CANOPY FORMATION COACHING MANUAL

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British Skydiving Canopy Formation Manual is updated periodically. As British Skydiving rules are continually evolving, our primary operational document, the British Skydiving Operations Manual, is regularly updated at meetings of the Safety & Training Committee which are held every two months. Therefore, in the case of any conflict between rules or requirements set out in the Operations Manual and any other British Skydiving manual, the provisions in the Operations Manual shall always have primacy as the definitive statement of the current position.

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The latest version of this document is available in electronic format www.britishskydiving.org

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Contents

1. Introduction to Canopy Formation Coaching

This manual is designed to be used by CF Coaches in conjunction with briefings, dirt-dives and jumps in order to introduce skydivers to CF in a safe and structured manner. The emphasis of this coaching is on safety in the air and promoting well-designed, executed and debriefed CF jumps that take into account issues such as equipment, weather conditions and exit order alongside the technical aspects of making canopy formations.

CF is a lot of fun and, if done well, can improve canopy handling ability. Through CF1 and CF2 skydivers can develop their ability to use the controls available to them under canopy in order to fly relative to, avoid and make contact with other jumpers and their parachutes. CF1 and CF2 coaching also promotes piloting skills that are incalculably valuable and relevant to all skydivers.

Done badly, CF can significantly increase the risk of serious injury and death already inherent to skydiving. Therefore, anyone interested in learning these skills should seek appropriate coaching from a CF Coach.

1.1 To be a British Skydiving approved CF Coach, a skydiver must meet the following requirements:

a) Have a minimum of 2 years in Skydiving
b) Have a minimum of 100 CF jumps, with at least 10 completed within the previous 6 months
c) Be of proven CF ability
d) Have CF-specific equipment included on their Packing Certificate under 'Specialised Equipment' or in their logbook and signed by an appropriate Rigger or Instructor
e) Be fully familiar with the current CF Manual
f) (i) be a Category System or AFF Basic Instructor, or
(ii) have attended a Sports Coach UK Course on 'Coaching Methods and Communication,' or
(iii) have specific teaching or coaching qualifications, or
(iv) have attended a Methods of Instruction lecture, given by an Advanced Instructor, or
(v) have attended a Military Methods of Instruction Course
g) Be evaluated by an Advanced Instructor who is a CF Coach, or by a CF Coach nominated by a British Skydiving Advanced Instructor

NB(1) A British Skydiving approved CF Coach may coach both CF1 and CF2
NB(2) To make an application, see CF Coach Application (Form 134A)

CF Coaches' Objectives are:

a) To help the student feel at ease learning CF (which can be a daunting experience)
b) To provide the student with the knowledge necessary for them to safely make CF jumps
c) To ensure that the student uses appropriate equipment when making coached CF jumps
d) To develop the student's canopy skills by teaching the exercises set out in this manual
e) To communicate in-air to maximise the student's learning throughout the skydive
f) To give the student constructive critique and corrective training after the skydive
g) To promote CF as a discipline, and be a positive representative of the CF community
h) To represent current standards of good conduct as a British Skydiving approved Coach and adhere to the British Skydiving Code of Practice for British Skydiving Instructors and Coaches (Form 288)

1.2 Before starting CF1 / CF2 coaching, a skydiver must have:

For CF1

a) At least a British Skydiving B Licence.
b) A minimum of 100 jumps, with at least 5 made in the last 2 months.
c) Received 'Safety Briefing 1: Canopy Formation Basics' (see section 2.1) from a CF Coach.

For CF2

a) CF1 Grade.
b) Received 'Safety Briefing 2: Considerations for Larger Canopy Formations' (see section 3.1) from a CF Coach.

1.3 To achieve a CF1 / CF2 Grade, a skydiver must demonstrate the ability to:

CF1

a) Safely approach, and fly in close proximity to, a target canopy.
b) Control 3D movement relative to another canopy using appropriate inputs.
c) Dock safely on one other person having exited the aircraft after them.
d) Receive a centre dock and pilot a 2-stack / 2-way plane.
e) Receive and make a wing dock.
f) Brief the Pilot and spot for a 2-way CF jump from at least 8,000ft AGL.
g) Land safely within 50m radius of a pre-declared target and show good altitude, heading and airspace awareness throughout each qualifying jump.
h) Pack CF-specific equipment of the type(s) they are using (to be added to the student's packing certificate or logbook).

NB(1) An ability to pack CF-specific rigs is likely to be necessary to a jumper safely continuing with CF and a CF1 holder is likely to encounter types of CF kit and CF packing methods other than that covered during their CF1 coaching. Any equipment that they jump must be added to their packing certificate or log book and appropriately endorsed.

NB(2) A CF1 Grade skydiver is able to make 2-way CF formations with other CF1 or CF2 holders, with CI approval. A CF1 holder must not make canopy formations larger than 2-way unless with a CF coach.

CF2

a) Safely approach, and fly in close proximity to, a target formation.
b) Control 3D movement relative to at least 3 other canopies using appropriate inputs.
c) Safely approach a 2-way stack or planed formation and dock 3rd .
d) Safely approach a 3-way stack or planed formation and dock 4th .
e) Receive a dock as 2nd or 3rd in a stack.
f) Pilot a formation of 4 or more canopies in a stacked or planed formation.
g) Brief and complete a 4-way CF jump (a 4-way plane is recommend), which includes briefing the Pilot appropriately.
h) Spot for a 4-way CF jump from at least 8,000ft AGL.
i) Land safely within 50m radius of a pre-declared target and show good altitude, heading and airspace awareness throughout each qualifying jump.

2. Canopy Formation 1 (CF1)

A skydiver must receive the following Safety Briefing from a CF Coach before making their first CF1 jump. Coaches should give adequate time to this briefing and be prepared to use a range of aids as appropriate to the student(s) involved. For guidance regarding the delivery of this briefing, see section 5.1 'Example Lesson Plan for Safety Briefing 1.' Coaches should check that their student has retained all key points from the following safety briefing before taking them on a first CF1 jump.

2.1 Safety Briefing 1: Canopy Formation Basics

Equipment - While there is some variation across the systems used, the following are basic guidelines for equipment that should be used for safely undertaking CF:

- **Clothing and Accessories** – Unlike other types of skydiving, CF jumps necessarily involve direct contact between the jumper's body and canopy and lines. It also generally involves verbal communication during the skydive. Therefore, the following are required:
  - Thick socks and snag free shoes that can be kicked off fairly easily
  - Long sleeves and trousers, preferably cotton and without grips
  - Gloves
  - Open face helmet that allows for good peripheral vison and doesn't reduce ability to hear
  - Goggles (not essential but recommended)
  - Visual altimeter mounted in a way that minimizes snag potential

- **Container** – CF involves direct contact with canopy and lines and may involve a delay between cutting away a main canopy and deploying a reserve canopy, so the following should be taken into account when selecting a container:
  - At least two substantial knives should be mounted in different areas on the harness
  - An RSL must be disconnected and secured (not on three ring) before making a CF jump
  - Pop top reserves are inappropriate for CF

- **Main Canopy** – As CF makes different demands of main canopies and their lines than other types of skydiving, it should only be undertaken with CF-specific kit eg:
  - Non-collapsible pilotchute
  - Retractable bridle system
  - Reinforced nose
  - Dacron lines, non-cascaded A-B lines, coloured target lines
  - Slider with large mesh, spider slider or full sail slider
  - Cross-link connectors
  - Risers with blocks, and big grab toggles with Velcro or equivalent
  - The main canopy may be packed using a D-bag with #8 grommet for line-first deployment or free-packed into the main tray of the container for simultaneous line-canopy deployment, with lines stowed in a tail pocket and a kill cone fitted. CF jumpers must be familiar with the system(s) they are jumping. They must be aware of the additional hazards presented by that system and be able to conduct a flightline check for the equipment they are jumping. They must have their packing certificate (or logbook) appropriately endorsed for any type of CF kit or configuration that they are jumping.

