ground winds in case of landing out.
- Make sure someone in your group has a mobile phone on them in case of off-DZ landing.

### 5.3. DZ Safety

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- Be aware of local knowledge – landing hazards, surrounding “neighbours” who enforce a no landing zone etc.
- Adhere to National and local regulations.
- DZs have different regulations in regards to AADs and RSLs on equipment. Make sure you check with DZSO on these rules, and get clearance to disconnect RSL, if such rules apply to DZ.

## 5.4. Spotting for CRW

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- Predetermine winds at various altitudes using information available whilst still on the ground (wind sock, cloud movement, meteorological forecasts, feedback from earlier loads, etc).
- If you are the first load of the day, ask the pilot for wind direction and strength at various altitudes to determine correct exit point, allowing for wind drift, to make it safely back to DZ.
- There is a general misconception that CRW groups should/must exit last. This is not the case as long as you are planning to do CRW from exit altitude (you are spending the entire skydive doing CRW and not planning freefall).
- Your exit position will depend on the wind direction and strength, eg:
  - If the winds are light all the way up, then exit first heading towards the drop zone.
  - If the winds are strong all the way up, and jump run is facing into the prevailing winds, then exit last.
  - If the winds are medium strength all the way up, exit somewhere in the middle of all groups (if few groups exit last and remember to adjust heading during skydive to make it back to DZ).
- Avoid turbulent areas and areas of poor visibility (i.e. cloud).
- Allow for other parachutists and airspace users as well as local airfield air traffic rules when calculating your spot.
- Maintain wind-line (upper winds may differ from lower winds).
- Exiting Aircraft – Hop n Pop
- For some, a hop n pop may not have been done since Stage #9 of the AFF Table, or they may be at a new DZ with a different aircraft to what they are used to.
- If necessary, revise exiting the aircraft stable – right from the climbout to presenting the body to the relative wind.
- Discuss exit separation between each person in your group and the agreed delay from exit to Pilot Chute (PC) throw.
- Heading control – looking at the aircraft helps to keep stable on exit and gives a reference for flight direction of the formation.
- CRW canopy openings – most CRW canopies open firmly.  
If you have never flown a CRW specific canopy, discuss opening characteristics with your tutor.



## 6. Glossary / Terminology

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Commands – what you may hear during a CRW skydive

*Commands are kept short and to the point so not to be misconstrued.*

<b>“Left”</b>	turn left
<b>“Hard left”</b>	turn more left
<b>“Right”</b>	turn right
<b>“Hard right”</b>	turn more right
<b>“Incoming”</b>	used when approaching a formation, about to dock on a formation, to raise attention of person you are about to dock on
<b>“Heavy”</b>	use more trim (usually given to an unlocked wing in a diamond)
<b>“Light”</b>	use less trim (usually given to a wing holding too much trim)
<b>“Complete”</b>	formation is complete
<b>“Starburst”</b>	call to initiate countdown and break of complete formation
<b>“Break”</b>	at completion of countdown, drop all grips.
<b>“Break it down”</b>	call to initiate break down of unhealthy formation.
<b>“Drop me”</b>	used when it is safe to be released (usually by an unlocked wing)

## 6.1. Other terms

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**Stack**

A formation of two or more parachutes where the grips are taken on the A-lines of the centre cell and the feet are at the top of the lines (under bottom skin of canopy)



**Plane**

A formation of two or more parachutes where the grips are taken on the A-lines of the centre cell and the feet are hooked onto the risers



**Stair step/Wing**

A formation of two or more parachutes where the grip is taken by the inside leg on the outside A line

**Base/Pilot**

the top person in a formation, the person steering the formation

**Pin**

the person docking on the base of the formation

**Lockup**

in larger diamond or box formations the position below a wing is the lockup

**Echelon**

in large formations, while you wait to dock on the formation you fly to one side of the formation in line with others waiting to dock. This line (or group) of fliers is an "echelon"

**Top dock**

docking onto the top of the formation.

**Spiral**

steering your parachute around in a circle (usually to lose height in relation to the formation)

**Sashay**

steering your parachute from side to side in order to go back and down in relation to the formation

**Stall**

excessive application of toggles or rear risers will make your canopy an inefficient wing and lead to stalling your parachute.

**Wrap**

when a parachute is wrapped around a parachutist's body.

**Entanglement**

when two parachutes are tangled together.

## 7. Learning Basic Flight Concepts and Controls

Understanding what your controls do and learning how much and when to use them comes with practice. Every parachute has different flight characteristics depending on size, wing loading, age (number of jumps) and line trim. Using the same parachute throughout your training will give you consistency in learning. This is not always possible so do not assume that parachutes of the same size will fly exactly the same.

When flying your canopy always start with small inputs and increase if needed. Remember slow is smooth.



### 7.1. Full Drive

When you have your toggles all the way up, your parachute is said to be in full drive – this is its natural rate of descent and forward speed.



### 7.2. Front Risers

Use these to go down and forward in relation to the formation. The more you front riser the further down and forward you go. Using front riser input will increase your forward speed, therefore when you release the front risers you will gain lift.



### 7.3. Rear Risers

Use these to go up and forwards in relation to the formation. A good tool to use when stuck behind, and slightly low on a formation to change the angle of attack on your approach whilst maintaining drive.



