

Australian Parachute Federation Incorporated

CANOPY RELATIVE WORK TRAINING GUIDE



**A Guide for Coaches
and
Novice Canopy Relative Workers**

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Status: Educational

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Alternatively, contact the APF Office for a paper copy at a cost of \$5.00



1.1. Warning

Parachuting and flying in parachuting aircraft can be dangerous.

1.2. Price

This Training Guide is offered free to APF Members.

1.3. About this publication

This Training Guide is produced by The Australian Parachute Federation (APF) for the information of APF members. If you want more information or copies of this guide (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

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

This guide has been produced for the information and assistance of APF members. It is not a do-it-yourself guide and 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 Coach and must only be used in accordance with this training. Information in this guide may not be applicable to all types of manoeuvres, operations or canopy descents.

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

1.5. Copyright

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1.6. Revision

Updated (Jules McConnel) 19 Mar 2010 and Tom Begic 17/04/2015. Revisions (National Office) were published on 28 Sept 2011, 13/12/2013 and 20/04/2015.

1.7. Credits

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! APF would also like to thank Tom Begic and others for their contributions to updates.

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2. Index and References

2.1. Contents

2. Index and References	3
3. Notes for Coaches	4
4. Equipment	5
5. Basic Safety.....	6
6. Glossary / Terminology.....	8
7. Learning Basic Flight Concepts and Controls.....	10
8. Communication / Signals	12
9. CRW Emergency Procedures	14
10. Skill Levels	18
11. Skill 1 – Learning Basic Flight Controls	19
12. Skill 2 – Flying as a Pilot.....	21
13. Skill 3 – Docking As Pin	23
14. Skill 4 – Exiting 2 nd , as part of a 3 or 4 stack.....	25
15. Advanced Skill 5 – Rotations (Through the Burble)	27
16. Advanced Skill 6 – Rotations (To the Side).....	30
17. Advanced Skill 7 – Docking third or fourth	32
18. Advanced Skill 8 – Stair-steps / Wings	34
19. Solo Drills	35
20. Advanced CRW Training.....	36
21. CRW Training Table.....	37

2.2. For More Information

For more information on CRW:

www.ozcrw.tripod.com

www.diamondquest.org

For current Canopy Formation competition dive pools, go to the APF web site www.apf.com.au

2.3. Bibliography

Mike Lewis, CRW Emergency Procedures article

Tom Begic, information from www.canopyformation.org and www.diamondquest.org

3. Notes for Coaches

This Training Guide 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 Coaches 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

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 coach'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.

Referring to APF Operational Regulation 9.3 before commencing CRW training the candidate should have at least an APF Parachutist Certificate B, and Op Reg 7.1.6 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 training guide 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.

The first four skill levels must be completed as per the Canopy Relative Work (CRW) Training Table in Appendix M of the APF Training Operations Manual (see also section 21 at back of this Guide). The additional advanced stages are recommendations only.

4. Equipment

The following items are essential for safely doing CRW:

4.1. Rig

- 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

- Use a canopy that follows current CRW trends and is considered compatible.
- 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

- 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

- 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 7.1.5 “An approved and functioning visual altimeter set to indicate height above the DZ shall be worn on all descents.”

5. Basic Safety

5.1. General

- 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 9.3.3 “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

- Make sure DZSO, manifest, loadmaster, 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

- 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

- 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 coach.

6. Glossary / Terminology

6.1. Commands

Commands – what you may hear during a CRW skydive

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

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

6.2. Other terms



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



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

Stair step/Wing

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.

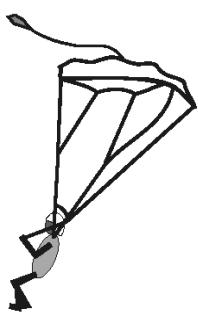


7.4. Toggles

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

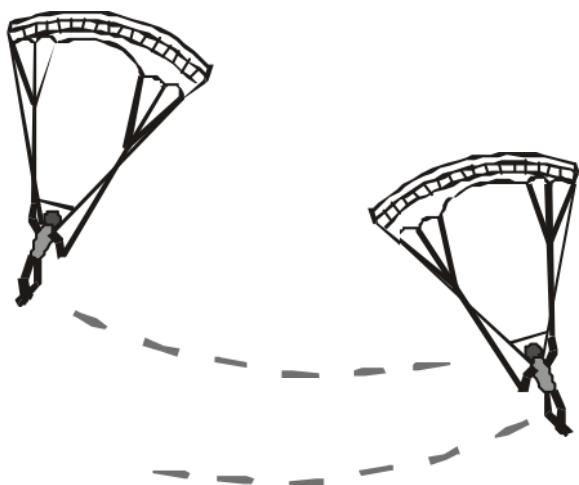
7.5. Stalling

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

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. Hand or Arm Signals

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

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

By covering all the basic safety and equipment guidelines outlined earlier in the guide, 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. Canopy Deflation (Hinging)