- **AADs** - Any CF jumps must use kit that meets the requirements of the host PTO / CI, which may include mandatory AADs. While AADs are not mandatory for CF jumps in the UK (beyond PTO / CI requirements), CF Coaches should discuss the relative benefits of using AADs on CF jumps with their students.

Weather Considerations for CF

A Canopy Formation group should always be able to land where intended. However, this often requires those in the formation doing a little extra planning and making an informed decision as to the suitability of prevailing weather conditions.

Weather restrictions laid down in the British Skydiving Operations Manual with regards to cloud and wind are the basic requirements for skydiving in general and apply to the whole descent, which, in the case of CF usually takes considerably longer than the average skydive. This means that in some conditions it may be suitable for other types of skydiving to take place but not appropriate for CF jumps. CF jumpers need to ensure they meet the requirements set out in the Operations Manual and understand the additional requirements specific to the discipline, which are set out in more detail in the 'Spotting for CF' brief (section 2.2).

Pre-jump Planning

Pre-jump planning for CF includes working out wingloadings (jumpers' weight in lbs + equipment weight (around 22 lbs) / canopy size in sq ft = wingloading). While the wingloadings themselves will vary according to the type of jump, the key thing is to ensure that they are consistent across the formation. Pre-jump planning also includes making sure that all jumpers have kit that is in good order and appropriate to the type of CF being performed.

The spot for a CF group also requires some pre-jump planning: weather conditions may mean it is necessary for the CF jumpers to get out short, very deep or in the middle of the load (for more on this see the Spotting for CF brief, section 2.2). Working within the PTO's SOPs, or ensuring there is no airspace conflict between CF jumpers and other jumpers may mean a CF group needs to get out on a parallel run-in, or at a different flight level. At busier PTOs with multiple planes running it is advisable to liaise with Manifest to ensure CF loads fit into the lift cycle in a way that avoids a conflict of airspace, even if exiting from the normal freefall exit altitude. Also, Ground Control and Pilots need to be aware that canopies will be opening high. So, before jumping, the CF jumpers should liaise with Manifest / the CI / the Pilot as appropriate, and brief the JM and the Pilot as required. Unless the CF jumpers are getting out on a separate pass it is also a good idea to discuss the CF spot and appropriate exit order with the JM.

As with other disciplines, CF jumpers should always ensure everyone in the formation is adequately briefed for the jump, that they have dirt-dived and been properly flightline checked.

Exit, Opening and Approaching a Target Canopy

- **Exit and Delay**

  - For safe exit separation each jumper should wait until they see the previous canopy deploying before leaving the aircraft.
  - A jumper must not deploy their pilotchute until they are clear of the aircraft.
  - A 3 to 4 second delay means a jumper is clear of the prop wash, which is more conducive to an on-heading opening.
  - A stable / on-heading exit is important because:
    - CF canopies reliably open on heading – whichever heading the jumper's body position gives them.
    - CF canopies are configured to open quickly and firmly so an unstable deployment may lead to injury or equipment damage.
  - A jumper must know the maximum delay for the equipment they are jumping and its current configuration and be suitably briefed in the appropriate action if they approach that maximum.

- **Opening**

  - Following the usual after-opening drills, a jumper needs to make any necessary heading corrections as quickly as possible and then hold the heading while watching the next person in the formation exit the aircraft. If the next person has an off-heading opening the jumper must be prepared to perform an avoidance manoeuvre if necessary.
  - If the jumper is Base (the first out) for a formation, they must hold the heading and fly in a neutral position (¼ brakes) to allow the other jumper(s) in the formation to approach and set up in the correct position(s).

- **Approach**

  - During the dirt-dive jumpers are assigned a side of the formation, and they should stay on that side of the centre line while approaching the Base.
  - A jumper should never cross the centre line near the Base or fly in front of the other canopy in a position where they might cause burble to interfere with it. If a jumper needs to cross the centre line, they must do so as far ahead of the Base as possible.

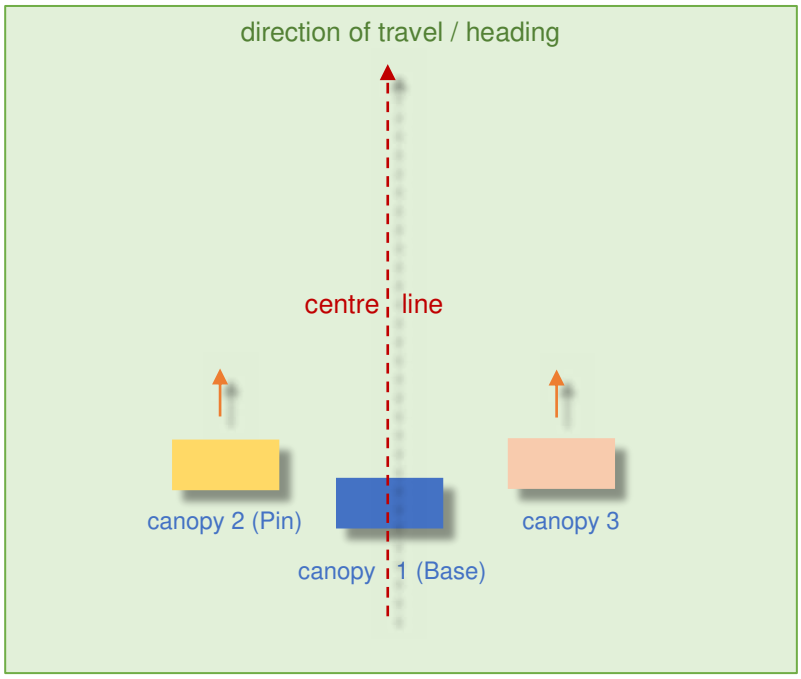


Fig. 1: Ariel view of canopies in a 3-way formation flying their slots before docking (not to scale)

Controls

A key to making successful 2-way CF jumps is keeping the canopies close together: the greater the distance between the two canopies the further there is to fly, which means more input is required and more speed can be built up. Flying closer together makes CF easier, more controlled and safer. Keeping canopies flying closely together depends on jumpers being able to:

(a) hold a steady position in order to provide a fixed target
(b) use the appropriate controls to approach a target in order to make a safe, controlled dock

In 2-way CF these two roles change throughout the jump, giving both jumpers the chance to practice the following:

Static jumper(a) – while holding in a fixed position, a jumper has opportunity to check altitude and airspace and should choose a clearly defined reference point on the ground to ensure heading is maintained relative to the landing area. The tendency here can be to want to 'help the other jumper out' but this just means that both canopies are moving, which makes it harder to achieve a safe dock. While providing a fixed target, it is important that jumper(a) adopts a neutral position (¼ brakes) and avoids harness inputs or inadvertent toggle inputs. They also need to maintain control of their canopy and avoid making inputs whilst picking up a grip with their foot / feet.