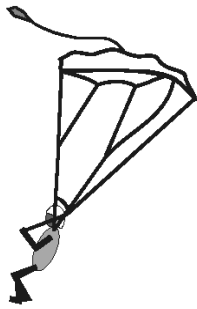
### 7.4. Toggles

Use these to go up and back in relation to the formation. They can also be used to slow down a fast approach to the formation: a quick “pop” of the brakes, holding them down for too long will create unwanted lift in this situation

### 7.5. Stalling

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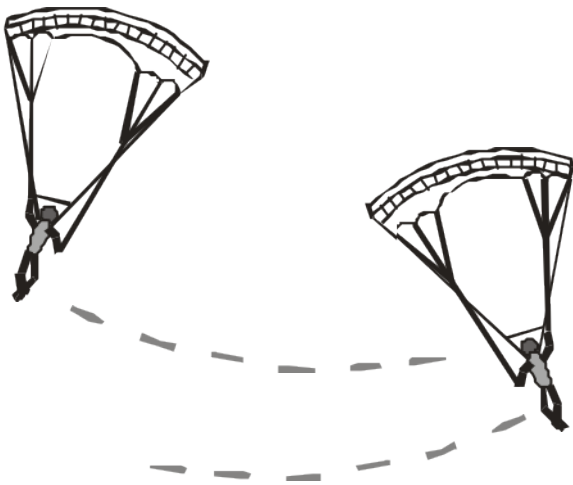
Excessive application of toggles or rear risers will make your canopy an inefficient wing and lead to stalling your parachute. Avoid doing this during a CRW skydive.



### 7.6. Sashay

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Used to go back and down in relation to the formation. Always turn away from the formation first.



## 8. Communication / Signals

Communication in CRW can be visual or audible. We use leg and arm signals to communicate what inputs we want the other jumpers to give or to adjust heading. Because of the slower speeds at which we fly, we can also verbally communicate, however we still need to shout commands over the wind.

### 8.1. Verbal Communication

Always give concise, positive commands. i.e. "front riser", instead of "don't use toggles" as the listener may only pick up the last part of what you say.

Remember – as the listener, just because a command is shouted to you: it does not mean you need to fly aggressively. Always ease into your inputs and allow momentum to follow – you can always add a little more if necessary. It is very common for a new CRW jumper if they get low and behind a formation, and hears "rears" yelled at them that they yank on the rear risers, stalling out their canopy. Always fly smoothly with all inputs. Be patient, allowing your canopy to react to its new flight mode.

### 8.2. Leg Signals

Just like hand signals in freefall, leg signals can be used to communicate to each other.



#### Left Turn

Shake left leg – turn left



#### Right Turn

Shake right leg – turn right



#### Breakoff

Waving legs open and closed – break off



#### No more CRW

Crossed legs – means no more CRW (if you are tired or injured and don't want someone docking on you, cross your legs to communicate this to other jumpers.)

### 8.3. Arm Signals

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Arm signals can also be used to communicate when side by side or in close proximity. Remember when given a signal, to ease on the controls, allowing for the canopy to react to the changed flight mode.

Here are some arm signals you may see or use:



#### Front Riser

Pointing down – front riser



#### Rear Riser

Pointing up – rear riser



#### Sashay

Making a zigzagging motion with one forearm away from the body – sashay

## 9. CRW Emergency Procedures

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There are many different scenarios that may result in emergency situations – it is important to have a plan to deal with the most common of these occurrences. However, we would benefit further if we could avoid these situations all together.

### 9.1. Avoidance

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By covering all the basic safety and equipment guidelines outlined earlier in the manual, we are already in a good position to avoid problems.

Also remember the following whilst docking on a formation:

- Do not dock with sideways momentum relative to the formation.
- Do not dock too high or too fast.
- Do not dock on a formation that is oscillating, or that has a collapsed canopy.
- Do not fly in front of a formation.
- If the formation is out of sight above you, do not fly in brakes up into the formation.

Conversely, if someone is approaching you too quickly, or from a bad angle and you are a solo canopy: turn to avoid them. If you are on the bottom of a stack and someone is on a bad approach; wave them off if they're still on approach, then "get big" to minimise the amount of lines your body will go through.

This leads us into various emergencies – there are two types of CRW emergencies – wraps and entanglements. A wrap is when a parachute is wrapped around a parachutist's body. An entanglement is when two parachutes are tangled together.

### 9.2. Wraps

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A wrap is similar to a low speed malfunction. The top pilot's parachute will remain open. This gives you more time to deal with a problem than you would have with a freefall emergency. You do not want to land a modern square parachute with two people under it. You may have incredible forward speed because of the increased wing loading.

The general rule for wraps is that the lower jumper cuts away first. The top parachute usually remains open, so there is no reason to release it. If the jumper who has the parachute around him cuts away (the top jumper); he will go into freefall with the lower jumper's canopy wrapped around him. That will only worsen the situation. Usually you can climb out of a parachute by sliding the material down your body. If not, tell the lower jumper to input some more brakes to release some tension.

If this does not help, check there are no obvious lines caught on yourself or on your equipment (you might just need to cut one or several lines with your hook knife to solve the problem).

If not, then the lower jumper cuts away. That will release the tension and make it easier to climb out of the fabric.

If you are at the top of a three person stack, where the bottom canopy is wrapped around the middle person, stay holding onto the formation, even if the person you are holding onto has a perfectly functioning parachute. If the bottom person cuts away, you can act as pilot, and control the other person's canopy while they deal with getting the cutaway canopy off their body.

### 9.3. Entanglements

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An entanglement usually results from one jumper passing through the lines of another jumper's canopy. This causes the two parachutes to be entangled, with the pilots dangling beneath them. This situation almost always requires both jumpers to cut away. Usually one person will be suspended higher than the other.

The general rule for entanglements is the top person goes first. If the lower jumper releases, the lines and risers may recoil upward and wrap the other person. When the top person releases first, they may bounce off the bottom person on the way down, but they won't have much momentum.

The top jumper usually is the one who passed through the lines, and many times the parachute will pull itself out of the mess after being released. This is a bonus for the lower jumper who then has no need to cutaway.