Older seven cell parachutes would often de-pressurise as a result of a poor dock. This would lead to cell closure, partial shutdown, or total deflation of a canopy. The most common scenario is a stack dock leading to a wrap. The common practice is to untangle the mess if possible, and literally shake air into the canopy to initiate re-inflation. If shaking the deflated canopy does not reinflate it, dropping it from the formation gives it some more air speed, which will usually reinflate it (akin to a secondary deployment of the canopy). The person being dropped must be prepared for possibilities such as line twists and cell closure. If the person who is wrapped is unable to drop the canopy away, the bottom person would then have to commence emergency procedures. The wrapped person then attempts to clear the mess away from their body.

Modern CRW parachutes have been designed to maintain and/or attain pressurisation regardless of what forces they are exposed to. They tend to hinge or bend at the point where they hit another parachute or person and then bounce off it. They also tend to pressurise faster. The deflation scenario is also possible. This has meant that CRW jumpers (Rotations and 8-way Speed plane docks in particular) can dock at greater speeds and forces than before, which in turn has improved times.

9.3. Wraps

This is when a parachute wraps around a body and is usually caused by one parachutist docking their canopy at a poor angle or speed around the body of another parachutist. This is a low speed emergency as you usually still have at least one fully inflated parachute above the wrap. This is a supported situation. If a cutaway is required, the lower person usually has first right of way.

There are several scenarios. The subtitles used below are an attempt to describe each scenario; they are not official CRW jargon. There are scenarios to consider for 2-ways and larger formations. Most people, especially students, should only learn the 2-way techniques first.

The pilot should maintain heading (minimise turns) and height awareness throughout. The bottom person should communicate what (s)he sees (lines, location of feet, where tangled, etc.) to the pilot, as it is sometimes difficult for the pilot to see what is below the canopy material. The pilot should not drop the bottom canopy unless all other options have been explored and all persons have agreed to pursue that option.

2-Ways

1. Deflation Around Lower Body

The pilot should locate the leading edge top skin of the wrapped canopy and attempt to shake it out (to the side) from his body. The further you can reach away from the centre cell, the better. The pilot is trying to reinflate the lower parachute. If unsuccessful, the pilot should drop the bottom parachutist and allow airspeed the opportunity to reinflate the parachute. If the bottom parachute does not reinflate, the lower person should initiate emergency procedures. Be careful not to drop the parachute directly into other people or the path they are flying. Other people should keep the area clear too.

2. Deflation Around Lower Body With Tangled Lines

Try to untangle the lines first and then follow the procedure from situation 1 above.

3. Deflation Around Upper Body

In this case, there is a chance that the pilot will not be able to see anything, and that their hands may not be free at all. If the bottom canopy is totally deflated, there is also the chance that the weight of the lower parachutist may make it difficult to lift and manoeuvre lines around to untangle them. Another issue is if the canopy is twisted around the head or risers of the person above, it will be almost impossible to move the canopy from the narrower risers past the wider body. There is also a greater chance that maintaining heading and descent will be more difficult due to interference with the brake lines of the top canopy. Make an attempt to clear the mess from above you to below, and then follow the procedure from situation 2 above. If the bottom person cuts away, the top person should attempt to clear the mess and throw it off themselves. Due to the chance of line entanglement, interference with control lines, and the possibility of reinflation, the top person (pilot), may have to consider a cutaway.

4. Deflation Around Upper Body With Tangled Lines

This is the situation where you are most likely to have to use your hook knife. It is more like an entanglement than wrap. Try to untangle the lines and focus on keeping them away from your Reserve equipment. Then follow the advice from situation 3 above.

5. Fully Enclosed Wrap

Trying to locate anything is difficult due to a lack of visibility. Always try to clean the mess and get the bottom canopy flying. Try to get your head and/or your hands free at a minimum. Failing that, follow the advice from the steps above as appropriate. DO NOT be the first to cutaway in this situation. You have a higher chance of surviving a spiralling landing than an enclosed fully deflated wrap. Keep the inflated canopy above your head until you are sure that you can clear away from the wrap to deploy a Reserve. Despite the protests of the person below you, you may have to use your hook knife to give yourself some breathing space.

