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## FORMATION SKYDIVING PROGRESSION MANUAL



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# Contents

Chapter 1: Manual Objectives	Page 4
Chapter 2: Introduction –Why FS1?	Page 5
Chapter 3: The BPA Operations Manual	Page 6
Chapter 4: Your Learning Experience	Page 8
Chapter 5: The Skydives	Page 10
Chapter 6: FS1 Qualifying Skydive	Page 13

## Appendices

Appendix A: FS Skills Theory - Neutral Position	Page 17
Appendix B: FS Skills Theory - Fall Rates	Page 20
Appendix C: FS Skills Theory - Rotational & Transitional Moves	Page 21
Appendix D: FS Skills Theory - Grip Taking	Page 22
Appendix E: FS Skills Theory - Tracking	Page 23
Appendix F: FS Skills Theory - Dive and Approach a Target/Swoop to Pin	Page 25
Appendix G: FS Skills Theory - Exits	Page 27

## Figures

Figure 1	Expected Points for FS1 Qualifying Skydive	Page 13
Figure 2	FS1 Skydive Formation Choices	Page 15
Figures A.1-6	The Neutral Body Position	Page 17-19
Figure B.7	Slow Fall	Page 20
Figure B.8	Fast Fall	Page 20
Figure C.9	Forwards Movement	Page 21
Figure C.10	Backwards Movement	Page 21
Figure C.11	Left Turn	Page 21
Figure C.12	Side-slide to Right	Page 21
Figure E.13	Low Angle of Attack	Page 23
Figure E.14	High Angle of Attack	Page 23
Figure F.15	No Lift Dive Position	Page 25
Figure G.16	Front Float Exit	Page 28
Figure G.17	Centre Float Exit	Page 29
Figure G.18	Rear Float Exit	Page 30
Figure G.19	Inside Diver Exit	Page 31
Figure G.20	4-Way Stair-Step Diamond Exit	Page 33

# **Chapter 1: Manual Objectives**

The aim of this manual is to act as an information manual for skydivers aiming to attain the Formation Skydiving Grading System (FS1) and to assist skydivers in achieving a good foundation in Formation Skydiving. This foundation can then be used to progress further in formation skydiving.

The main objectives of this manual are to provide you with guidance that will help you decide how to prepare yourself for your FS1 progression. It will also provide guidance on how to go about arranging and tackling your FS1 progression in order for it to provide you with a good foundation so that you are able to progress further in formation skydiving.

Training programmes and methods other than those contained in this manual are acceptable provided they meet the requirements of the BPA Operations Manual (Section 2, Paragraph 6.4.1).

# **Chapter 2: Introduction – Why FS1?**

This manual contains information required to help you obtain FS1. Moving on from your initial skydiving training, you need to obtain the appropriate skills to be able to jump with other skydivers safely.

Whether you have just finished your Accelerated Free Fall (AFF) course, Category System course, just become an 'A' licence parachutist, or even if you have been doing lots of solo jumps to gain experience in the air since obtaining your 'A' licence, there are new steps to now consider. You might be thinking about working towards your 'B' licence. In which case you need to gain your Canopy Handling (CH) Grade 2 and Jump Master (JM) Grade 1 qualifications. Your next step, however, should you wish to jump with others, is to obtain Formation Skydiving (FS) Grade 1. Whilst working on your FS1, you can also work on the qualifications for your 'B' Licence above, and it is a good idea to consider starting this now. The requirements for FS1 are laid down in the BPA Operations Manual (Section 2, Paragraph 6.4.1). These specific skills will be introduced in the next Chapter.

There is no substitution for good coaching but from a preparation point of view it will help you to read through the information in this manual. Bear in mind, however, that the level of skill you wish to attain, (as long as it fulfils the requirements in the BPA Operations Manual [Section 2, Paragraph 6.4.1]) may differ from that of another skydiver, as it will need to be relevant to the level you are about to progress on to. For instance, if a skydiver has a particular passion to join a 4-way team they will have differing goals to someone who would like to progress straight on to free-flying, as they would differ for a skydiver interested in big-ways, vs. fun jumps with friends or one of the several canopy disciplines. You may not have a specific goal in mind yet and the FS1 progression will be a great place to spend time finding out more about the options available and the skills needed to progress in those options. The FS1 skydive is simply a stepping stone to give the basic skills to progress in many, if not all, of the numerous skydiving disciplines and can be tailored to suit the individual's needs.

These disciplines may feel like they are a long way off, and being able to skydive with friends or people you don't even know is the foundation for years of fun. When you have achieved FS Grade 1 you will have a great set of basic skills that will help you to stay safe jumping with others, and that you can build on and improve. With this good understanding and good basic ability you will be able to continue to learn in any discipline you may choose.

# Chapter 3: The BPA Operations Manual

The BPA Operations Manual is where we can find all of the information we need to, for instance, find out which grading systems are designed for which skydivers and parachutists and what the requirements are for each of the grades.

The “Grading System” is found in Section 2, Paragraph 6 of the Ops Manual. It states that,

“Once a parachutist has obtained Category 8 (or, prior to obtaining Category 8 in some cases. e.g. CH1), that parachutist’s continuation training will continue via a choice of various disciplines:”

To expand on this, the FS1 Grade, associated coaching and basic skills are designed for:

- a) The student who through the Category System has qualified Category 8 and successfully completed CH Grade 1 and obtained their BPA ‘A’ Licence.
- b) The student who, on the Accelerated Free Fall Course (AFF), has qualified Category 8 and successfully completed CH Grade 1 and obtained their BPA ‘A’ Licence.
- c) Any BPA ‘A’ Licence Holder and above who wants to revisit their basic techniques or improve their understanding.

The British Parachute Association Operations Manual states the following with regard to the FS1 grade:

## **“6.4. Formation Skydiving (FS)**

6.4.1. To obtain Grade 1 in Formation Skydiving (FS1) the parachutist must, be introduced to FS by a CCI/Advanced Instructor nominated FS1 Grade parachutist or equivalent of proven FS instructional/coaching ability, have received a full safety brief and demonstrated the ability to:

- a) Control fall rate and turn in place.
- b) Dive and approach a target and achieve docking techniques.
- c) Break-off turn and track away to obtain clear airspace for deployment.
- d) Maintain good altitude awareness throughout the skydive.
- e) Control horizontal movement (forwards, backwards and sideways).
- f) Complete four points of 4-way FS.