Sometimes the entanglement will start spinning, with one jumper hanging downward and the other one orbiting the entanglement. In this situation the orbiter should cut away first. This will fling the orbiter clear of the entanglement without changing the downward jumper's orientation. If the jumper hanging downward releases first, it will change the orbiter's orientation to the entanglement and could make their situation worse.

Whatever emergency situation you find yourself in, it is very important to communicate to the other jumper/s involved. Do not just cut away – you may be leaving yourself or someone else in more trouble than what you began with.

### 9.4. Communication

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When involved in a wrap or entanglement the first thing to do is to communicate with each other. You need to communicate the altitude, the problem and the plan of action.

Always use positive commands. "Don't cut away!" is the wrong thing to say as the other jumper might only hear the last part of this phrase and jettison their canopy.

When someone has a parachute wrapped around them, they may not be able to read their altimeter. When you are totally engulfed in nylon, it is very reassuring to hear the altitude called out every 500 feet. It also helps to hear that your parachute is okay; and "if you crawl to the left it will come loose", or some similar instruction is much more useful.

If you cannot get any response from the person wrapped up in your canopy you should go ahead and cutaway. The jumper probably has nylon around their face or neck and you need to alleviate the tension by releasing your risers.

If you are the one who is wrapped in a parachute you should communicate that you are working on the situation. Speak to the other jumper/s at regular intervals.

Once the decision to cut away has been made, do not panic. Make sure the airspace below you is clear. If more than one person has to cutaway, then stagger delay times to avoid reserve opening collisions.

APF Operational Regulations state, "During all CRW training descents, the minimum working height shall be 2000 feet."

For novice CRW jumpers, it is recommended not to make any new formations below 3000 feet, so you have plenty of height and therefore time to deal with an emergency situation – *Don't panic!*



## 10. Skill Levels

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Each of the following skills can be mastered in separate jumps or more than one skill level can be done in the one jump. This will depend on a couple of factors including jump altitude (how much working time you have) and the novice's experience/competency. The tutor must ascertain the ability of their novice based on jump numbers and previous jump experience to engineer a suitable skydive.

(A general rule of thumb for a skydive from 10,000 ft, a jumper with no CRW experience can usually get through the first 3 Skills.)

Include a solo drill at the end of each skydive – a task for the novice to practice after break off, initially to familiarise them with their new equipment and later to learn new techniques before using them closer to larger formations. At the end of this section on page 32 is a list of Solo Drills to be practised after break off.

On completion of first tutor jump, before break off remind novice to practice flaring parachute, so they get a feel of how to land the parachute before they get to the ground. This may be the first 7 cell they have ever flown, and they do perform differently to a 9 cell. Remind them to find the stall point, so that they do not reach that point when landing.

Before the first skydive, the tutor should give a thorough briefing on CRW safety, CRW emergency procedures, spotting for CRW, exiting the aircraft, and basic flight concepts. This briefing should take at least one hour, depending on size of group and experience. Time must also be allocated for equipment – canopy allocation and rigging/connecting and packing parachutes.

The tutor may wish to give the briefing and organise equipment the night before jumping to maximise the time presented by good early morning weather conditions.

During the skydive where repetition of docks is planned; if either tutor or novice flies to an unfavourable position which will take a longer recovery time: calling out the word “next” to signal moving onto the next formation will keep the skydive flowing.

## 1. Skill 1 – Learning Basic Flight Controls

### 1.1. Objectives

Stable exit and parachute deployment

Learning Basic Flight Controls – Front Risers, Rear Risers, Toggles

### 1.2. The Dive

1. Novice exits base – 3 second delay. Flies on aircraft heading in  $\frac{1}{4}$  brakes.
2. Tutor observes novice's exit, then exits – 1 second delay (clear and pull) – and sets up next to novice, flying in same direction 1-2 canopy widths away from novice.



Novice



Tutor

3. Tutor demonstrates use of front risers – flying down and forward in relation to novice.
4. Novice uses front risers to set up alongside tutor.
5. Tutor demonstrates use of rear risers – flying up and forward in relation to novice.
6. Novice uses rear risers to set up alongside tutor.
7. Tutor demonstrates use of toggles – flying up and back in relation to novice.
8. Novice uses toggles to set up alongside tutor.
9. Tutor gives signal for novice to toggle sashay.
10. Novice demonstrates toggle sashay and observes new position in relation to tutor.
11. Tutor resets next to novice and signals for front riser sashay.
12. Novice demonstrates front riser sashay and observes new position in relation to tutor.
13. (OPTIONAL) Tutor demonstrates bumping end cells on novice.
14. (OPTIONAL) Novice uses minimal inputs to bump end cells with tutor.
15. If time allows go to Skill Level 2.
16. Break off by 3000 ft and practice solo drill.

### 1.3. Notes

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A good skydive begins from the exit – The novice should exit the aircraft stable for a good, on aircraft heading opening.

CRW canopies open firmly. If this is the novice's first CRW skydive, discuss opening characteristics of the particular canopy being used.

Heading control – look for tutor canopy or aircraft as reference, or pick something on horizon as reference, or the sun in relation to where you are when exiting. If the novice has an off heading opening, the novice should turn the parachute back onto aircraft heading, and fly on quarter brakes.

Every parachute is unique and has slightly different flight characteristics compared to another. Any difference in age, line trim, brake settings, and wing loading will also alter the performance of a parachute relative to another. Therefore, when “copying” use of controls, as a novice it is important to remember to use the same control as the instructor, but not necessarily the same amount of input.

After break off, remember to practice flaring the canopy to get a good feel of where the flare point is for landing. Also, if time and height allow, find the stall point of the canopy – to know the limit of your range before you get to the ground.