6. High Tension Restrictive Enclosed Wrap

Now we are getting really exiting. This is very uncomfortable, especially if you are claustrophobic. The tension is created from the weight of the lower jumper and/or the spiralling action of the canopies. As always, try to clear the mess to get yourself into a simpler situation. You are more than likely going to be constrained in this scenario and your first step will be to reduce the tension. Try to stop the spiralling action first by using all means possible (harness balance, control inputs, etc.). Then try to resolve the weight issue. Usually this will require the bottom person cutting away but it may also be achieved by altering where the tension is acting. Sometimes another option in scenarios 5 and 6 is for the bottom person to cutaway and for the pilot to push all the material up and then cutaway as well.

In each of the above situations, your objective is to move yourself into a higher situation (i.e. situation 2 -> clear lines -> situation 1 -> drop parachute = resolved) as they are easier to deal with.

If you are below a safe cutaway height, you have a number of options. One is to land the formation as is. Due to a much higher descent rate and drag from the collapsed canopy, the flaring capabilities are much lower. The landing will be much harder. You could try landing in softer areas such as water, shrubs, etc., but this adds complexity, risk, and other hazards. The other option is for the lower man to do an inflight transfer.

Bigger-ways require breaking down each scenario into components and then making decisions as if you are in a series of 2-ways. There are scenarios where this will not be possible. You will have to make decisions based on your knowledge and what you see in the situation you are in.

9.4. Entanglements

This is when parachute equipment tangles up together and is often caused by the body of one parachutist passing through the lines of another parachutist. This may be either a low or high-speed malfunction and has the potential to change from one to another very quickly. There are usually heading and descent issues (entanglements often spiral). This situation usually requires quicker action than a wrap. This situation usually spirals with both canopies and lines tangled in the centre of the situation and the jumpers on the outside, clear of all material. The canopies often collapse and reinflate. It is an unsupported situation.

If there is ample altitude, you should make an attempt to untangle by following the lines out. Consideration should be given to situations where material is rubbing against other material at high G forces. This will lead to equipment damage and you may be better off disconnecting the Main parachute to minimise this damage. Remember that your choice should be based on self-preservation first and equipment preservation second.

If a canopy collision is imminent, the jumper should protect their Reserve rip cord with one hand and spread the other hand and both legs to catch as many lines as possible. This may stop or minimise lines passing through. If you cover your face, your handles will be reasonably well protected because your arms/elbows will probably cover your handles anyway. Remember to consciously do this. It can be very problematic to have a Reserve deploy into an entanglement.

The higher person has priority in cutting away in entanglements. They must ensure that there are no lines or material still connected to their body prior to cutting away. Otherwise they'll take the canopy and the lower jumper back into freefall with them. This could be ugly if trying to deploy a Reserve whilst in this situation. If you can't manually untangle the mess, use a hook knife if necessary.

There are several reasons why the higher person gets priority.

- The lower person will be able to load both canopies if they remain connected after the top person cuts away. They are more likely to stay below the canopies due to their weight. Once the top person is out of his way, they can then safely cutaway and deploy their Reserve.
- The top person is more likely to be tangled/wrapped with lines and material and the bottom person is more likely to be clear of material. Give the person in the worst predicament the best chance to escape. The top person should cut the tangled material prior to cutting away.
- If the top person cuts away first whilst he is caught up in lines, he may radically alter the orientation of the situation and leave the bottom person worse off. The bottom person may become the top person.
- Depending on how the entanglement and canopies are moving (note that I am not using the word flying anymore), a cutaway, deflated canopy may wrap the higher jumper and leave them in a mess whilst in freefall. They may not be able to access their Reserve handles and their Reserve may be covered.
- The top person is closer to both canopies and is more likely to remain tangled (or become involved in an enclosed wrap) if the bottom person cuts away first.

If you find yourself below a safe cutaway height, your only option is to deploy your reserve and start praying to your chosen spiritual leader.

9.5. Communication

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

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 coach 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 jump 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. Section 9 has a list of Solo Drills to be practised after break off.