*N.B.(1) Prior to obtaining FS1, an ‘A’ Licence parachutist may make 2-way jumps, when not carrying out coaching jumps, provided he/she has received a full safety brief and the other parachutist is at least a ‘C’ Licence FS1 parachutist or equivalent, approved by the CCI.*

*N.B.(2) Prior to obtaining FS1, during coaching jumps, no more than one non-FS1 parachutist per group (maximum of a 4-way), all other parachutists must be at least FS1 grade or equivalent, including an FS coach or equivalent.*

*N.B.(3) Training programmes other than those contained in the BPA Formation Skydiving (FS) Manuals are acceptable for training for FS1, provided all the requirements of sub-para 6.4.1. (above) are met.*

*N.B.(4) The qualifications to become an FS coach may be found on BPA Form 134.”*

You will have many questions that may sound something like: How many jumps do I have to do? What if I “fail” a jump? When can I do my 4-way jump? When will I get my “sticker” so that I can jump with my friends?

Chapter 5 of this manual will discuss the different skydives you may have to complete in more detail. However, the emphasis on the word “may” is important. Unlike AFF or the Category System, the FS1 progression is not designed to be a list of specific skydives with a “Pass” or “Fail” outcome. This phase of your skydiving is very specific to you and you obtaining the skills required above. Of course, this also means that you have the opportunity to repeat any skills you wish to, until you are happy with your own level of proficiency. Essentially, you are able to set your own goals above and beyond the minimum requirement of the BPA Operations Manual and to arrange your own progression to achieve them.

It is important to note that the 4-way skydive that is often the skydive that is completed just before receiving the grading sticker is not the only aim. It is part of a series of skills that should be demonstrated before the FS1 grading can be awarded. If a skydiver can, for example, perform well on a 4-way skydive, but is unable to dive and approach a target safely, the requirements for FS1 have not been met.

# **Chapter 4: Your Learning Experience**

Before you start your FS journey, there are a few things worth considering that may improve your experience and help you achieve your goal more effectively.

## **Your Coach:**

Your FS coach is going to be someone who has been awarded an FS Coach rating by the BPA. This means that they are able to coach you in all of the aspects stated in the BPA Operations Manual that are required to obtain your FS1 qualification.

There are many coaches out there. Not all of them will be the right coach for you and there are many different factors to consider when choosing your coach but, most importantly, find someone who fulfils your individual FS needs best and if you feel that your coach is not the right one for you, then do not be afraid to consider someone else. There are multiple reasons why a coach may not be the right one for you as everyone has differing teaching and learning techniques, but your coach also has to understand your goals and why you have them to teach you in a way that works for you.

Whilst FS Coaches all have the same FS coaching qualification, they may come from very different backgrounds/disciplines/experience levels. Some may, for instance be at a Drop Zone (DZ) every weekend doing 1-to-1 FS coaching, some may be British or World Champion skydivers who take time out from their chosen discipline to coach and some are full time coaches for whom it is their livelihood. Any of them could be the coach for you. Some coaches may charge for their coaching, some do it for the price of their jump ticket, some even for free. At some DZs, the DZ will pay the coaches for the jumps they do at the end of the day. Some DZs or skydiving teams offer coaching from a group of coaches that all have the same coaching ethos, and therefore can offer continuity and quality that is consistent between several people. This often works well as the coaches are all working together with the same goal. If you are lucky enough to find a coach who will teach you for free, remember that this is your learning experience, not theirs, and be sure that the experience is right for you!

## **A Picture Paints a Thousand Words:**

An FS coach has to have a 'C' licence and is therefore qualified to wear a camera to jump. It is not a "requirement" for a coach to film you, however, the benefit of being able to see your skydive as part of your de-brief is immeasurable. In addition to the debriefing points you expect (i.e. what went well, and where the improvements can be made), occasionally, the skydive you thought that you just completed is very different to the one you actually did, and this gives both you and the coach the chance to discuss what those differences were, why they happened and, if correction is required, how to correct them.

Feel free to ask your coach if they are planning to video your jumps before you jump with them. If not, ask them if they can wear a camera for your jumps, as the benefit is so great that there is no real reason why they wouldn't wear one if asked to. However, bear in mind that not all coaches have access to a video camera.

After you have jumped it is of great benefit to ask your coach for the footage of your jumps. The benefits firstly include the fact that you are able to watch your skydives yourself as a way of reviewing and revising your skills and remembering the improvement points you were given. Secondly, if you are able to show your coach the last jumps you did, it is a great tool for the coaches to remind themselves, or in the case of a new coach learn about your skydiving so far. If you have footage of your jumps, consider keeping it with your logbook and taking it along with you next time.

**Continuity and Consistency:**

You may already have an idea of how often you are able to jump and how many jumps you want to do each time you go to the DZ. Bear in mind, however, that your FS coaching will benefit enormously from being able to jump regularly. Several weeks or even months between each jump will not make your FS1 an impossible achievement, but may slow your progress down as your body will take longer to remember the skills previously learned. This could result in you needing to do many more jumps overall than if you were able to jump more regularly over a shorter period.

Changing coaches can be a very positive step as you may find that a different coach works much better with you and suits your style as an individual more appropriately. However, bear in mind that formation skydiving is far less prescriptive than the AFF or Category System course you may have just completed and there are differing, but equally acceptable methods to achieve the same aim in formation skydiving. This may mean that a change of coach can leave you feeling frustrated or as if you have taken a retrograde step when, or if, a new method is introduced. For instance, even some of the best formation skydivers in the world use significantly different methods to turn in place, so don't be surprised to find different methods out there.

**Wind Tunnel:**

The FS1 qualification is a skydiving qualification that is designed to enable you to be able to jump safely with others. It is designed for skydivers and the greater part of what you are learning that keeps you safe cannot be practised in a wind-tunnel (e.g. swoop to pin, tracking, altitude awareness) However, it would be wrong not to mention the benefits of being able to practise some of the aspects of formation skydiving in a wind tunnel. If you are lucky enough to be near enough to a wind tunnel or ever have the opportunity to go and to be coached by a skydiver then it is of great benefit. Based on the "free-fall" time you get in a wind tunnel it can be great value for money and allows you to work on your body-position and stability in detail, without the additional considerations required in free-fall.

# Chapter 5: The Skydives

As previously mentioned, unlike the very structured style of the AFF or the Category System course, your FS progression is not based on a set of specific jumps, but on a series of skills that you must be able to demonstrate the ability to perform. We've seen that these skills are detailed in the BPA Operations Manual, but how do we turn those skills into individual skydives for you to complete with your FS coach?

This chapter is designed to give you an idea of some of the skydives that you might do with your FS coach, and a clearer idea of what makes this progression something that is different for every skydiver, and should be tailored to each individual.