Moving jumper(b) – making a dock, or transitioning from one dock to the next, requires small definite inputs to initiate a movement and equally small and controlled inputs to stop the canopy and position the lines precisely for the next grip to be taken. The moving jumper can use a range of inputs to achieve this:

- Toggles – to sashay out to the side and back, to rock the canopy to lose height, to make flat turns and slides, to stop the canopy at the end of a manoeuvre, to transform speed into lift
- Front risers – to move downwards and forwards, to steer the canopy
- Rear risers – to generate lift.

Often a combination of inputs is required. The tendency here can be to make inputs that are too big, or to make lots of inputs without giving the canopy time to respond. It usually takes a good deal of practice to refine these inputs, flow smoothly between them and instinctively know when to use each of them. For more on basic inputs see section 5.2 'Understanding Your Inputs.'

Fig. 2: Jumper(a) holds a static position while jumper(b) flies to the slot
(Photograph © Ming Chu)

Docks

Good docks are slow and controlled. A good dock allows static jumper(a) to easily take the grip by placing their foot / feet in the correct line(s) with little impact on jumper(b)'s canopy.

Less-than-good docks are those that involve a canopy approaching too fast with a lack of control or from below. These docks can cause problems and jumper(a) should not take the grip.
In 2-way:

- The target jumper(a) can avoid these docks by turning away from the moving canopy, by 'going big,' by applying a little toggle input to rise above the moving canopy or often simply by lifting their legs to avoid the oncoming canopy.
- The moving jumper(b) can abort an approach that seems too quick or from a bad angle by making a sharp toggle input to stop the manoeuvre. If the static jumper (a) goes out of sight above them, jumper(b) should use a small front riser input to ensure they do not fly up into jumper (a).

The best way to avoid bad docks is to keep the canopies close together and to make small, controlled inputs.

Communication During CF Jumps

During CF jumps, verbal communication can often be impacted by distance and wind noise. In order to minimise the chance of confusion, CF jumpers use some commonly accepted calls to communicate with each other. This includes:

- “target jumper’s name” or ”stand-by”
- “turning left” / “turning right”
- “heading”
- “grip, grip”
- “break it down”
- “drop me, going left” / “drop me, going right”

CF jumpers also use hand and whole-body signals to communicate in-air, such as:

- extending hands to the side to signal “turning left” and “turning right”
- crossing legs to signal “do not dock”
- waving legs to signal “end of work”

Key calls and signals should be included in briefings and dirt-dives as this can lessen the chances of in-air confusion.

CF Specific Emergency Procedures

Definitions:

A wrap occurs when the canopy of the lower person collapses around another person. Wraps tend to be lower speed malfunctions.

An entanglement occurs when one person passes through the lines of another person’s canopy. Entanglements are more likely to be high speed malfunctions. They tend to be either streaming entanglements or orbiting entanglements.

Emergency Procedures for Wraps

- Establish communication, then maintain communication and altitude awareness throughout
- If communication cannot be established within 10 seconds, the lower jumper should immediately cutaway
- Only use positive commands, ie “hold on” rather than “don’t cut away”
- Once communication is established the wrapped (top) jumper can attempt to peel off fabric / lines whilst protecting handles
- The clear (lower) jumper may be able to help by communicating what they can see, and by applying some light toggle input to release tension on the wrapped canopy
- If the problem cannot be resolved the lower person should cut-away and ensure they are in clear airspace before deploying their reserve
- Once the lower jumper has cutaway the canopy may release itself from the wrapped jumper. The top jumper should check their handles to make sure they are in place and make sure the cutaway canopy isn’t still attached to them or their equipment. If it is, they should endeavor to release the cutaway canopy, which may require the use of their knife. If they are unable to do that they may have to land with the canopy and should prioritise preventing it from re-inflating during the remainder of the canopy flight.

Emergency Procedures for Entanglements

- Establish communication and altitude, then maintain communication and altitude awareness throughout
- If a jumper attempts to establish communication and cannot get a response within 10 seconds they should cut-away
- Only use positive commands, ie “hold on” rather than “don’t cutaway”
- If the entanglement can’t be quickly resolved, jumpers should attempt to clear lines / fabric from their person and container prior to cutting away, and, while each situation is different, as a general rule:
  - If it is a streaming entanglement, the top person should cut-away first
  - If it is an orbiting entanglement, the outer jumper should cut-away first
- Whichever jumper cuts away first, they should take a delay before deploying their reserve to ensure they are clear of the other jumper
- If the second jumper also needs to cutaway, reserve deployments need to be staggered in order to create vertical/horizontal separation

Decision altitudes when dealing with an emergency – Reserve deployments take time. When taking part in CF jumps it is important to think about the altitude at which cutting away is no longer a viable option and when only deploying a reserve might be advisable.

End of Working Time, Break-off and Landing

Safe minimum altitudes for docking, making transitions and breaking-off should be agreed for each jump. As this will vary according to the experience of the jumpers and the nature of the jump the following are for guidance:

- Recommended minimum docking altitude for 2-way formations: 3,500ft AGL
- Recommended minimum break-off altitude for 2-way formations: 3,000ft AGL

As single canopies fly more efficiently than docked canopies, jumpers should be prepared to break a formation down earlier than planned if they are at risk of landing off.

Before breaking down a formation each jumper should check altitude, heading and airspace, they should also check their equipment is clear of lines, fabric, pilotchutes etc.

A jumper should not drop someone without communicating with them.

When dropped from the bottom of a formation, a jumper should move immediately out to their side of the centre line and not return unless re-docking.

After break-off, all jumpers need to watch out for other groups and observe the landing pattern.

2.2 Briefing: Spotting for CF

Spotting for CF involves taking into account the cloud and winds at all altitudes the formation will fly through. CF canopies loaded at 1.3:1 descend at approximately 1,000ft/min, so a formation might be in the air for around 12mins. This means the spot for CF often differs from the freefall spot, and it is the CF jumpers' responsibility to ensure they correctly work out the spot to give themselves the maximum working time, the best chance of landing on and the safest flight plan.

Assess Conditions

Before jumping, CF jumpers should familiarise themselves with conditions. Useful sources of information include: clouds and AFF / Tandem canopies; Pilots, Tandem instructors or Ground Control; aviation forecasts such as the Met Office Spot Wind Chart F214. Paying attention to conditions can alert jumpers to issues such as the presence of wind shears (different wind directions), inversions (wind strength dropping at higher altitudes) or turbulence. CF jumpers also need to bear in mind the tendency for conditions to change during the day, which means the spot and flight plan may need to be adjusted.

Due to the time spent in-air, cloud can present particular issues for CF. On a low wind day, a few small clouds may be manageable as it is possible to avoid them while a strong wind at altitude may be acceptable if there is no cloud as the jumpers can ensure they keep a heading and remain on the wind-line. However, as strong wind makes deviations from the wind-line more significant, this becomes an issue if there is a considerable amount of cloud. Additionally, cloud might indicate the likelihood of turbulence during working time, which can make a formation unstable and more difficult to dock on thereby reducing the productivity and safety of a jump.