## 2. Skill 2 – Flying As A Pilot

### 2.1. Objectives

Catching / Receiving Dock

Introduction to flying as pilot of formation

Observing techniques for docking as pin

Planning down formation

### 2.2. The Dive

1. Novice exits base – 3 second delay. Flies on aircraft heading in  $\frac{1}{4}$  brakes.
2. Tutor observes novice's exit, then exits – 1 second delay (clear and pull) – and sets up next to novice, flying in same direction, no more than one canopy width away from novice.



Novice



Tutor

Tutor demonstrates set up position and techniques for smooth, controlled centre dock – placing nose and centre A-lines on novices back for novice to easily catch.



4. Novice receives dock, placing feet in centre A-lines. (If novice requires use of hands – remember to release toggles before reaching for canopy!)
5. Novice checks heading and adjusts accordingly for spot.
6. *(optional)* Novice does 360° turn.
7. Novice planes down lines (keep aware of maintaining heading), at the risers you must place feet below slider and hook them in the risers or in cross connectors (if attached).



8. If time allows go to Skill Level 3.
9. Break off by 3000 ft and practice solo drill.

### 2.3. Notes

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Harness awareness – when receiving a dock, don't reach for grip, let canopy fly to you.

Whilst picking up grips stay square in harness, and fly canopy straight – be aware of your hands and keep them from over-steering.

If the novice needs to use hands to pick up grips, they must release the toggles before reaching for the canopy.

Heading maintenance – flying as pilot use smooth controlled toggle inputs to steer. Tutor on bottom may give hand signals for direction to turn.

Plane-ing from top – release toggles, bending forward grab both centre lines (i.e. left hand takes left centre line, right hand takes right centre line) and evenly pull down lines. Pin (person docking) can help by applying some brakes to clear the nose of their parachute and come up in relation to base. The pin should also check that the canopy does not tangle with the container of the base. For plane formations, the base should lock their feet into stirrups or cross connectors.

### 3. Skill 3 – Docking As Pin

#### 3.1. Objectives

Docking as pin

Planning up formation

#### 3.2. The Dive

1. Novice exits base – 3 second delay. Flies on aircraft heading in  $\frac{1}{4}$  brakes.
2. Tutor observes novice's exit, then exits – 1 second delay (clear and pull) – and sets up next to novice, flying in same direction, no more than one canopy width away from novice.



Novice



Tutor

3. Novice sets up and approaches to place centre cell on tutor's back.
4. Tutor receives dock, placing feet in centre lines.



5. Tutor adjusts heading for spot with minor corrections.
6. *(optional)* Tutor does 360° turn.
7. Novice applies a small amount of brakes for tutor to plane down lines.



8. Repeat docking and receiving as height allows.
9. Break off by 3000 ft and practice solo drill.

### 3.3. Notes

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Aim your centre cell or A lines onto the body of the base parachutist. If you lose sight of the base's feet, then front riser out to the side you approached from, reset and try again. DO NOT brake up into the base.

Make smooth docks that are on the same heading and with a speed similar to the base. If you feel like you're approaching too fast, you're probably not, as long as you make a straight in approach. Aim your centre cell at the body or lines, the base will catch you. If the closing speed is excessive, abort by slapping your toggles, reset and try again.

Do not dock with sideways momentum to the formation.

By setting up side by side, you can note whether you are flying faster or slower than the base, and if you are "sinkier" or "floatier" than the base. From this information, you can calculate a good set up point

- If "floatier", the set up point can be slightly lower than on level when approaching the base;
- if "sinkier", the set up can be slightly higher than on level when approaching the base;
- if you out-drive the base, set up further back;
- if you fly slower than the base, keep in tight on your approach.

When plane-ing up, the novice should apply a small amount of brakes. Excessive brakes will cause their canopy to stall.

## 4. Skill 4 – Exiting 2<sup>nd</sup>

### 4.1. Objectives

Set up concepts for exiting 2<sup>nd</sup> or later

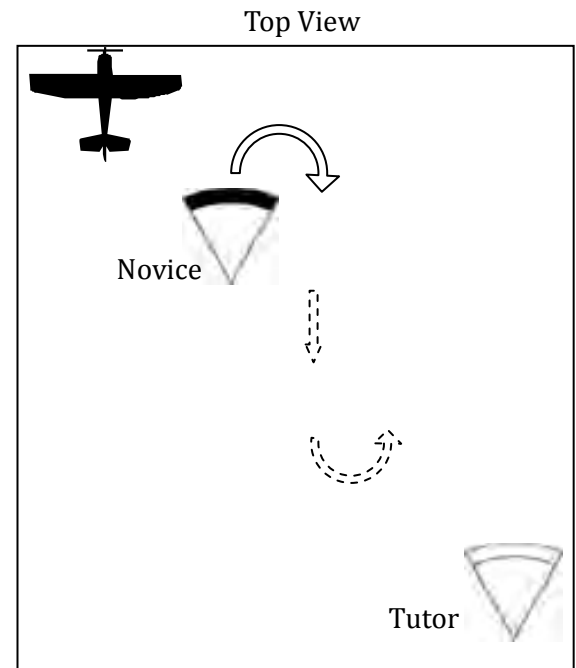
*(optional)* Runbacks

### 4.2. The Dive

1. Tutor exits base – 3 second delay. Flies on aircraft heading in ¼ brakes.
2. Novice waits for tutor to open (3 seconds) then exits, clear and pull (1 second delay).

3. Novice turns 180° inwards to tutor, flying towards set up point next to tutor (do not fly directly in front of tutor).  
Maintain at least two canopies height above tutor (you will lose this height when you turn into set up point).

Novice turns 180° before reaching set up point next to tutor (tutor is moving forwards, if you turn when you are directly next to them, you will end up behind the tutor).