Take another look at the BPA Operations Manual requirements:

## **“6.4. Formation Skydiving (FS)**

6.4.1. To obtain Grade 1 in Formation Skydiving (FS1) the parachutist must, be introduced to FS by a CCI/Advanced Instructor nominated FS1 Grade parachutist or equivalent of proven FS instructional/coaching ability, have received a full safety brief and demonstrated the ability to:

- a) Control fall rate and turn in place.
- b) Dive and approach a target and achieve docking techniques.
- c) Break-off turn and track away to obtain clear airspace for deployment.
- d) Maintain good altitude awareness throughout the skydive.
- e) Control horizontal movement (forwards, backwards and sideways).
- f) Complete four points of 4-way FS.”

Whilst bearing in mind that these are the minimum requirements for FS1, some example skydives that your FS coach may want to carry out with you to fulfil these requirements are as follows:

Skill I:	Fast and Slow Fall
Skill II:	Forwards and backwards
Skill III:	Side-slides
Skill IV:	Grip taking
Skill V:	360 degree turns
Skill VI:	Swoop to pin
Skill VII:	4-way skydive

However, as your FS coach is unlikely to approach your Club Chief Instructor (CCI) for your FS1 unless they believe you will be safe to jump with others and that you at least understand the principles you need to follow on every jump with others to stay safe, it is unlikely that your progression will look like this.

A more realistic progression may look a little bit more like this, in any order, with any number of repeats of each jump:

Skill I:	Body position
Skill II:	Fast and slow fall
Skill III:	90 & 180 degree turns
Skill IV:	360 degree turns
Skill V:	Side-slides
Skill VI:	Forwards and backwards
Skill VII:	Grip taking (multiple 2-way drill dives)
Skill VIII:	Dive and approach a target (aka. swoop to pin/dive to pin)
Skill IX:	Tracking
Skill X:	3-way skydive
Skill XI:	4-way skydive

Remember, each jump will be tailored to you, your experience levels and skill level. All of these examples may need to be repeated several times, until you have demonstrated the ability to complete the skills described in the BPA Operations Manual.

Even if you 'ace' each skill on each jump, your FS coach needs to see that you will be safe jumping with others. For instance, if you manage each skill well, but do not, for example, demonstrate good eye contact or more importantly altitude awareness; expect to continue your FS progression until you do.

A couple of the jumps above involve demonstrating skills that are virtually impossible to practise in any wind tunnel but are arguably the most important skills needed for your FS progression. Being able to dive and approach a target safely and successfully at the beginning of a formation skydive and being able to track away from it at the end before deploying your parachute are skills that are fundamental to both your own safety and the safety of others. These skills may be practised alongside other skills during your progression, (e.g. unlinked exits and tracking off at the end of each jump) but there is great merit in using individual skydives to concentrate on these skills on their own. Before you are awarded your FS1, make sure you are confident at both. Both are great fun to practise and you never know when you will find yourself felling very grateful for having them – tracking to some clear airspace to deploy your parachute or being able to safely but dynamically dock onto that big-way formation after being the last person to dive out of the plane!

It can be seen from this chapter that the FS progression with regard to jump numbers is not an exact science and that your FS coach(es) will tailor your progression specifically to you.

It is not the intention of this manual to be exact about the individual skills required either. The reason for this is that there are many different techniques that can be used to achieve the same goal. Even some of the top FS jumpers in the world would teach you how to use your body position to perform, for example a 360 degree turn using very different techniques. They all work, some equally well, but what is important is to try the technique taught by your FS coach and ultimately to find a technique that works for you. If you are interested in the basic theory behind how to use your body to perform each move, this can be found at the end of this manual, in Appendices A to G.

It is recommended that you have a basic understanding of the theory discussed in these appendices before you start your FS progression. Even if your chosen coach teaches you slightly different techniques to those shown in the appendices, they will still evolve around the same principles.

# Chapter 6: The FS1 Qualifying Skydive



## **Introduction to 4 Way Formation Skydiving**

Successful 4-way formation skydiving requires the same priorities and basic discipline as 2-way FS.

### The Priorities of FS

1. Be on level – Fall rate issues, the biggest challenge in FS.
2. Be in your slot – Translate or rotate to get where you need to be, then stop.
3. Get a grip – Pick up grips
4. Continue to fly – There should be no tension on the grips when on the grips, you should be in a neutral position and when the grips are released you should be able to stay in place.

To correctly apply all four priorities requires self-discipline. You have already demonstrated the discipline and skills necessary to do 4-way, so it is more of a confirmation of these skills than learning a new one. Treat the FS1 skydive as a 2-way and look across the formation to the person opposite you, just as you would on a 2-way with the coach opposite, and use him/her as a reference to the fall rate and distance.

The FS1 qualification will be awarded by the CCI after reviewing the video of the skydive, and/or discussion with the FS Coach. Whilst in accordance with the BPA Operations Manual, the MINIMUM requirement in order to be awarded the FS1 is to achieve a four point 4-way, the following guidance is offered to CCIs, FS coaches and students.

The number of “points” achievable is, in its most basic sense, proportional to the amount of free-fall time available on that skydive. i.e. if you are in free-fall for twice the amount of time, with the same ability level, you should be able to achieve twice the number of points. However, it is well known that other factors can affect the “score” of a skydive, such as the exit, conditions etc., and these factors should be taken into account by the CCI when considering awarding the FS1. The following guidance is based on an average day where FS1 candidate “A”, jumping from 10,000ft without a linked exit, is able to achieve four points. In order to demonstrate an equivalent level of skill to candidate “A”, the number of points that should reasonably be expected from any other candidate from a given altitude using a linked/unlinked exit is as follows:

Altitude	Min Points Expected Using Linked Exit	Min Points Expected Exit Not Linked
10,000ft	5	4
11,000ft	6	5
12,000ft	7	6
13,000ft	8	7
14,000ft	9	8
15,000ft	10	9

Fig. 1 Expected Points for FS1 Qualifying Skydive

The expected points above do not overwrite the requirements as described in 6.4.1 (f) of the BPA Operations Manual. However, they offer the CCI guidance when taking into account all factors on any given FS1 skydive, based on free fall altitude (and therefore, time) available.