On completion of first coach 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 jump, the coach should give a thorough briefing on CRW safety, CRW emergency procedures, spotting for CRW, exiting the aircraft, and basic flight concepts. A thorough briefing 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 coach 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 jump where repetition of docks are planned; if either coach 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.

11. Skill 1 – Learning Basic Flight Controls

11.1. Objectives

Stable exit and parachute deployment

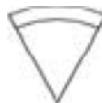
Learning Basic Flight Controls – Front Risers, Rear Risers, Toggles

11.2. The Dive

1. Novice exits base – 3 second delay. Flies on aircraft heading in $\frac{1}{4}$ brakes.
2. Coach 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



Coach

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

11.3. Notes

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 coach 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.

12. Skill 2 – Flying as a Pilot

12.1. Objectives

Catching / Receiving Dock

Introduction to flying as pilot of formation

Observing techniques for docking as pin

Planning down formation

12.2. The Dive

1. Novice exits base – 3 second delay. Flies on aircraft heading in $\frac{1}{4}$ brakes.
2. Coach 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



Coach

3. Coach 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.

12.3. Notes

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. Coach 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.

13. Skill 3 – Docking As Pin

13.1. Objectives

Docking as pin

Planning up formation

13.2. The Dive

1. Novice exits base – 3 second delay. Flies on aircraft heading in $\frac{1}{4}$ brakes.
2. Coach 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



Coach

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



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



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

13.3. Notes

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.

14. Skill 4 – Exiting 2nd, as part of a 3 or 4 stack

14.1. Objectives

Set up concepts for exiting 2nd or later

(optional) Runbacks

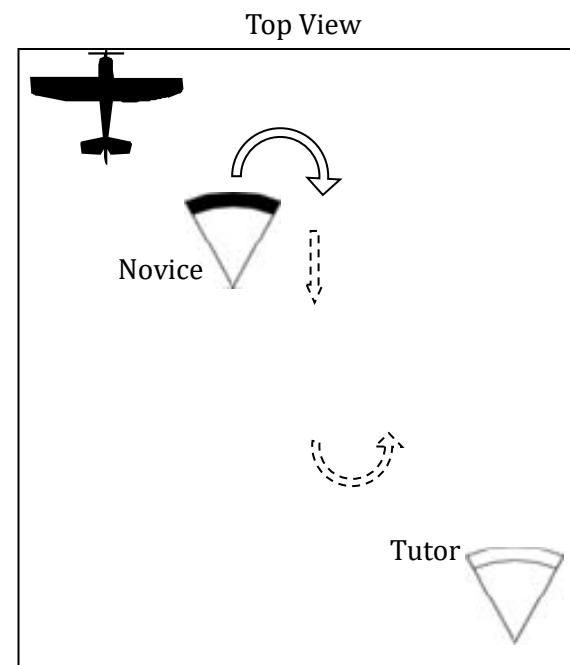
14.2. The Dive

1. Coach exits base – 3 second delay. Flies on aircraft heading in $\frac{1}{4}$ brakes.
2. Novice waits for coach to open (3 seconds) then exits, clear and pull (1 second delay).

3. Novice turns 180° inwards to coach, flying towards set up point next to coach (do not fly directly in front of coach).
Maintain at least two canopies height above coach (you will lose this height when you turn into set up point).
Novice turns 180° before reaching set up point next to coach (coach is moving forwards, if you turn when you are directly next to them, you will end up behind the coach).
5. Novice makes minor adjustments to reach desired set up next to and on level with coach.



6. Novice docks as pin.



14.3. (Optional) Runbacks

- Coach 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.