5. Novice makes minor adjustments to reach desired set up next to and on level with tutor.



6. Novice docks as pin.



### 4.3. *(Optional)* Runbacks

- Tutor releases novice, and does 180° turn, followed shortly by another 180° turn – to position themselves in a similar position to where they were from exit.
- Novice repeats exercise.



## Notes

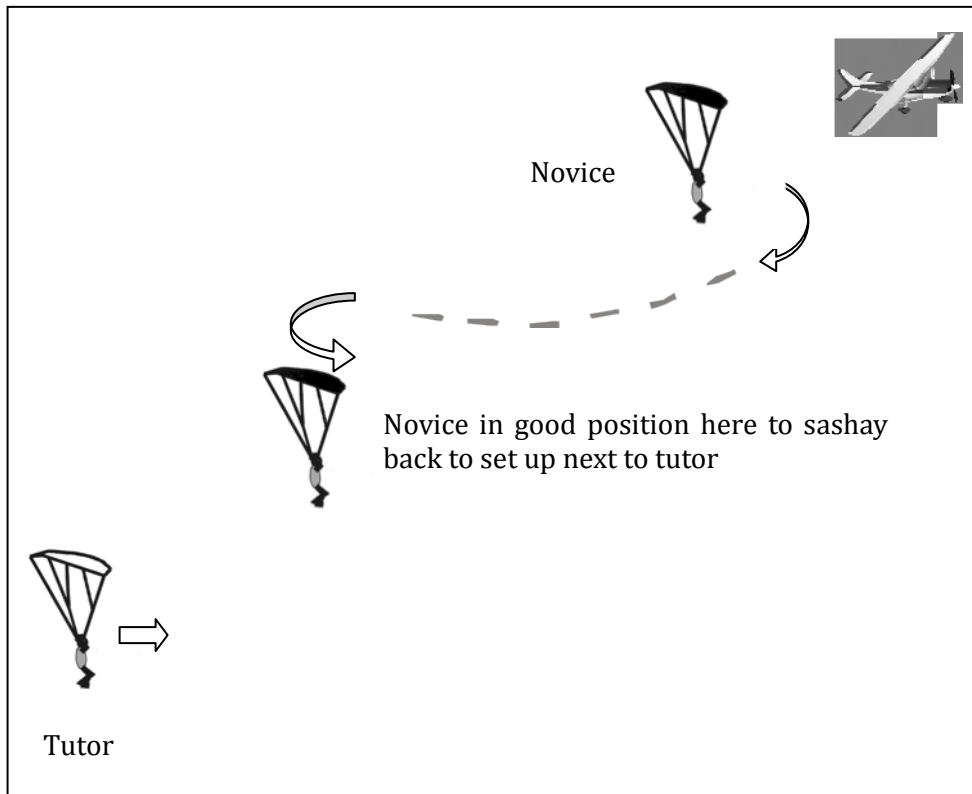
If novice takes longer than 1 second delay, and ends up on level, or below tutor, the tutor can help by sashaying or doing a quick 360° turn to lose altitude in relation to novice – giving the novice a better picture.

Conversely, if novice has very fast opening in relation to tutor, putting them very high above tutor, the novice can do a 360° turn to lose altitude in relation to tutor.

When novice approaches tutor, if novice turns too early ending up in front of, and slightly above their set up point they are in a good position. From here the novice can use sashays to lose altitude whilst working backwards in relation to the tutor. (See 'side view' diagram below)

\* Remember when sashaying to turn away from the formation first.

Side View



- During runbacks novice must keep flying their heading until tutor does the second 180° turn, to simulate exit positioning.

## 5. Skill 5 – Rotations (Through The Burble)

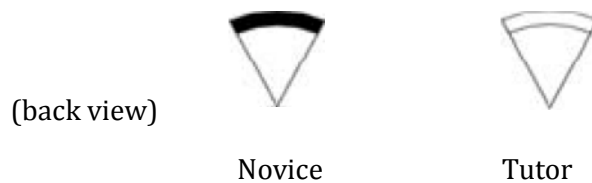
### 5.1. Objective

Rotations – over the top through the burble of the other canopy

*(Optional)* Introduction to flying a stairstep formation as wing

### 5.2. The Dive

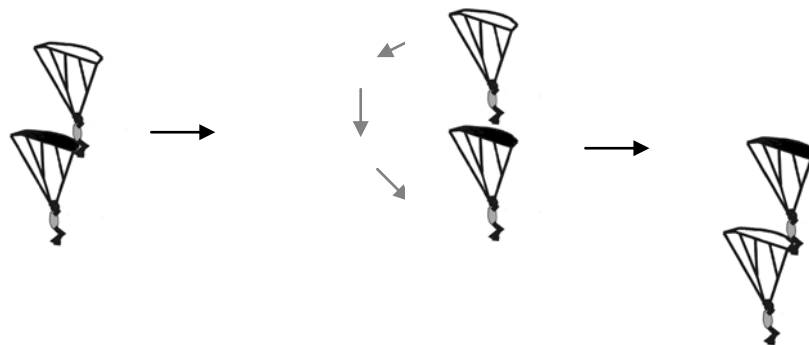
1. Tutor exits base – 3 second delay. Flies on aircraft heading in  $\frac{1}{4}$  brakes.
2. Novice waits 3 seconds (i.e. waits for tutor to open), then exits – 1 second delay (clear and pull).
3. Novice flies to set up position next to tutor.



4. Novice docks on tutor in a stack configuration.

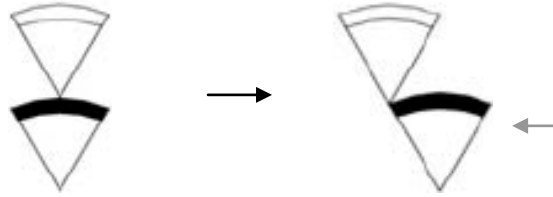


5. Tutor demonstrates rotation – releases grip, flies through the burble of the novice's canopy, and places centre cell on novice's back, to form a stack.