Plan the Spot, Heading and Flight Plan

Ideally, CF jumpers want to fly in a straight line facing into wind and without needing to make any turns during working time. So, pre-planning a heading is important. The heading for the jump should be determined by the prevailing wind direction, bearing in mind the intended break-off point.
Most CF canopies loaded at 1.3:1 tend to travel forwards with an airspeed of around 20 knots, which should be taken into account when working out the spot, eg:

> If the winds are 20 knots all the way down, the spot will generally be just past the overhead as the formation will roughly be holding over the ground with a minimal ground speed.
>
> If the winds are < 20 knots all the way down, the spot will generally be downwind of the intended landing area with the formation flying toward the landing area for the entire jump.
>
> If the winds are > 20 knots, it is generally necessary to get out past the intended landing area and back up relative to the intended landing area for the entire jump.

CF jumpers should also bear in mind that most PTOs around the UK have airspace restrictions, with many limited to an airspace of 1.5 miles from the centre of the PLA. Some PTOs have additional limitations in certain directions. Therefore, if conditions require use of the full extent of the permitted airspace, it is important to discuss the intended jump with the Pilot and / or CI.

NB: If conditions mean that jumpers planning a CF formation do not feel confident spotting or making and flying the formation, they should seek advice from more experienced CF jumpers, reconfigure the plan and / or remain on the ground.

2.3 Notes for Coaches making CF1 jumps

When taking students for CF1 jumps, Coaches should give careful consideration to:

2.3.1 The student's canopy experience - The Coach should ensure that their CF1 student uses a CF canopy that is appropriate to their experience level and puts them at the same wingloading they are currently jumping at, or lower. Wingloading for CF1 jumpers should be no more than 1.3:1

2.3.2 The kit provided - It is the Coach's responsibility to check that the kit their CF1 student is using is in good order and appropriate for this purpose. It is also the Coach's responsibility to ensure that that such kit is packed by those with the appropriate endorsements on their packing certificates or in their logbooks and that an appropriate log of the packing and configuration of kit provided for student's use is maintained (see section 5.3 for examples of logs that might be used when providing CF coaching part of a group or an individual).

2.3.3 The conditions - When taking students for their CF1 jumps it is ultimately the Coach's responsibility to ensure that the jumps take place in conditions suitable for inexperienced CF jumpers.

2.3.4 The student's recent experience with hop-and-pop exits - If the student is not confident in their ability to exit and deploy in a stable position, the Coach should go over various exit options in the first jump briefing and it may be appropriate to suggest the student practices on a hop-and-pop before making a CF1 jump.

2.3.5 The use of 2-way radios - Radios can be extremely helpful on CF jumps as they allow for calm and clear communication. However, the Coach should ensure that a student does not become reliant on the use of radios, that they are confident making and understanding calls and other signals, and that they can determine correct inputs for themselves in a range of scenarios.

2.3.6 The exit altitude - While higher altitude jumps give more training time, they are also more tiring, meaning that the extra time is often not used effectively, and students generally tire after fewer jumps. The intensity of lower altitude jumps can be more stressful for CF students who feel under greater pressure to perform in limited time, which causes some to learn less effectively. Before deciding on an exit altitude a Coach should take the fitness, experience and needs of their student into account.

2.3.7 Additional jumpers - Contact in CF1 coaching jumps must be limited to one student per Coach but can include other suitably experienced CF1 jumpers. It can also be useful for students to practice skills while shadowing a CF 2-way involving a Coach and another student. If the additional student has been cleared to jump with camera, this can have the advantage of providing outside footage for debriefing. However, shadowing a coaching jump should not be part of a student's first two CF1 jumps, and should be considered on a student-by-student basis.

2.3.8 CF1 progression - This is not based on a series of specific jumps, but on acquiring a set of skills. The exercises set out in sections 2.4 and 2.5 below have been devised to help CF1 students demonstrate these requirements and should be used with that in mind. These exercises don't need to be done in the order they are presented. To encourage sound progression, the Coach should ensure the student completes each task rather than 'helping them out.' Similarly, if the student does not comfortably land within a 50m radius of the target (ie make the landing area with ease), they should be required to repeat the level.

2.4 CF1 Jump 1

To start their CF1 progression, a student needs to perform this jump, even if they have already completed other CF jumps.

Pre-jump

The Coach should check the student's logbook to ensure they meet the pre-requisites (see section 1.2).

The Coach should provide a detailed brief and dirt-dive before the jump, which should include revision of signals / calls and emergency procedures.

The student should kit up with plenty of time for the Coach to go through the following:

- Full equipment check.
- Check handle locations.
- Check knife locations.
- Check weight belts/vests (if required).

Once the student is kitted up there should be time to run through the jump without rushing.

The Coach should check the student's equipment prior to leaving the aircraft.

The Jump

- Student exits first.
- Coach exits second and sets up next to the student.
- Coach signals for the student to dock.
- The student docks using a toggle elevation input.
- Coach demonstrates stack-to-plane and plane-to-stack manoeuvres (compresses / decompresses).
- Coach demonstrates rotation technique.
- Student pilots the stack.
- Student performs stack-to-plane manoeuvre, resumes piloting.
- Student performs plane-to-stack manoeuvre, resumes piloting.
- Break-off by 3,500ft AGL.
- Student practices flaring the canopy and finds the stall point of the canopy
- Coach lands first and watches the student's landing.

Post-jump

Coach and student debrief, starting with the student's account of the jump. Details of the exercises completed and aspects to work on should be clearly recorded in the student's log book and signed by the Coach.

2.5 2-way Skills Jumps for CF1

The Coach should provide detailed briefs and dirt-dives before each CF1 jump, including revision of signals / calls and emergency procedures.

The student should kit up with plenty of time for the Coach to go through a full equipment check and run through the jump without rushing.

The Coach should check the student's equipment prior to leaving the aircraft.

No more than two of the following exercises should be completed per jump. These exercises can be completed in any order.

The break-off altitude for CF1 jumps should only be lowered from 3,500ft when the Coach is confident in the student's ability to perform CF in a safe and controlled manner and familiarity with the flight characteristics of the canopy they are jumping.

Jumps should be followed by debriefs, with details of exercises completed and aspects to work on clearly recorded in the student's log book and signed by the Coach.

- **Exercise 1 – Learning the inputs**

  - Student exits first.
  - Coach exits second and sets up alongside student.
  - Coach demonstrates an input (eg front risers, rear risers, toggles, cross control and sashays) while student remains static, and student imitates while coach is static.
  - Complete next task or continue as above until break-off.

- **Exercise 2 – Piloting**

  - Coach exits first, student practices approaching a Base.
  - Student docks on Coach.
  - Coach performs a rotation and docks on student.
  - Student compresses, then pilots and makes heading corrections (min 2 x 90° turns).
  - Student uncompresses and then pilots the stack making heading corrections (min 2 x 90° turns).
  - Complete next task or continue as above until break-off.