14.4. Notes

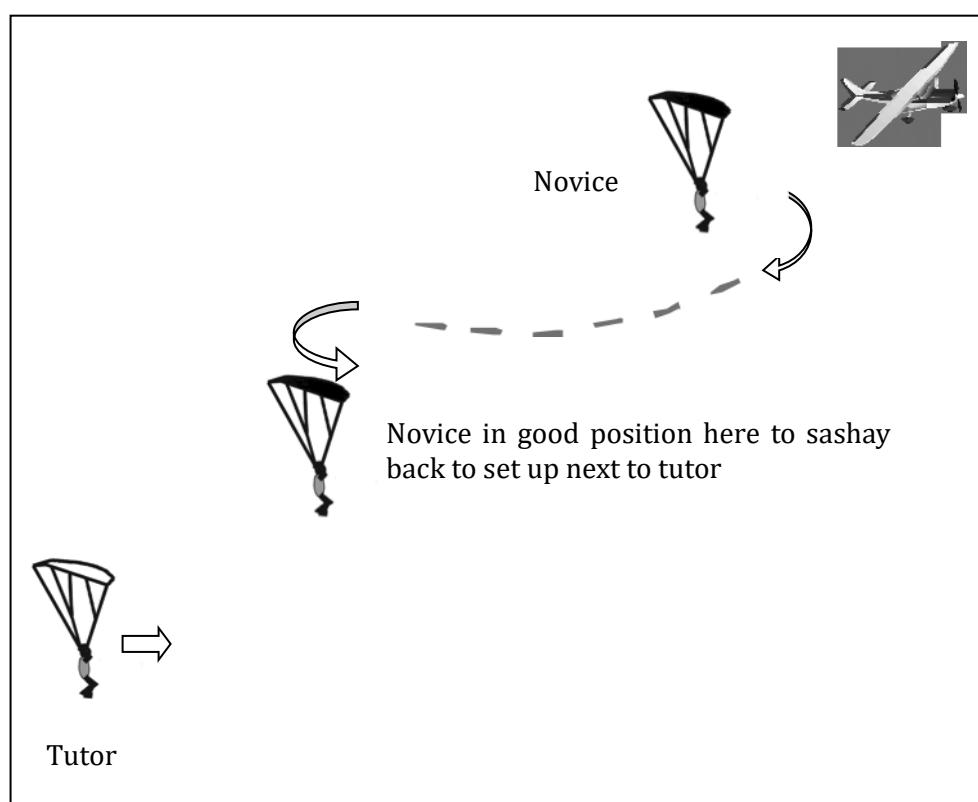
If novice takes longer than 1 second delay, and ends up on level, or below coach, the coach can help by sashaying or doing a quick 360° turn to lose altitude in relation to novice – giving the novice a better picture.

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

When novice approaches coach, 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 coach. (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 coach does the second 180° turn, to simulate exit positioning.

15. Advanced Skill 5 – Rotations (Through the Burble)

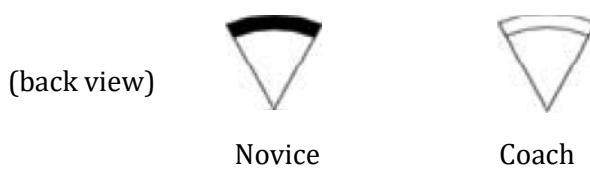
15.1. Objective

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

(Optional) Introduction to flying a stair-step formation as wing

15.2. The Dive

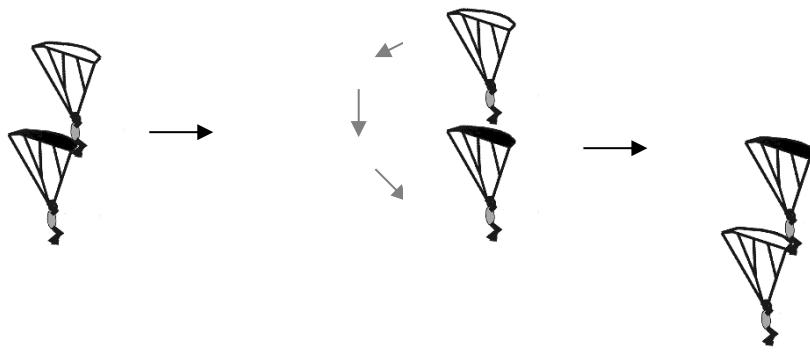
1. Coach exits base – 3 second delay. Flies on aircraft heading in $\frac{1}{4}$ brakes.
2. Novice waits 3 seconds (i.e. waits for coach to open), then exits – 1 second delay (clear and pull).
3. Novice flies to set up position next to coach.



4. Novice docks on coach in a stack configuration.

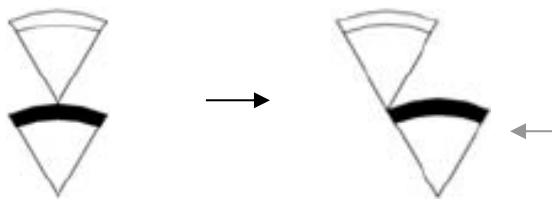


5. Coach demonstrates rotation – releases grip, flies through the burble of the novice's canopy, and places centre cell on novice's back, to form a stack.