## The FS1 Skydive

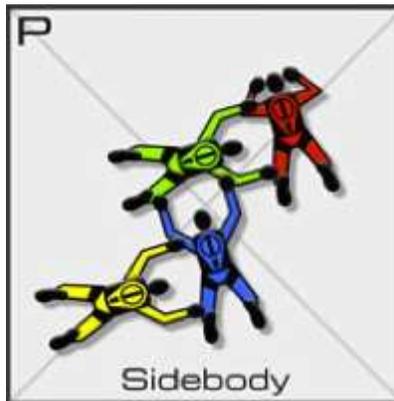
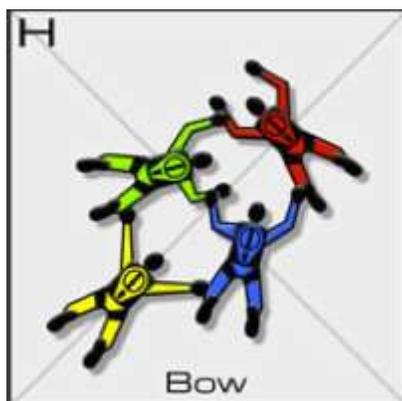
Part of completing a good FS skydive is how it is constructed and briefed. Whilst there is no requirement to brief this skydive, it is of great benefit to understand the shapes you are going to be part of forming. This is a perfect opportunity to learn as much as you can about planning, organising, briefing and de-briefing a skydive.

In most circumstances you will take the position or “slot” of “Point” although you may discuss with your coach should you have a strong desire to take a different “slot”.

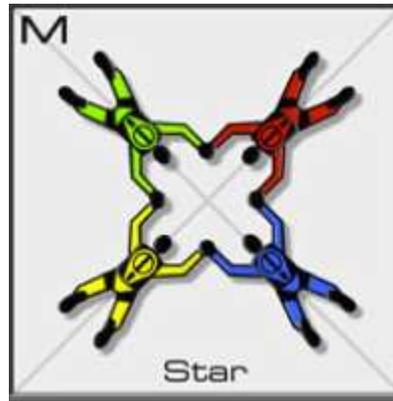
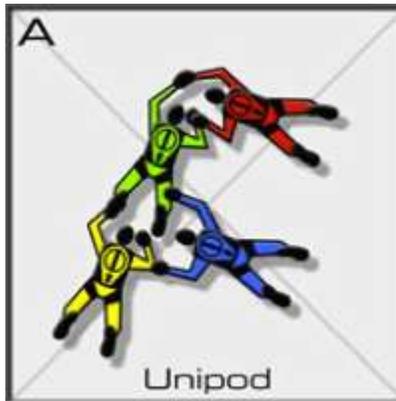
Considering the diagrams below, you would be the red skydiver (top right). If you have a black and white document, ask your FS coach to point out which skydiver in each formation is “Point”.

Your FS1 skydive should include one of each of the following four selections to make a four point 4-way.

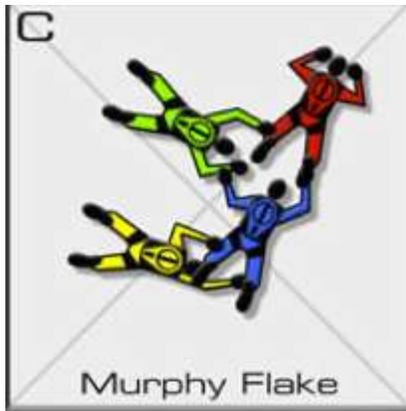
- a) Bow (H) or Side-body (P) [e.g. side-ways move to formation]



b) Unipod (A) or Star (M) [e.g. face in and take two grips]



c) Murphy-flake (C) or Phalanx (Q) [e.g. outfacing with leg grip(s) taken]



d) Satellite (O) or Meeker (E) [e.g. round formation that includes grip taking and having grips taken on]

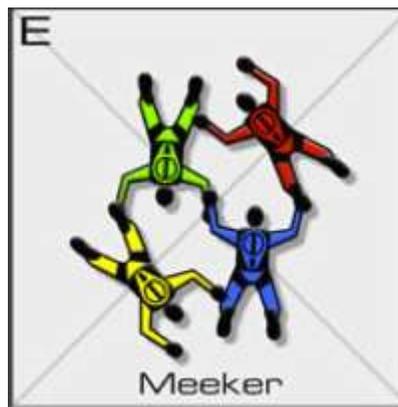


Fig.2 FS1 Skydive Formation Choices

## **Preparation**

The following elements of preparation are important to ensure your 4-way skydive goes as planned:

### **Puzzle**

Before you work out the puzzle of the sequence learn the sequence by the names of each formation. Say the names to yourself and repeat this sequence until you can easily remember it. Next relate each name to the name of the formation. Look at the pictures and learn the names of the formations. Once you know the names, look at your slot within that formation. On the FS1 skydive, if for instance, you will take the slot of "Point" you need to study the red jumper in the formation. Also study the red jumper's position relation to the others in the formation, in particular to the "Tail", who in this instance will be opposite you.

Once you have a mental image of where you need to be on each formation, you are half way to solving the puzzle.

The Dirt Dive: The 'dirt dive' involves all four jumpers walking through the dive sequence. Simply walk through the dive in slow time just to build the familiarity with the formations and the grips you need to take or present. Establish eye contact with the skydiver opposite you when in each formation.

### **Angles**

To work on the angles of each formation all four jumpers will lie on a creeper and go through the formations. Creeper work is the most realistic preparation for FS because you get a similar visual reference on the ground that you will in the air. As you go through each formation, cross-reference on the skydiver opposite and learn where you are in relation to him/her. As you move, continue to reference against the skydiver opposite as if it was a 2-way. When in the right place look at the grip you need to take, take the grip then look back at the skydiver opposite. THINK, MOVE, STOP, PICK UP GRIPS.

### **Keys**

The key is the signal to move on to the next formation. The key comes from whoever is best suited to see that the formation is built and ready. In these dive sequences, the jumper flying the outside centre position is most likely to give all keys.

### **Exit**

The exit is a very important part of the preparation. It gives the skydivers to work out their position in the aircraft door and how they are going to exit the aircraft in the formation, presented to the relative airflow. A mock-up of the aircraft door will be used, and the count will be practiced. This is a vital part of the skydive to get right, and should be learned and visualised along with the rest of the skydive.

### **Secret Stuff**

The secret stuff is basically any top tips for a particular dive or team. The top tips on an FS1 qualifying dive are relax, cross reference, be on level, be in your slot, get a grip but don't chase it, continue to fly and most of all enjoy!

# Appendix A: FS Skills Theory – The Neutral Body Position

In any discipline of skydiving, you must start from a position of balance. To be balanced is to be neutral or in a state of equilibrium. It is in this state that you can provide a good stable foundation from which to progress in any direction.