- **Exercise 3 – Docking on a formation**

  - Coach exits first, student practices approaching a Base.
  - Student sets up next to Coach.
  - Coach demonstrates safe docking technique to dock on student i.e. slide in approach from the side with toggle elevation inputs.
  - Student drops the grip and slides to the side to set up for approach on Coach, then imitates Coach's approach and makes a dock.
  - Complete next task or continue as above until break-off.

NB(1) Exercise 3 should not be performed on the same jump as exercise 4

- **Exercise 4 – Rotating on a formation**

  - Coach exits first, student practices approaching a Base.
  - Student docks on Coach.
  - Coach breaks grip and demonstrates rotation technique utilising toggle sashay to come out to the side and front risers to approach and dock on student (N.B. as an advanced technique, the 'over the top' rotation technique is not recommended here as it does not provide the CF1 student with an opportunity to build appropriate sight pictures and skills to progress on to more refined docks in the same way as the 'out-to-the-side' technique).

- Student imitates Coach.
- Complete next task or continue as above until break-off.

NB(2) Exercise 4 should not be performed on the same jump as exercise 3.

- **Exercise 5 – Approaching a formation**

  - Coach exits first, student practices approaching a Base
  - Student docks on Coach
  - Coach breaks grip and performs a run-back in order to give the student another attempt at approaching a fixed target and avoiding crossing the centre line of the formation
  - Complete next task or continue with run-backs of varying distance/height until break-off

NB(3) Exercise 5 should be performed on at least two jumps
NB(4) A deeper spot than usual is generally required to allow for run-back exercises

- **Exercise 6 – Managing a less-than-perfect dock (wing walking)**

  - Coach exits first, student practices approaching a Base.
  - Student docks on Coach.
  - Coach demonstrates wing walking technique across at least 2 cells to each side.
  - Coach rotates to dock on student.
  - Student imitates wing walking technique, while maintaining heading and control of their canopy.
  - Complete next task or continue as above until break-off.

NB(5) Exercise 6 should not be performed on the same jump as exercise 7.

- **Exercise 7 – Off-set docks (wing docks)**

  - Coach exits first, student practices. approaching a Base.
  - Student makes off-set dock on Coach.
  - Coach manoeuvres the formation, with student making adjustments as appropriate.
  - Coach rotates to make off-set dock on student.
  - Student manoeuvres the formation .
  - Complete next task or continue as above until break-off.

NB)6) Exercise 7 should not be performed on the same jump as exercise 6.

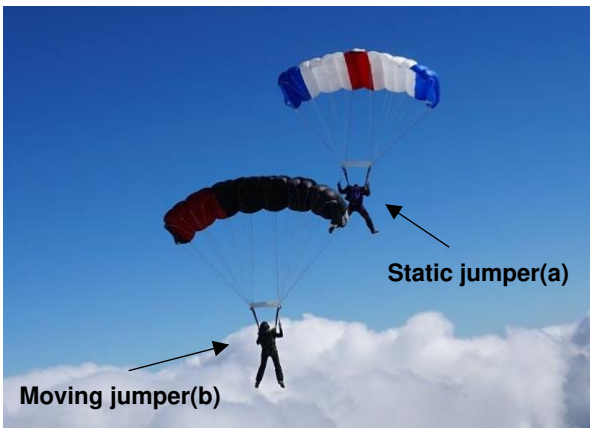


Fig. 3: Making a wing dock
(Photograph © Pete Lindstrand)

3. Canopy Formation 2 (CF2)

A skydiver must receive the following Safety Briefing from a CF Coach before making their first CF2 jump.

Coaches should give adequate time to the briefing and use a range of aids as appropriate to the student(s) involved.

Coaches should check that their student has retained all key points from Safety Briefings 1 and 2 before taking them on a CF2 jump.

3.1 Safety Briefing 2: Considerations with Larger Canopy Formations

The basic safety considerations that apply to 2-way CF (as set out in Safety Briefing 1) also apply to larger formations, with the following additions:

Equipment

As all jumpers in a CF group should match wingloadings, there is more likelihood of jumpers wearing weight when taking part in larger formations. In this case, care should be taken in selecting a weight belt / vest with the minimum snag potential and minimum restriction of movement in the harness. Attention should also be given to ensuring the canopies to be used in a formation are compatible, for example that they of the same type, ie all Triathlons or all Lightnings (or other types of CF-specific canopies) and that they are as closely matched in size as possible.

Weather

CF jumpers involved in larger formations need to take into account that these are more difficult to build and fly in turbulence than smaller formations. They also need to bear in mind that it is extremely difficult to build a larger formation if the Base / Formation Pilot does not maintain a consistent heading throughout the working time. This means that in some conditions it may be advisable to build several smaller formations rather than a larger one, which can have implications for the spot and the exit order.

See section 3.2 ‘Spotting for Larger CF Groups and Piloting Formations’ for more on these considerations.

Approaching the Formation and Flying the Slot

- A larger formation begins with a 2-way. Base and Pin exit first and second. Once they have docked, they provide a stable target for the other canopies to dock on to, with no.1 becoming the Formation Pilot

- After the usual opening drills, each jumper should pay attention to the next jumper exiting. They should then maintain their heading while locating the Base canopy in their peripheral vision (to avoid any confusion at this point, it can be helpful to check the colour of each jumper’s canopy while dirt-diving).

- With more canopies in a formation it becomes even more important to keep to the agreed side and not to cross the centre line either in front of or behind the Base of the formation. So, once the jumper has located the Base they should ensure they are on the correct side of the centre line and if they need to correct this they should do so before making an approach toward the Base.

- A jumper should never put themselves directly in front of a formation as the turbulence from a single canopy may cause part or all of the formation to collapse and, as larger formations are slower and more cumbersome to turn than smaller ones, the Formation Pilot is unable to make an avoidance manoeuvre.