6. Novice releases grip, flies through burble of tutor's canopy, and places centre cell on tutor's back, to form a stack.
7. Repeat to break off or 4000 ft if proceeding to next step.

8. *(optional)* Introduction to stairsteps – At about 4000 ft, when tutor is on top of stack, tutor walks from centre cell of novice canopy out to the wing – demonstrating piloting a stairstep formation. (Whilst tutor walks out to wing, novice must maintain control of their canopy by using opposite front riser to the wing being held).



If tutor walks to left side of novice's parachute, novice must use right front riser to control canopy.

## Notes

### Rotations

Use short, sharp inputs to keep rotations tight.

Person who is rotating releases centre line grips, uses enough brake to go up and back, just passing top skin of canopy, followed immediately by enough front riser to go down and forward, and closes placing centre cell square on target's back. Once grips are released, pilot (person on top) to go on ¼ brakes and maintain heading.

You will need some power to cut through the burble of the parachute when rotating from top to bottom. If coming in with excess speed, aim high (on the lines of the other parachute), to avoid your parachute folding around the other person. In this situation, the person catching should spread out wide with their body to avoid tangling in the lines of the other parachute.

Always keep sight of who you are docking on – when rotating from top to bottom, if you front riser too much and lose sight of your target's feet – DO NOT USE BRAKES!!! – you could find yourself braking back up into the other person, resulting in a wrap. If you lose sight of your target's feet continue to front riser out to one side. When you regain sight of the other person apply some brakes to reset for another approach.

If you find yourself too far behind the formation after rotating, rather than wasting minutes of the skydive trying to slowly make it back, call "NEXT" for the pilot to rotate and dock on you. Remembering what you did to get back there so as not to repeat the mistake. This will keep the flow of the skydive and allow for lots of good practice.

## Flying a Stairstep Formation



Pin  
(rear view)

The pilot has their inside foot in the outside A-line of pin's parachute (in this example, the pilot's right foot is in the far left A-line). The pilot's leg is therefore blocking off the left cell (not allowing air to pass through it), and decreasing lift on that side of the wing.

So the right side of the pin's wing has more lift wanting to fly up and forward (potentially a wrap if it continues to fly around the pilot's leg).

To counter this, the pin must pull on the right side front riser – therefore pulling the right side of the canopy down and on level with the left side – this is called 'front riser trim', or 'wing maintenance'.

Pin should continue to watch the leading edge of their canopy whilst flying a stairstep, monitoring it to adjust trim. The wing doesn't need to be hard down on the foot of the pilot, but shouldn't rise much past the knee.

Pilot can communicate to pin using legs signals for trim adjustment:

- shaking the leg means more trim, pull down harder on front riser
- twisting the foot means less trim, ease off pressure on front riser

If novice is slow to react on holding enough trim, pilot can slowly turn away from stairstep to maintain the grip while the novice learns wing maintenance.

## 6. Skill 6 – Rotations (To The Side)

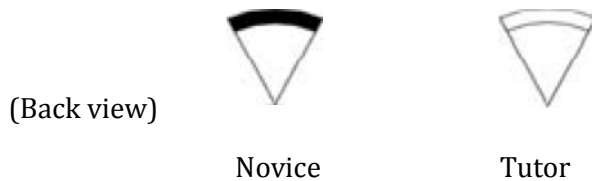
### 6.1. Objectives

Rotations – out to the side, flying in clean air to dock

*(Optional)* Introduction to piloting stairstep formation

### 6.2. The Dive

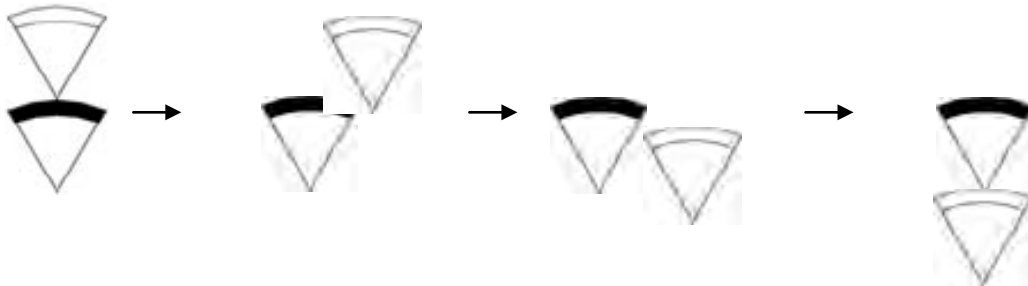
1. Tutor exits base – 3 second delay. Flies on aircraft heading in  $\frac{1}{4}$  brakes.
2. Novice waits 3 seconds (i.e. waits for tutor to open), then exits – 1 second delay (clear & pull).
3. Novice flies to set up position next to tutor.



4. Novice docks on tutor in a stack configuration.



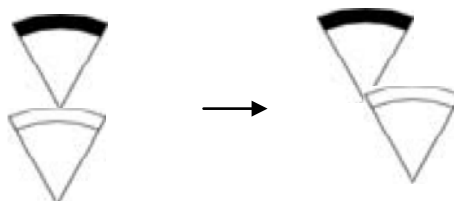
5. Tutor demonstrates rotation – releases grip, flies through clean air by manoeuvring to one side of novice's canopy and in behind to place canopy square on novice's back, to form stack.



6. Novice releases grips, flies through clean air to one side of tutor's canopy and back in behind to place canopy square on tutor's back, to form a stack.
7. Repeat to break off or 4000 ft if proceeding to next step.