The neutral flying position is the starting and ending point to whatever you do in formation skydiving. Before you transition into making any move, you must be balanced, static and neutral.

To fully understand and master this skill, it helps to build a relationship with the air travelling around your body. Think of every inch of your body being an effective surface area. Use your sense of feel as your body cuts through the air, pushing the air out of the way as you travel through it. Maintain a relaxed neutral position and constant feel of air pressure on ALL FOUR LIMBS.

The following series of diagrams aim to give an idea of the body position you should be aiming for as a formation skydiver. The exact position to be adopted will vary for each individual, so follow the guidance of your coach, but bear in mind the following elements of theory involved in finding your own neutral position.

**TORSO RELAXED AND STRAIGHT: The Torso** is the catalyst to everything you do in freefall. As the torso is the centre of your body as a whole, it has a direct influence on how both the upper and lower limbs behave. Your torso is the key to your balance because it represents your whole body's centre of gravity. At the centre of your torso is your spine.

A good neutral position will require a very relaxed arch. The spine also needs to be straight and its worth knowing that no matter what move you make as you progress through your FS1, your torso should always remain straight as shown in Fig.1.

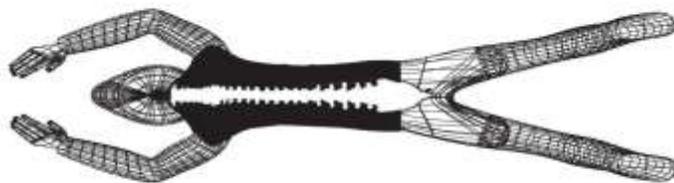


Fig. A.1



Fig. A.2

**HEAD: Just think head up.** If your torso is in a good position then your head will be too as it is an extension of the spine.

**ARMS AND LEGS:** To achieve a balanced neutral flying position you must understand that the human body is symmetrical in its structure. Pay particular attention to this fact, since the action of positioning your limbs when flying will create a reaction of either solid powerful moves or a series of inconsistent compensations. Maintain symmetry with your limbs and you will maintain balance.

The student positioning of the **arms** can be seen as a bad habit if you want to improve your flying position. Having a wide arm stance is great for stability - think of a narrow boat with out-riggers. However, your arms need to be in a position of mobility i.e. in a grip-taking position, as well as maintaining equal air pressure to that of the legs. Lying on the floor and propping your chin up on your fists as if watching the TV, then dropping your hands away from your chin, forwards, can gain a reasonably accurate approximation of the arm position to be aimed for.

Your elbows should be wider and lower than your shoulders as shown in Fig.3. It's common for your hands to be too close to the face. Think about creating more surface area as shown in Fig. 4 by extending the arms forwards.

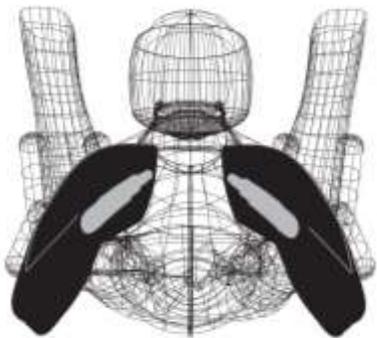


Fig. A.3

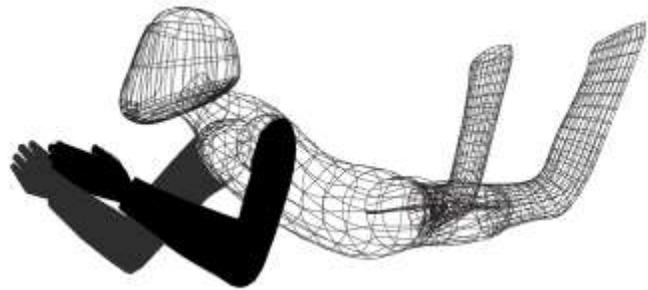


Fig. A.4

A common area for improvement for students and even experienced skydivers is in their **leg** position. As we know, being wide in a stance provides great stability. However legs being too wide can cause problems such as de-arching of the hips. Legs are also often too bent which reduces the overall effective surface area of the body in freefall. One of the reasons these problems arise is due to the fact that you rely on feeling for leg positioning as you can't see what they are actually doing and our sense of feel is often deceiving. Bear in mind that your legs, especially if in a bootie suit, are much bigger than your arms so they play a vital role in your position.

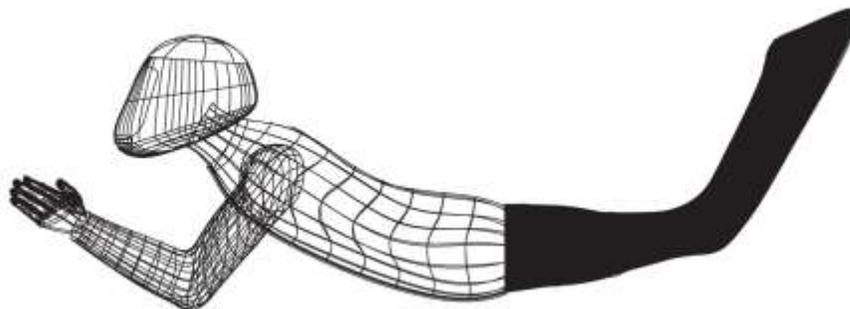


Fig A.5

A good visual reference to what your legs are doing is to look at your arms. If you are falling straight down (i.e. not back sliding) and you can see that your arms are close to your head then your legs are possibly tucked up or too bent. To find your neutral leg position, stand over a mat with feet about shoulder width apart then crouch down, lean forward and lie on your front without parting your legs any further. Next consciously think point toes but not straight up but about 45 degrees to the ground as shown in diagram fig. 5 & 6. Your toes are an extension of your legs.