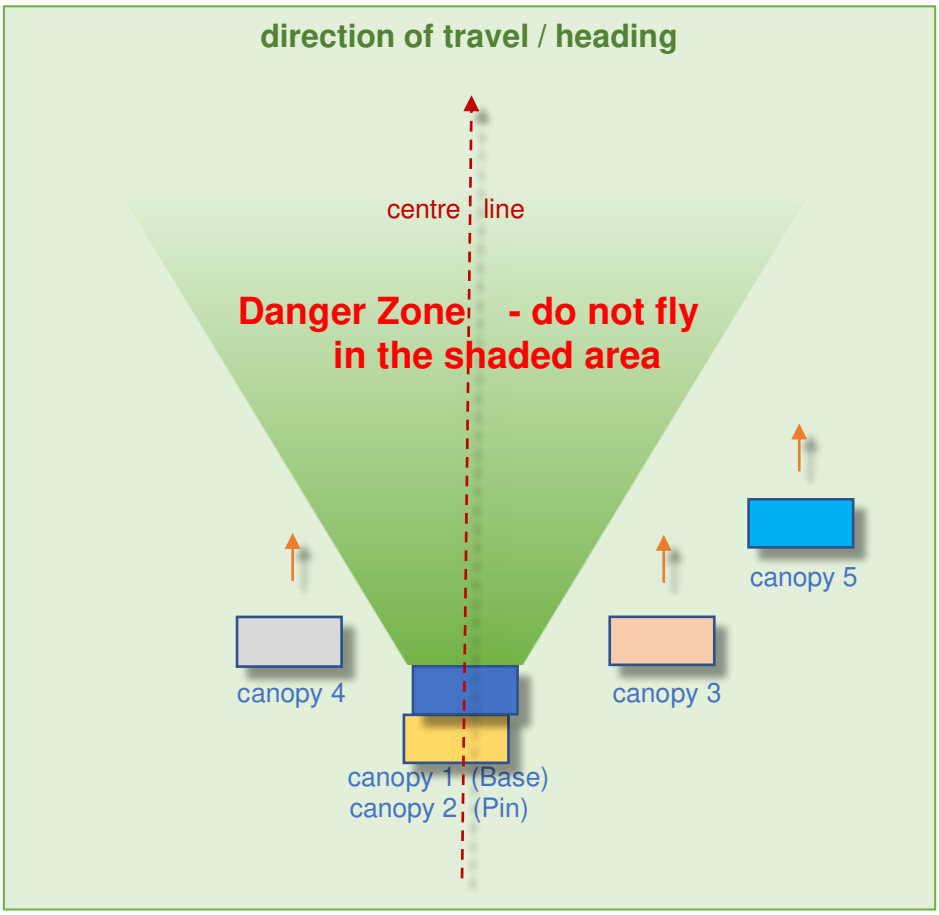


Fig. 4: Ariel view of canopies in a 5-way formation flying their slots while Pin and Base dock.

- Jumpers make their approach towards the Base whilst maintaining a position ahead of, above and slightly to the side of the formation, gradually working back in echelons alternating their approach according to the docking order i.e. number 2 goes left, number 3 goes right and so on, as in Fig. 4 above.

- If a jumper makes a mistake in approaching a formation, the formation has less agility than a single canopy and cannot easily correct for that mistake. Therefore, building larger formations requires greater precision in flying, both in making the correct approach and in flying the slot while the formation builds. The most common mistake is going low and behind, it is always advantageous to stay in front and a little high while the formation builds.

- A 2-stack formation will sink significantly more than a single canopy in flight. If the canopies in the Base are planed before any more canopies dock this will allow the two canopies to fly more efficiently than when they are in a stack configuration.

- Once a jumper has made their approach they may need to fly their slot while waiting for the rest of the formation to build. There may be other canopies waiting on the same side, which the jumper needs to be aware of while they work to keep with the formation while it builds (eg no.s 3, 4 and 5 in Fig. 4 above need to fly their slots while Pin and Base get together)

Making the Dock and Flying in the Formation

- Larger formations generally require greater precision and control when docking as the target jumper is unable to make an avoidance manoeuvre if approached by a less-than-good dock. Therefore, particular attention should be given to this in dirt-dives to ensure jumpers are confident in the approach to take and the controls to use.

- If a jumper is making an approach to dock and they are coming in too fast, at the wrong angle, or from below, they should abort the dock, move back out to their side of the formation, allow their canopy to settle in clean air and then make another approach.

- If a jumper loses sight of the formation at any point when making a dock, they should front riser out to their side of the formation and move away from the formation in order to avoid a potential collision / flying in front of the formation.

- In a larger formation, once a jumper has taken a grip they generally return their attention to their own canopy and watch for signs that they may need to make an input or that the formation is not flying healthily and needs to be broken down.

- In a larger formation jumpers have to be alert to calls and signals that might come from others in the formation. To help ensure clear communication and avoid any confusion, shouting should be limited to the necessary calls. There are also some extra calls and signals to bear in mind here such as:

  "Go light," which can be shouted by someone with a grip on the jumper's canopy and also signaled by a foot vigorously twisted horizontally in the line. This means apply a little brake to lighten the canopy on the foot.

  "Go heavy," which can be shouted by someone with a grip on the jumper's canopy and also signaled by a foot vigorously moving up and down in the line. This means apply a little front riser to settle the canopy down on the foot.

  "Complete," which indicates that the last grip on the formation has been taken.

"Starburst, Starburst," which signals a simultaneous break down of the whole formation that follows a countdown shouted by the whole formation to ensure that all grips are dropped at the same time.

Emergency Procedures

The basic wraps and entanglements drills set out in section 2.1 apply to larger formations too, with a few additional considerations to bear in mind:

- There may be more than one cut-away and jumpers should be aware that it is necessary to stagger delays before deploying a reserve in order to create a safe vertical / horizontal separation and avoid the additional risks of deploying a reserve, or releasing a freebag, into other canopies (reserves or mains).

- In the event of a wrap or entanglement among jumpers lower in a formation, the jumper(s) above should keep hold of the canopy, if safe to do so. The grip should be held until the lower jumper(s) make(s) the call to be dropped. This has the advantage of giving the jumper(s) in the incident more chance of resolving the situation if possible and the upper jumper(s) can keep the formation in good position relative to a safe landing area.

- If a jumper approaches to dock and sees an issue with the formation, they should move back out to the side, let the formation settle and then move in to dock. It is generally unsafe to dock on an oscillating plane / stack (ie one that is swinging side-to-side) or a sequential formation that is breathing heavily (ie canopies are moving span-wise).

- If the person at the bottom of a formation does not wish to be docked on for any reason, they signal this by crossing their legs and keeping them crossed. This indicates that other jumpers should wait before approaching this person / the formation.

- If a jumper in a formation sees that it is not flying well and there is a risk of it collapsing, they should call “break it down, break it down” and other jumpers should echo this call back up to the Formation Pilot. The formation would then be broken down from the bottom. It is essential for all jumpers in the formation to respect this call.

- If there are cut-aways during a CF jump, any jumpers who are not involved in the incident should keep at a safe distance from loose canopies. If possible, it can be useful for one of the jumpers to keep an eye on where the main(s) and freebag(s) land. Landing with equipment should not be prioritised over landing safely on the intended landing area. However, it is advisable for someone to follow any jumper(s) on their reserve(s) to check they are okay and to land with them if they need to land off.

End of Working Time, Breaking down a Larger Formation and Landing

- If a formation is incomplete at the end of working time (recommended minimum 3,500ft AGL for 4-way with low experience CF jumpers, higher for larger formations), the person at the bottom should wave-off any jumpers who may be waiting to dock. This is done by crossing and uncrossing their legs several times in quick succession.

- Stacks and planes are broken down from the bottom up and as they are dropped each jumper uses a small front riser input to leave the formation in the direction that they approached from.

- Formations such as diamonds can be broken down from the bottom, or by using a starburst manoeuvre. In both cases, the inputs required on the release of grips should be covered in the dirt-dives as they will vary according to the jumper’s position in the formation.

- Before releasing their grip on a canopy, a jumper must ensure the person being dropped is ready i.e. has their hands in their toggles, has clear airspace etc.

- Once all jumpers have broken grips, adequate separation should be achieved to set up for landing.

3.2 Briefing: Spotting for Larger CF Groups and Piloting Formations

As larger CF formations have far less capacity for heading adjustments than smaller formations, it is even more important to plan a spot that allows a consistent heading to be held for the duration of the working time. In winds that are particularly light or strong, this can mean using the full 1.5mile airspace with either a very short spot or a very deep spot. On occasions, the run-in available may mean that the required spot is not possible and so a different plan will need to be devised. For example:

- breaking the group down to make several smaller formations (If several smaller groups are on the same load, conditions may require that they exit on separate passes).