### **(optional) Piloting a stairstep**

At about 4000 ft, when novice is on top, novice walks from centre cell of tutor's canopy out to the wing.



## 6.3. Notes

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### Rotations

- Going out to side, doesn't mean coming in with sideways momentum, remember to square up before you place the grip.

### Piloting a Stairstep Formation

- Walking the canopy from the centre out to the wing – release both toggles, hold onto nose as you walk canopy across. Keep square in harness.
- When piloting the wing, do not turn or lean into the bottom canopy – if anything, think about leaning away from the docked canopy.

## 7. Skill 7 – Docking third or fourth

### 7.1. Objectives

Docking 3<sup>rd</sup> or 4<sup>th</sup> in a stack

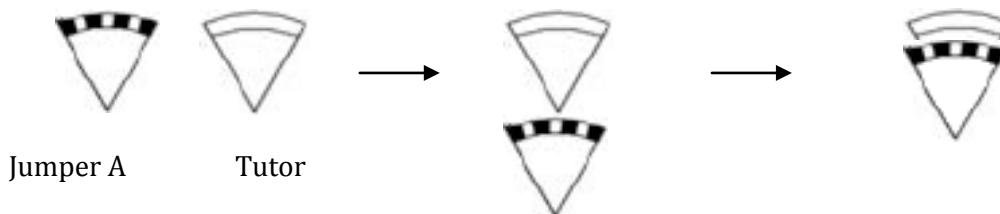
### 7.2. The Dive

This is a 4-way dive, to make it successful the other two jumpers should have at least the same experience as the novice. For this dive sequence we will call the other jumpers 'Jumper A' and 'Jumper B'.

This dive can also be done as a 3-way if not enough experienced CRW jumpers to make a 4-way.

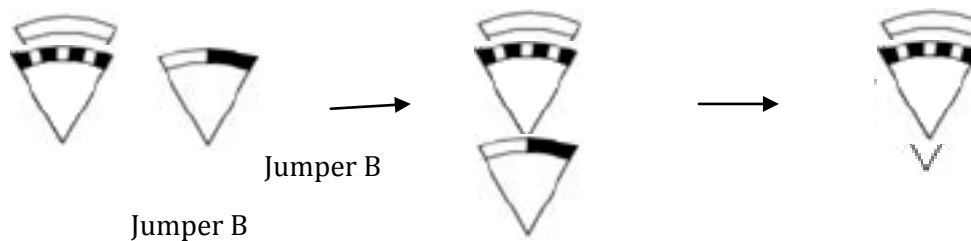
1. Tutor exits base – 3 second delay. Flies on aircraft heading in ¼ brakes.
2. Jumper A waits 3 seconds in door, then exits 2<sup>nd</sup> – 1 second delay, then flies back to tutor to set up and dock 2<sup>nd</sup> from a predetermined side (for this example, let's say from the left of tutor).

Tutor planes down formation



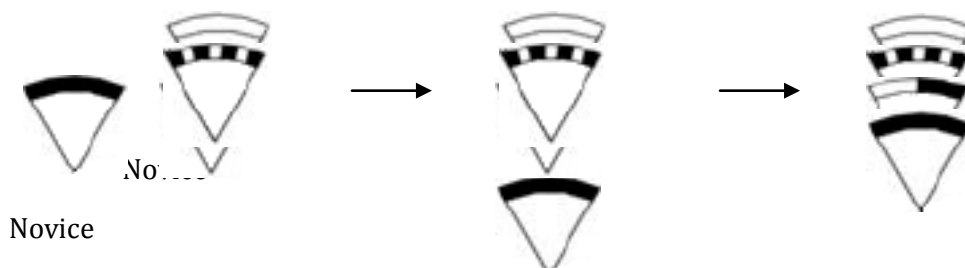
3. Jumper B waits 3 seconds in door (after Jumper A's exit), then exits 3<sup>rd</sup> – 1 second delay, then flies back to formation to set up and dock 3<sup>rd</sup> from the opposite side to Jumper A (in this example from the right).

Jumper A planes down formation



4. Novice waits 3 seconds in door (after Jumper B's exit), then exits last – 1 second delay, then flies back to formation to set up and dock 4<sup>th</sup> from the opposite side to Jumper B, (in this example from the left).

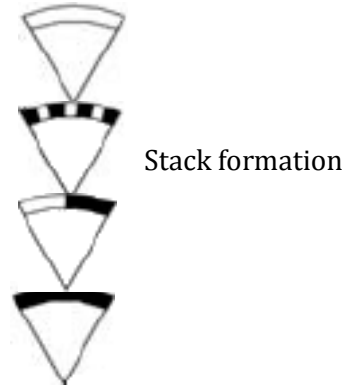
Jumper B planes down formation



5. If height allows, do run back and swap 3<sup>rd</sup> and 4<sup>th</sup> on stack, i.e. novice docks 3<sup>rd</sup> and Jumper B docks 4<sup>th</sup>.

### 7.3. Notes

- Be sure to check equipment for cross connectors before planning down. If equipment doesn't have cross connectors, then build a stack (i.e. don't plane down).



- Planning down makes formation more stable to fly, particularly if there are rough docks. Planning down also makes formation sink less than a stack – making it easier for 3<sup>rd</sup> and 4<sup>th</sup> to dock on.
- Docking 3<sup>rd</sup> or 4<sup>th</sup> – when setting up next to the formation, set up on the person you are docking on, not the pilot. If you set up at the pilot's height, you are too high, and therefore will come into the formation with excess speed. Note that a stack configuration will have more sink than a single parachute.
- Break off – drop one at a time from the bottom up, or countdown and break together – going to the same side you docked from.