(Side View)

6. Novice releases grip, flies through burble of coach's canopy, and places centre cell on coach's back, to form a stack.
7. Repeat to break off or 4000 ft if proceeding to next step.
8. (optional) Introduction to stair-steps – At about 4000 ft, when coach is on top of stack, coach walks from centre cell of novice canopy out to the wing – demonstrating piloting a stair-step formation. (Whilst coach walks out to wing, novice must maintain control of their canopy by using opposite front riser to the wing being held).



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

15.3. 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 $\frac{1}{4}$ 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 Stair-step Formation



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).

Pin
(rear view)

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 stair-step, 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 stair-step to maintain the grip while the novice learns wing maintenance.

16. Advanced Skill 6 – Rotations (To the Side)

16.1. Objectives

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

(Optional) Introduction to piloting stair-step formation

16.2. The Dive

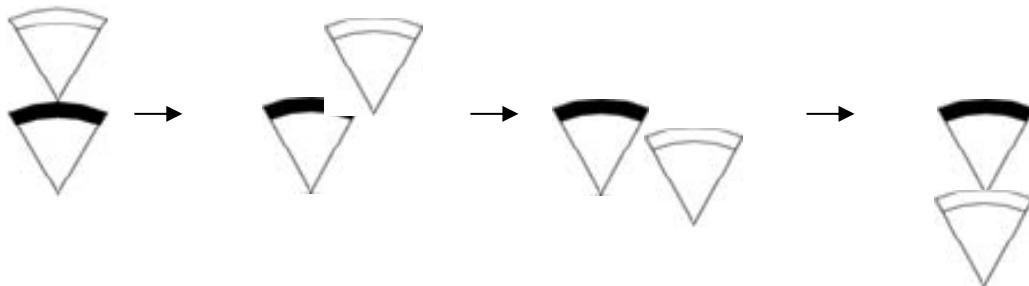
1. Coach exits base – 3 second delay. Flies on aircraft heading in $\frac{1}{4}$ brakes.
2. Novice waits 3 seconds (i.e. waits for coach to open), then exits – 1 second delay (clear & pull).
3. Novice flies to set up position next to coach.



4. Novice docks on coach in a stack configuration.



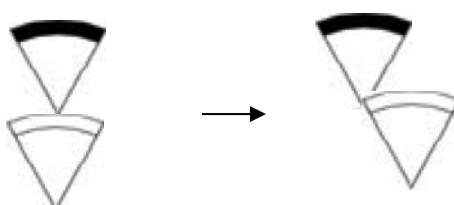
5. Coach demonstrates rotation – releases grip, flies through clean air by manoeuvring to one side of novice's canopy and in behind to place canopy square on novice's back, to form stack.



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

(Optional) Piloting a stair-step

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



16.3. Notes

Rotations

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

Piloting a Stair-step 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.

17. Advanced Skill 7 – Docking third or fourth

17.1. Objectives

Docking 3rd or 4th in a stack

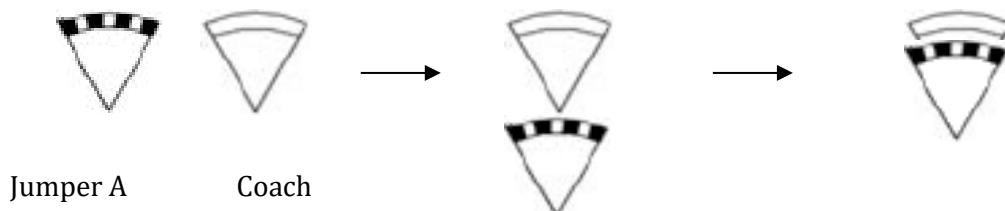
17.2. The Dive

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.

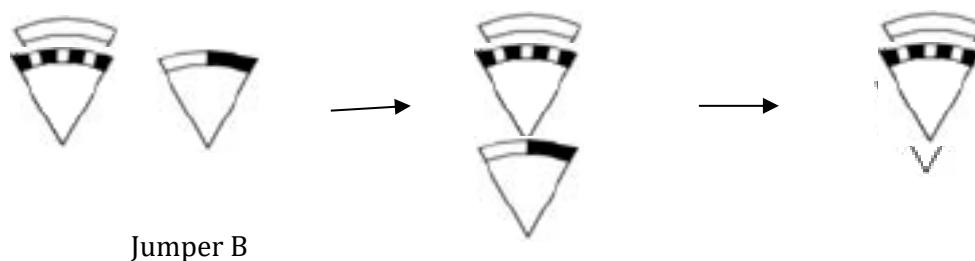
1. Coach exits base – 3 second delay. Flies on aircraft heading in $\frac{1}{4}$ brakes.
2. Jumper A waits 3 seconds in door, then exits 2nd – 1 second delay, then flies back to coach to set up and dock 2nd from a predetermined side (for this example, let's say from the left of coach).