- factoring a break-down and rebuild of the formation into the jump plan, or a change of heading or a change of formation at a specified altitude

On a 'rotations' or 'sequential' jump, the Formation Pilot changes throughout the working time and various jumpers will be in the position of Pilot for a brief time before transitioning to another position. Therefore, in these formations all jumpers will be involved in ensuring the correct heading is maintained and being aware of the position of the formation in relation to the planned landing area.

On a large or single point formation there will be a dedicated Formation Pilot who will exit first and will be responsible for ensuring the formation remains on heading throughout the jump. This jumper is also responsible for making decisions regarding, for example, the need to change heading and calling "starburst" or "break it down" at the appropriate time. However, it is not solely the Formation Pilot's responsibility to call "break it down" when a formation is flying poorly; all jumpers in the formation should be prepared to make this call.

Whether piloting for the whole jump or just until transitioning to the next point, a jumper who is piloting needs to keep their hands in their toggles and be alert to any inadvertent input they may make, which is generally through movements in the harness or allowing one or both hands to sink. They also need to be aware of the increased pendulum effect turns will have on the canopies below them and if heading corrections are required, they should only make very gentle and gradual inputs.

When making corrections to the heading, it is paramount that a Formation Pilot is aware of other jumpers who may be docking on the formation so that they can avoid turning the formation into them. With this in mind, it can be helpful if clear repeated calls of "turning left" or "turning right" are made prior to turning the formation and jumpers at the bottom of the formation use their arms to indicate the direction of a turn. The Pilot should give a delay between the call and making the turn to allow for any undocked jumpers to prepare for the turn.

3.3 Notes for Coaches

CF2 progression is based on acquiring a set of skills, which build on those acquired through CF1 jumps. The skills required for CF2 are encompassed in the exercises set out in this section. To make best use of these exercises Coaches should bear in mind the following:

3.3.1 Points 2.3.1, 2.3.2, 2.3.3 and 2.3.6 set out previously continue to be relevant to CF2 coaching.

3.3.2 It is not appropriate to use radios during CF2 coaching jumps as students need to become familiar with and practice the calls and signals used in larger formations without having their hearing compromised.

3.3.3 The Coach should provide detailed briefs and dirt-dives before each jump, which should include recapping signals / calls and emergency procedures.

3.3.4 The student should kit up with plenty of time for the Coach to go through the usual equipment checks and run through the jump without rushing.

3.3.5 The Coach should check the student's equipment prior to leaving the aircraft.

3.3.6 There should only be one CF student per CF2 formation.

3.3.7 Each CF2 jump should be followed by a debrief with details of the exercises completed and aspects to work on recorded in the student's log book and signed by the Coach.

3.3.8 The CF2 skills exercises should be completed in sequence, ie 1, 2 then 3, and they should be completed on separate jumps.

3.3.9 It may be necessary for the CF2 skills exercises to be repeated. For example, if a student flies in front of the formation but completes the other coaching objectives of the 3 or 4-way dive, they should repeat that exercise.

3.3.10 Students must adequately demonstrate an ability to pilot both 3- and 4-way formations, including showing good awareness of altitude, heading and airspace throughout and ensuring all jumpers in the formation land on the dropzone.

3.3.11 Before being awarded CF2, a student must demonstrate an ability to JM a CF load, or to inform the JM / Pilot of the requirements of CF jumpers on a mixed load. This should be practiced across at least two jumps.

3.4 2-, 3- and 4-Way Skills Jumps for CF2

- **Exercise 1 – Making, receiving and flying offset docks**

  - Coach exits first (Base), followed by student (Pin)
  - Student makes an off-set dock on Coach
  - Coach releases grip and rotates to make an offset dock on the student
  - Student receives the dock, flies the off-set formation and makes any necessary heading corrections
  - Student releases the grip and rotates to make an offset dock on the Coach
  - Continue as above until break-off

- **Exercise 2 – Docking 3rd and piloting a 3-way**

  - Coach exits first (Base), followed by second jumper (Pin)
  - Student exits 3rd and safely approaches the 2-way plane in a timely manner
  - Student docks 3rd using a safe docking technique and planes the formation
  - Coach rotates, then second jumper rotates
  - Student pilots the planed formation, making heading corrections (min 2 x 90° turns)
  - Continue as above or continue rotations until break-off

- **Exercise 3 – Docking 4th and piloting a 4-way**

  - Coach exits first (Base), followed by second jumper (Pin) and third jumper (no. 3)
  - Student exits 4th and approaches the 3-way plane in a safe and timely manner
  - Student docks 4th using a safe docking technique and planes the formation
  - Coach rotates, then second and third jumpers rotate
  - Student pilots the planed formation, making heading corrections (min 2 x 90° turns)
  - Continue as above or continue rotations until break-off

4. General Safety Rules for CF

Regardless of experience and size of formation, all CF jumpers should:

- **Always ensure they are familiar with the type and configuration of CF equipment they are using, are cleared to pack it and can perform a flightline check on it.**
- **Never dock on, or with, a malfunctioned parachute.**
- **Never perform CF on, or with, a reserve parachute.**
- **Never attempt to catch a cutaway parachute, freebag or accessory.**
- **Never fly directly in front of a formation.**
- **Never cross the centre line of a formation.**
- **Always consider their experience relative to the formations / exercises they are attempting to complete.**
- **Always get appropriate briefs before attempting more complex jumps, such as bi-hands, downplanes, jumps using accessories and landing formations.**
- **Always use the appropriate equipment for the type of jump they are making.**
- **Always respect altitude.**

5. Appendix

5.1 Example Lesson Plan for Safety Briefing 1: Canopy Formation Basics

Time: min. 60mins

Aim: To ensure those making coached CF skydives have an appropriate understanding of relevant safety considerations and risk points before making those jumps.

Objectives: the CF student(s) will have an understanding of all aspects of CF safety and risk set out in Safety Briefing 1: Canopy formation Basics before making their first coached CF jump**.**

Structure: the following plan takes the student(s) through a CF jump from planning to landing. In order for students to take on the necessary information, it is advisable to deliver this in sections and to allow appropriate time for questions and recaps in relation to each section to ensure that the student(s) has/have understood the information covered.