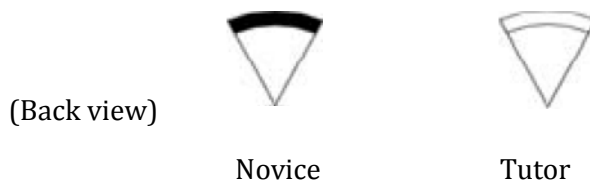
## 8. Skill 8 – Stairsteps / Wings

### 8.1. Objectives

Docking and receiving stairstep formations

### 8.2. The Dive

1. Tutor exits base – 3 second delay. Flies on aircraft heading in  $\frac{1}{4}$  brakes.
2. Novice waits 3 seconds (i.e. waits for tutor to open), then exits – 1 second delay (clear and pull).
3. Novice flies to set up position next to tutor.



4. Novice docks on tutor in a stairstep configuration (applying trim as necessary once docked).



5. Tutor releases grip and docks on novice in stairstep configuration.



6. Repeat as height allows.

### Notes

When docking a stairstep (or wing dock) it is important to wash off excess speed before placing grip. If you come in fast, the wing that isn't docked will continue to fly forward and around the person you have docked on – causing a wrap.

Aim the grip high – a common mistake of the person giving the dock is looking at the feet of the base, therefore aiming the corner of their parachute too low, making it hard for the base to get the line – usually resulting in the base putting their foot in the parachute's cell, or the novice flying underneath the formation. Aim the corner of your parachute under the base's arm, then the line is easily caught by base.

Once you have docked, continue to fly your parachute – see notes on “Flying a Stairstep Formation” in Skill Level 5.

When receiving a stairstep grip remember to keep square in your harness – do not reach for grip or lean into grip.

## 9. Solo Drills

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New techniques to practice after break off, to familiarise yourself with the new equipment, or try new flying techniques/skills on your own before attempting near a bigger formation.

*Note: Always make sure you are in a good spot to practice your solo drills, i.e. head back to drop zone first, and always make sure you have clear airspace when practicing drills.*

### Practice Flare

After break off from your first jump on a CRW specific canopy, familiarise yourself with the flare point of the parachute. Practice at least twice. Also, if height allows, try to stall the canopy – so you know the limit you do not want to reach when landing.

### Control familiarity

practice grasping front risers and rear risers without looking for them, so you don't lose sight of the formation looking for your controls while trying to dock – practice until you can do this instinctively. Your drill could be:

- look at front risers, grab front risers,
- release front risers,
- grab front risers without looking at them,
- repeat as necessary.

Do same drill for rear risers.

### Harness turns

You can steer your parachute by leaning in your harness. This is a very subtle method of steering, and ideal for slight heading changes.

When used in conjunction with a riser input, your harness will accentuate a turn (also good when flying a wing to assist in holding trim).

There are different methods to using harness inputs – try some of the following to find out what is most effective for you (try first with harness only then add riser input to see effectiveness):

- Leaning your weight to one side will make your parachute veer slightly to the side you are leaning.
- Lifting one leg higher than the other (from the thigh) will steer the parachute away from the lifted leg.
- Lifting both legs up, keeping feet together, and pointing feet to front corner of canopy will steer canopy to the side you are pointing your feet.

### Cross control (“Warping”)

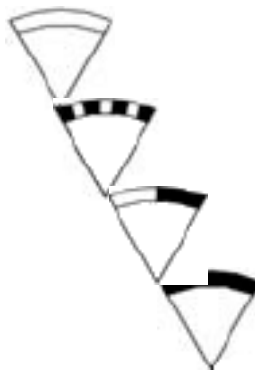
Holding down one front riser and opposite toggle to warp the canopy. This kills the lift and forward drive of the canopy – if done effectively will stop you in place, relative to the formation.

## 10. Advanced CRW Training

Now you have successfully completed the CRW Training Table, you can safely practice all the skills you have learnt in this manual and do CRW with other skydivers who have (at least) completed the same level of training.

For advanced training, seek advice from CRW tutors, or attend an advanced CRW course. In doing so you will be encouraged to learn more skilful CRW techniques which could include some of the following:

- Completing your CRW Crest (be in a successful canopy formation involving 8 or more parachutists)
- Top Docking
- Flying “Stairstep” formations



- Flying “diamond” formations



See Appendix for more references to CRW – links to websites and current competition dive pools.

## 11. CRW Training Descent Table

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*Refer to Operational Regulations Section 11.6*

<b>Skill Level 1</b>	<b>Learning Basic Flight Controls</b> Stable exit and parachute deployment Learning Basic Flight Controls <ul style="list-style-type: none"><li>▪ Front risers</li><li>▪ Rear risers</li><li>▪ Toggles</li></ul>
<b>Skill Level 2</b>	<b>Flying as a Pilot</b> Catching / Receiving Dock Introduction to flying as pilot of formation Observing techniques for docking as pin Planing down formation
<b>Skill Level 3</b>	<b>Docking as Pin</b> Docking as pin Planing up formation
<b>Skill Level 4</b>	<b>Exiting 2<sup>nd</sup></b> Set up concepts for exiting 2 <sup>nd</sup> or later (Optional) Runbacks
<b>Skill Level 5</b>	<b>Rotations (Through the Burble)</b> Rotations – over the top, through the burble of other canopy (Optional) Introduction to Flying a Stairstep Formation as Wing
<b>Skill Level 6</b>	<b>Rotations (To the Side)</b> Rotations – out to the side, flying in clean air to dock (Optional) Introduction to Piloting a Stairstep Formation
<b>Skill Level 7</b>	<b>Docking 3<sup>rd</sup> or 4<sup>th</sup></b> Docking 3 <sup>rd</sup> or 4 <sup>th</sup> in a stack
<b>Skill Level 8</b>	<b>Stairsteps / Wings</b> Docking and receiving stairstep formations