Coach planes down formation



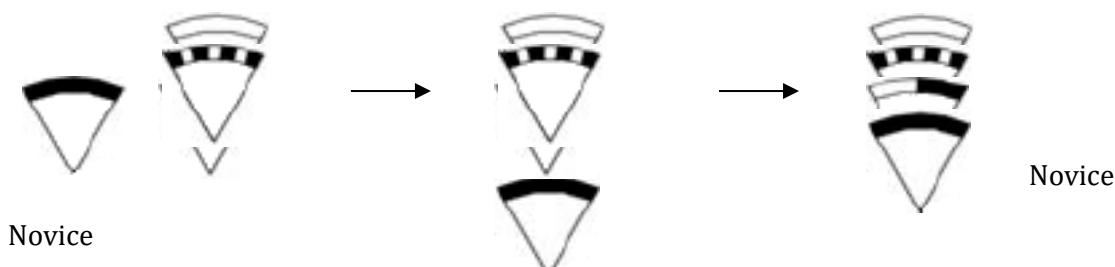
3. Jumper B waits 3 seconds in door (after Jumper A's exit), then exits 3rd – 1 second delay, then flies back to formation to set up and dock 3rd from the opposite side to Jumper A (in this example from the right).

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 4th from the opposite side to Jumper B, (in this example from the left).

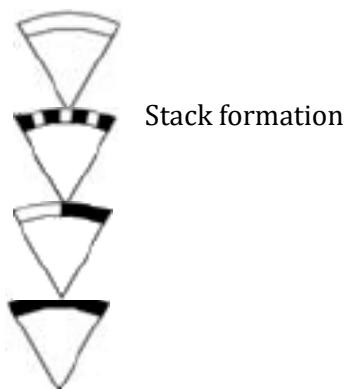
Jumper B planes down formation



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

17.3. 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 3rd and 4th to dock on.
- Docking 3rd or 4th – 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.

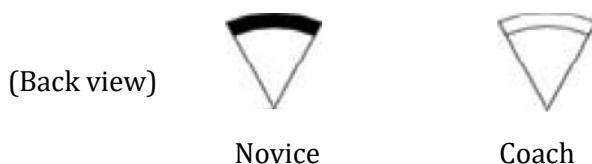
18. Advanced Skill 8 – Stair-steps / Wings

18.1. Objectives

Docking and receiving stair-step formations

18.2. The Dive

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



4. Novice docks on coach in a stair-step configuration (applying trim as necessary once docked).



5. Coach releases grip and docks on novice in stair-step configuration.



6. Repeat as height allows.

18.3. Notes

When docking a stair-step (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 Stair-step Formation” in Skill Level 5.

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

19. Solo Drills

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.

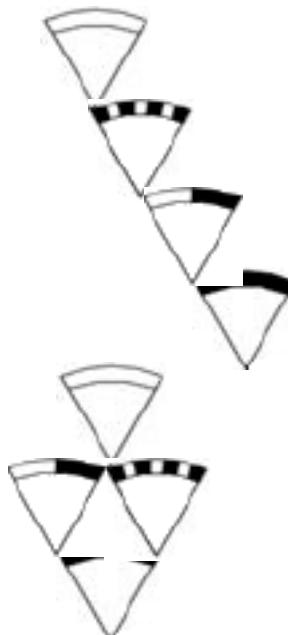
20. Advanced CRW Training

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

For advanced training, seek advice from CRW Coaches, 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 “Stair-step” formations

- Flying “diamond” formations



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

21. CRW Training Table

Refer to APF Training Operations Manual Appendix M.

Coach qualifications: Appointment by a CI.

Skill Level 1

Canopy flying techniques:

Exercise 1: Front riser flying

Exercise 2: Turning in formation

Exercise 3: Front riser sashays.

Skill Level 2

Base and pin (coach on top)

Landing the formation is at the discretion of the coach.

Skill Level 3

Base and pin (trainee on top)

Landing the formation is at the discretion of the coach.

Skill Level 4

Docking third and fourth

Planning the dive

Landing the formation is at the discretion of the coach.