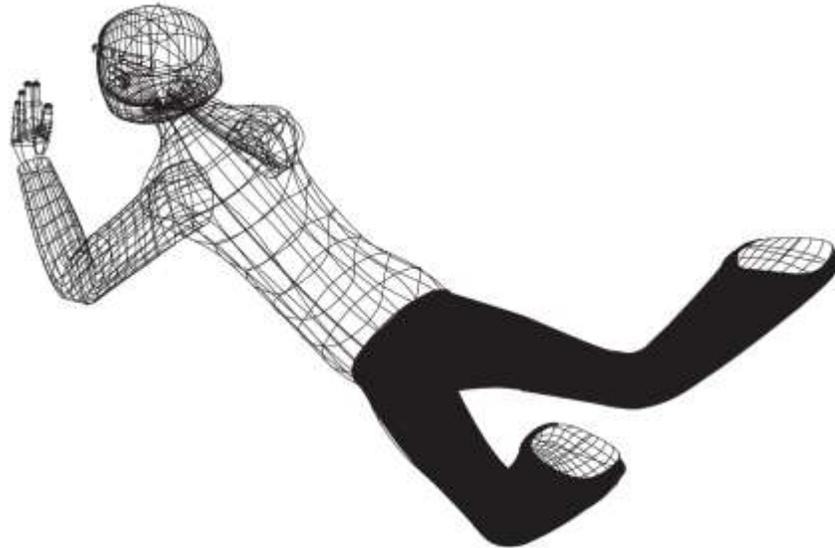


Fig. A.6

## Appendix B: FS Skills Theory - Fall Rates

A World Champion in 4-Way FS once said: "Fall rate issues are the biggest challenge in formation skydiving"

In formation skydiving we are always changing our body position, which will affect our fall rates. This is a problem, which will always arise no matter who we jump with. Formation skydiving requires you to be on the same level as everybody else; learning how to control your fall rate is the No 1 priority after achieving a good neutral flying position.

After we exit an aircraft, we accelerate towards the earth until we reach terminal velocity. We all accelerate at the same rate regardless of our size or mass due to the effect of gravity alone, but because of air resistance our terminal velocities will vary.

Since formation skydiving is about falling relative to each other we must learn to change our fall rates. In preparation for jumping with someone of a differing weight to you, it might be worth considering the use of weight belt(s) to assist in averaging out the expected fall-rate. However if we need to adjust rates once we are in free fall, then all we can do is change the air resistance. The amount of air resistance depends on the amount of our surface area. The more surface area, the more air resistance, the less surface area, the less air resistance as shown in fig 9 and 10.

Fig. B.7 Slow Fall



Fig. B.8 Fast Fall



To increase fall rate several different changes in body-position can be made. Firstly, the very best attempt to arch from the hips and lift the head up must be made. Also, bringing the arms in towards the face or pointing the elbows down will reduce air resistance at the top half of the body. An equal reduction in air resistance must also be made at the lower body in order to remain in a neutral position. This can be achieved by tucking the feet up by bending the knees and/or squeezing the knees together.

The opposite moves are made to reduce our fall rate, whilst maintaining eye contact with the person or formation we are aiming to fall relative to. This is achieved not by looking directly up (as we have seen above that lifting the head increases fall rate) but by laying the head to one side and looking above from the side. So roll the shoulders, suck in the abdomen; straighten legs and arms, to create the largest, flat surface area possible for the slowest fall-rate you can achieve.

You do not need to be as radical as the diagrams above if you only wish to go up or down in relation to the other person by a foot or two.

# Appendix C: FS Skills Theory - Translational and Rotational Moves

As we pointed out in Appendix A, all moves start from the neutral flying position. Before we make a move we should be in a position of balance. The resistance, which holds us in place, is this same force that we use to move. So as far as physical effort goes, the amount of input to create a move is at its greatest when starting and stopping. Whatever input we use to initiate a move, we have to use the same amount of input to stop it.

It's better to translate to close distance to a target before making the rotation. Backwards movement is used in formation skydiving but usually as a fix to a problem. If you need to present your leg grips to another skydiver then it should be as part of a turn in place. Flying backwards and not being able to see what's behind us is far less efficient and more technically difficult to do accurately than maintaining eye contact with the formation and making the turn close in.

Rotational moves are normally quicker because our centre point isn't moving when we turn in place. After you initiate a move, before you stop it there is a period when you go back into a neutral position. So we begin in a neutral position, we initiate a move, we go back to neutral, we stop the move with an opposite position then we resume a neutral position.

The pictures below give an idea of the body positions your coach may suggest you use to perform each move. However the specifics of each move are not an exact science and the way your coach describes each move will be formulated in a way that works for you before you attempt them in the air.



Fig. C.9 Forwards movement



Fig. C.10 Backwards movement



Fig. C.11 Left Turn



Fig. C.12 Side-slide to Right

# Appendix D: FS Skills Theory - Grip Taking

If ever there is a need to be in a neutral position before making a move, it is when taking grips. One of the many advantages of the neutral position over the conventional student position is that it's a good grip taking position.

There has always been the tendency to backslide away from the grips you are trying to take, and the more you reach, the more you backslide. The reason is obvious, as you know how to backslide deliberately. When your arms are pushed out in front of you they create lift, which in turn will push you back. Basically, taking grips involves arms and legs but the amount is subtle and is more closely related to being in a neutral position than any other move.

If formation skydiving is all about scoring points then it is because the grips are taken to complete a formation in order to score. But understand that grip taking is last in the list of priorities.

The priorities of FS:

1. Be on Level: Fall rate issues, the biggest challenge in formation skydiving.
2. Be in your slot: Translate or rotate to get where you need to be, then stop.
3. Get a grip: Pick up grips
4. Continue to fly: There should be no tension on the grips. When on grips you should be in a neutral position and when the grip is released you should be able to stay in position.

# Appendix E: FS Skills Theory -Tracking



With the ever-increasing performance of canopies the need for horizontal separation on deployment must also be ever increasing. To increase horizontal separation before deployment, we need to improve our ability to track.

You have already demonstrated the ability to track; if you hadn't you would still have student status. However, this is one of the skills we are unable to practise in the wind tunnel and often by this stage, you have only spent about the last five seconds of every skydive performing it. All skydiving skills require time to practise and time to get the feel for a new skill but so far tracking is the last thing we do. When the formation skydiving part has stopped, remember the tracking is still a vital part of the skydive.

Tracking is a life saving skill and should be taken seriously as a result. It is the move we learn here for you to know how to achieve distance from others in your formation before deploying your parachute. The longer (in time) that you are able to maintain the tracking position before reaching your deployment altitude, the further you will be from other members of your formation. To achieve this, we need to gain as much lift as possible. When tracking the angle of attack and the shape of your body are the two factors that influence the amount of lift we aim to achieve.

Lift increases as the **angle of attack** increases right up until the stall point. The angle of attack is the angle that the object meets the relative air. Relative air is relative to the direction you are travelling in.



The higher than angle of attack, the higher the amount of lift, and the lower the angle of attack, the less lift. The following figures show the two extremes and it should be obvious that the better position for gaining distance from a formation is shown in figure E.14.

Fig. E.13 Low Angle of Attack



Fig. E.14 High Angle of Attack

We also mentioned **body position** as a factor in achieving a good track. We do everything we can with our torso to achieve lift by rolling the shoulders, sucking in the abdomen.