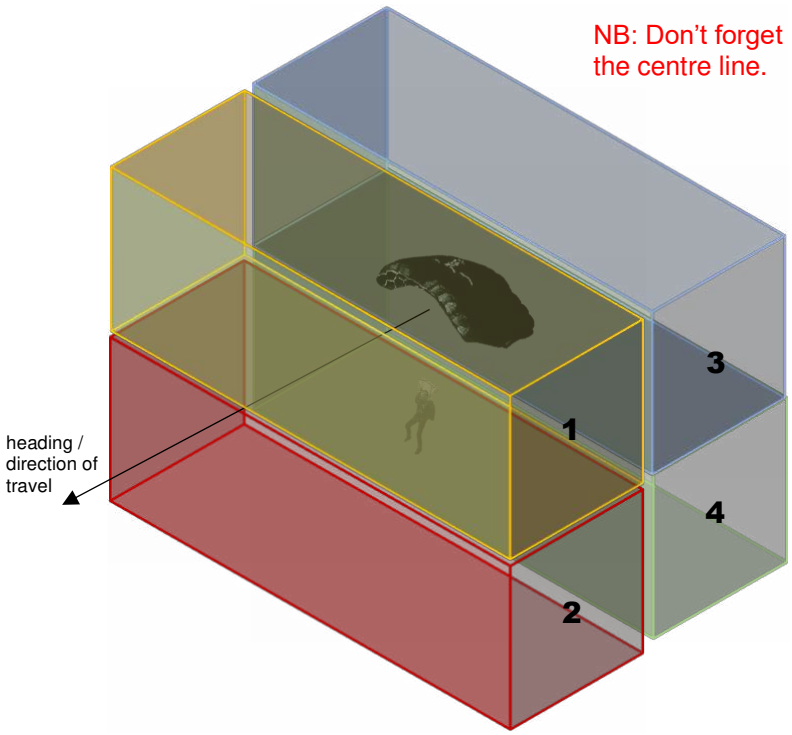
Section	**Materials**
1: Equipment for CF Weather considerations for CF Basic pre-jump planning for CF	- Current CF Coaching Manual - Rig(s) to be jumped, or similar to that to be jumped, by the student(s) - Other items of equipment to demonstrate
Break	
2: Recap section 1 / questions. CF exits and openings. Approaching a target canopy. Use of canopy controls during CF. Communication during CF. CF specific emergency procedures. End of working time, break-off and landing.	- Current CF Coaching Manual - Videos / images / demonstrations of good exits, good 2-way docks and good transitions from stack to plane. NB Videos / images / demonstrations of wraps and entanglements may also be used here but the emphasis of visual aids should be on good practice and ensuring the student(s) is (are) informed and confident.
Break	
3: Recap section 2 / questions.	- Current CF Coaching Manual.

NB To avoid unnecessary information overload, CF students should receive the 'Spotting for CF' briefing after they have made 2 or 3 CF jumps. The 'Spotting for CF' briefing should make use of information available at a PTO the student is familiar with / the PTO the coaching is taking place at, such as aerial photographs, Spot Wind Charts and discussion with the Pilot / CI. The Coach should then support the CF student(s) to put this into practice on subsequent coached CF jumps.

5.2 Understanding Your Inputs

Imagine your target, static jumper(a), is flying on heading while you move in to dock. You are flying close to jumper(a) and in the same direction as them. Now imagine that the airspace around jumper(a) is divided into four areas as shown in Fig. 5. As the moving jumper, you can put yourself in any of those four areas and might move between several of them as you try to make the dock.

If you are in the yellow area (1) of Fig. 5 you are to the front of your target and slightly higher than them, ie you will be looking backwards and downwards to keep them in your sight. In this case, you are in a good position and just need to make small toggle inputs away from and back towards your target (sashaying) in order to move you down and back relative to them and make a dock.



If you are in the red area (2) you are to the front of jumper(a) and slightly lower than them, so looking over a shoulder and upwards to see them, or you might have lost sight of them. If you can see the target jumper you should ensure you are to one side of them, using a toggle input to move further out if needed, and then put both toggles down to increase the drag and lift on the canopy, which will pull you up and back relative to static jumper(a). If you are unable to see the other jumper, use a small front riser input as this will take you down and out to the side, and then you will be able to safely use both toggles to take you up and back.

If you are in the blue area (3), you are behind jumper(a) and higher than them, probably looking down at the topskin of their canopy. The appropriate response here is usually to use your front risers, decreasing the lift generated by your canopy whilst increasing forward speed, which might allow you to catch your target. As attempting to dock with too much speed can increase the likelihood of a wrap, you may want to make a sharp 'slap' on both toggles to shut down the excess speed just as you reach your target.

If you are in the green area (4), you are behind and low relative to your target. In this position, you will likely need to move into clean air to the side of your target, then make small rear riser inputs, which will increase the lift generated by your canopy and so take you up relative to your target whilst not introducing as much drag as incurred when using toggles, so not taking you backwards.

NB The descriptions above are intended to be a supplement to, not a substitute for, CF coaching.

5.3 Example Equipment Logs for use During CF Coaching

The following pages include examples of the type of equipment logs that can be used to keep track of the packing and reconfiguration of rigs provided for students during CF coaching.

5.3.1 Coaching Events

The organiser of any CF coaching event (or appropriately experienced person nominated by the event organiser) must ensure that packing and configuration of CF kit during the event is undertaken, or supervised, only by those with the appropriate endorsements on their packing certificates (or in their logbooks) and that a log of the packing and configuration of that kit is maintained for the duration of the event. As with all CF coaching, it is the Coaches' responsibility to ensure that the CF students they are jumping with are using appropriate equipment.

The log included here (p.27) is an example of the type that might be used at events where several Coaches may be providing coaching simultaneously, and packing may be done by those Coaches or by others assisting with the event and kit may go through several reconfigurations.

5.3.2 Individual Coaches

Each Coach must ensure that kit used by their CF students is packed, or checked, by those with the appropriate endorsements on their packing certificates / in their logbooks. Coaches are also responsible for making sure that an appropriate log of the packing and configuration of kit they provide for students is maintained. This may take the form of notes kept in the Coach's logbook, or a separate log kept with their logbook or the kit or the example log included here (p.28).

NB For ease of use, the example logs included here may be photocopied from this manual, or they are available to be downloaded and printed or completed electronically via the British Skydiving website (Form 318A Word.doc and Form 318B Word.doc). If Coaches / PTOs choose to use a system of their own for keeping track of this information they must ensure that it records all relevant information, and whichever system is used it must be easily accessible in the event of an incident.

CF Example Equipment Log for Events

EXAMPLE LOG – Details of Event PTO:_____Date(s)_____

Details of rigs used at this event				**Log of packing / reconfiguration**							
Assign each container a number for this event	Person / organization providing container	Serial no. / description of container	Main canopy in container Is it packed? (Y/N)	Date / packer (name printed)	Changes to rig / configuration (Y/N) if yes describe here	Date / packer (name printed)	Changes to rig / configuration (Y/N) if yes describe here	Date / packer (name printed)	Changes to rig / configuration (Y/N) if yes describe here	Date / packer (name printed)	Changes to rig / configuration (Y/N) if yes describe here
1											
2											
3											
4											
5											
6											

Name of Organiser / Coach leading event (print)_____ I verify the above record (signature)_____date_____

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CF Example Equipment Log for Coaching

Example Log – Rigs Used for CF Coaching							
Dates.	Student Name.	Details of Rig Used.	Last checked Packed by (print names).	Details of any reconfiguration of the kit for / during this coaching.	Reconfiguration undertaken by (print names).	During this coaching packed by (print names).	Notes on maintenance / repair of this rig.

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5.4 List of Abbreviations used in this Document

AAD	**Automatic Activation Device**
AFF	**Accelerated Free Fall**
AGL	**Above Ground Level**
CF	**Canopy Formation**
CI	**Chief Instructor**
JM	**Jump Master**
PLA	**Parachute Landing Area**
PTO	**Parachute Training Organisations**
SOP	**Standard Operating Procedures**

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