Mastering a good track position requires a good understanding of what you are trying to achieve and having a well rehearsed routine and checklist.

When learning to track, an example of a routine we can use is known as the seven-stage track. When learning it, it will take approximately seven seconds to get into the optimum tracking position before deployment and it is not recommended to attempt the seven-stage method if you intend to start if below a height of 5000ft. However, it can be practised on a tracking dive initially, and then used as the method at the end of each skydive for separation once proficient.

### **The Seven-stage Track**

1. **Slow Fall and Turn**  
Since the idea is to create as much lift and air pressure as possible, start to build up air pressure by adopting a slower fall rate position as you turn 180 degrees into your clear air space. De-arch! (Even consider stretching arms out forwards as per your slow fall position to assist in creating lift)
2. **Legs**  
When you are facing your clear airspace extend your legs fully for maximum air deflection, legs straight, point toes, press shins on the relative air.
3. **Arms**  
As you start to move, sweep back your arms to either side of your torso in a slow and controlled way. Palms of hands down.
4. **Look Left and Right**  
When tracking into clear airspace maintain observation, look for other trackers and - even worse – canopies.
5. **Look Above and Below**  
As above.
6. **Flare**  
When flaring, go back into slow fall position for maximum air deflection and drag.
7. **Pull**  
Provided you tracked off at 5000ft and had no problems during the track, you should now be at about 3500ft.

We have already mentioned that tracking is a survival skill. The aim of the FS1 progression is to teach you the skills necessary to perform 4-way formation skydiving and as the very nature of formation skydiving is to be able to skydive in bigger groups, the need to be able to track off into clear airspace becomes more apparent. If the skydive all goes to plan and enough time is allowed between groups on exit and at break off everyone turns 180 degrees away from the centre of a formation then finding a clear airspace is easy. However things don't always go to plan and the ability to be able to change your heading, as an avoidance manoeuvre whilst tracking is vital.

Whilst tracking, the most effective way to change your heading is to use your head. Your heading comes from being symmetrical and the keystone to this symmetry is the head. The head acts like a rudder but at the front instead of the back. If you are heading towards an unexpected obstacle, look at clear airspace and point your nose in the direction you want to go.

# Appendix F: FS Skills Theory - Dive to and Approach a Target/Swoop to Pin

To dive and approach a target or to “swoop to pin” would normally be performed if you were part of a large formation load and were one of the last to leave the aircraft. Being the last to leave the aircraft creates a few problems to the skydiver and so requires lots of practice to get it right which is why it is usually left to the most skilful or experienced skydivers on the load.

If you are inexperienced in big ways then it is advisable to be as close to the door as possible on exit. However if you want to challenge yourself, and have more fun, then try getting further back in the line up.

The first challenge you have when leaving the aircraft, some time after the formation is the distance between you and whoever has already left. The distance is both vertical and horizontal and you should close the vertical distance as much possible before closing the horizontal although the last few hundred feet can be a combination of the two.

The second challenge when swooping down to a formation is eye contact. We rely heavily on what we see in FS as a visual reference to where we are in relation to others but when swooping we may lose sight of who is below us in order to maintain a vertical dive approach. Because we can't rely on visual feedback we need to rely on timing and anticipation, which obviously improves with practice. However, if you do lose sight of anyone below, it is better to stop and locate the other skydiver(s) and then continue. Also, a top tip is that it is ALWAYS better to recover out of a swoop too early and be high on the formation than to be too late and go low on a formation.

It is vital to be proficient at this skill for your safety and enjoyment in formation skydiving. Too fast approaching the formation and you are putting yourself and others on your formation at risk of collision and possible injury, too slow and you may not make it to the formation at all.

Reducing the vertical distance is the first priority and to do this we have to use the vertical dive or the no lift dive position as shown in F.15.



Fig. F.15

The vertical dive position is also known as a no lift dive position because it creates minimum lift as it has a very low angle of attack in relation to the relative air. Obviously, this is the quickest way to lose vertical distance due to minimum air resistance. To transition into this position you start from a dive exit then swoop back the arms and extend the legs as if you were tracking. Try to maintain visual contact with your formation at all times – if possible.

**The “Stadium” Approach.** How much time you spend in the vertical dive position whilst reducing vertical distance depends on how long you wait before leaving the aircraft after the target but remember it is better to be too early than too late. By maintaining eye contact with your coach or formation as you reduce the vertical separation your head will naturally lift, which assists in your transition from the vertical dive to a “flatter” position. As your angle of attack changes it produces more air pressure on the underside of your body, slowing your rate of descent.

Be aware that you are now travelling at a much higher speed than you have experienced before. To reduce speed quickly from this position we can use the body flare. Judging when to flare requires anticipation and its best to err on the side of caution and aim to be early.

Ideally you will be 100ft above your target and to close the remaining distance use a combination of fast fall and forward movement. A good approach would be at a 45-degree angle down towards your target but aim to set up on level and 10ft out. Close remaining distance on level, stop, and pick up grips. If you transition too early and still have a few hundred feet to go, then you can transition back into a vertical dive for a few seconds before flaring out again.

If you imagine the seats in a football stadium, steep at the top, shallow near the pitch, it should give you a good idea of the shape of the swoop we are trying to achieve. It is ideal to practise this skill at least twice, but at least as many times as required until safe and proficient.

# Appendix G: FS Skills Theory - Exits

The exit is the starting point to a skydive and it's important to get off to a good start in order not to use up valuable time having to regroup as a formation.

To be successful on exit, the whole formation (whatever its size) should be on the same geometric plane, and flying without undue tension or rotation. To achieve this the group needs the following 3 things:

1. Timing
2. Presentation
3. Placement

## **Timing**

Timing refers to how synchronous all jumpers are during the exit. It would be ideal for all jumpers to hit the air at the same time, however this is difficult from an aircraft with a door on the side of the fuselage. The precise time for individual jumpers to exit depends on their slot in the formation but, whatever your slot, all jumpers work off the same timing known as the pulse or count. The "count" as it is often known can differ significantly between coaches/teams. Some will use an "Out/In/Out" count, some a shake, followed by an "Up/Down/Out", some even use the traditional "Ready/Set/Go". You have to know what count is going to be used so that the timing of the exit is known. This timing needs to be consistent and well rehearsed on the ground.

## **Presentation**

Presentation refers to an individual's attitude in relation to the relative air. To be able to have good presentation individual jumpers need to present their flying surface (the under surface of their body) onto the air. As a group, a formation should avoid being too flat as this can cause a formation to fold itself. So it's better to be steep.

## **Placement**

Placement refers to an individual's slot within a formation. Your placement is the foundation to your timing and presentation. When you exit an aircraft in a formation, you need to know where to place your body in relation to other jumpers.

As you progress through the FS1 system, your coach will vary the type of 2-way exits you use. This will develop your awareness for different jobs on exit. When you are going for your FS1 qualifying dive you will exit as part of a 4-way formation and having an overall awareness for different jobs on exit will aid your success on the launch.

Every formation exit is different and to describe the technique used for each one in detail here would be impossible. The following pages give some examples of some of the different exit positions and techniques you may experience for both 2- and 4-way exits and the technique involved.

## **Example 2-Way Exits**

On a 2-way exit, each jumper will have a different job. This is because each jumper will have a different slot in the door and each slot has a different name. The most commonly known slots are:

Front Float (F.F.)  
Centre Float (C.F.)  
Rear Float (R.F.)  
Inside Diver (I.D.)

### **Front Float**

Front Float is one of three 'floaters' exit positions. The front float exit position is used when both jumpers decide to exit from a position in the door, which is outside the aircraft. The other jumper would be in the centre float position in the centre of the door

#### Position in the door

Climb out and assume a position as far forward in the door as possible. Hold the bar/rail with both hands and get balanced with your centre of mass over your right foot. Get presented by trailing your left leg. If you are launching a linked exit, the centre float will take your right arm grip with his left hand. When you are ready, look at the C.F. and watch for the count.

#### On exit

As the count comes, move with the C.F. but, as your placement on exit is higher in relation to the C.F. be aware of the power required to place yourself correctly above them. As you exit, maintain presentation and keep eye contact.



Fig G.16

## Centre Float

The centre float exit position can be used with the other jumper either inside or outside of the aircraft. The job of the centre float is one of controlling the exit and this slot would normally initiate the count.

### Position in the door

Climb out and assume a position in the centre of the door. Hold the bar/rail with both hands and get balanced with your centre of mass over your right foot. Get presented by trailing your left leg. If you are launching a 2-way linked exit with a front float, take the front floater's right arm grip with your left hand. Other exits may require the other jumpers to take up grips on you.

### On exit

If you are giving the count, ensure that the other jumper is ready and get eye contact. As you exit, push off with your right foot and get your hips away from the door. Think presentation and maintain eye contact.

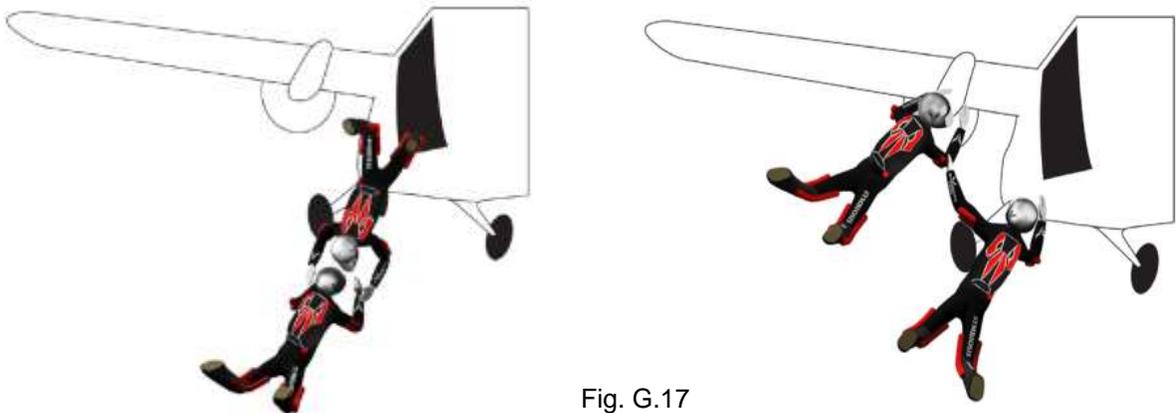


Fig. G.17



### Rear Float

The rear float exit position is used when both jumpers decide to exit from a position in the door, which is outside the aircraft. On a 2-way, the other jumper would be in the centre float position in the centre of the door.

### Position in the door

Climb out and assume a position at the rear of the door and wait for the centre float to get into position. Once the C.F. is in position take their right arm grip then, for practice, hang down as low as possible with your right arm fully extended. Trail your left leg and get presented.

### On exit

Look up at the C.F. and watch for the count. As the count comes move with the C.F. but as your job on exit is to be lower than C.F. think about exiting slightly earlier than C.F. Also, as your placement should be lower than the C.F. on exit, all you have to do is release your hold of the bar rail and drop straight down. Think presentation and maintain eye contact.



Fig. G.18

### Inside Diver

The Inside Diver position can be used when the other jumper is in the centre float position in the door.

#### Position in the door

Wait for the centre float to climb out and get into position in the door. Take the C.F. arm grips and position yourself as you briefed on the ground. Take time to get your position correct and think about which leg you are going to use to power out of the aircraft with to aid presentation. Get presented by lifting your right elbow and lowering your left. Stand with your left foot forward and feel balanced. You have the luxury of space in this slot so use it. Be near the door to help you exit, but don't crowd the C.F. by leaning out on them. When you are ready, look at the C.F. and watch for the count.

#### On Exit

As the count comes, move with the C.F. and leave with them. Use power in your exit to go with the C.F. rather than expecting them to "pull" you out of the plane. To aid in your presentation lead with your left foot and maintain eye contact.



Fig. G.19

## **4-Way Exits**

On a 4-way exit each jumper will have a different job. This is because each jumper will have different slots in the door. The four slots are commonly known as:

Point	Inside Centre (I.C.)
Outside Centre (O.C.)	Tail

### **Point**

The Point's job on exit is to be high on the formation in relation to the other jumpers. Point flyers use different techniques to achieve this on different formations – your coach will guide you.

#### **Position in the door**

As Point you may often feel like you have no room in the door especially with smaller aircraft. Pick up grips, be high in the door and get presented yet balanced. If necessary ask other jumpers to give you more room near the door to allow you to find your balance.

#### **On the launch**

Watch the count come from the centre and move with it, trust that space will appear as the formation leaves the door but don't wait to be pulled out of the aircraft. Your placement depends on the formation but you should be the highest jumper in relation to the rest of your group. You should always attempt to look across the formation towards the tail.

### **Outside Centre**

The Outside Centre's (O.C.) job on exit is one of responsibility and control due to their position in relation to the other jumpers on exit. The Outside Centre usually gives the count so they should know when the formation is ready to launch.

#### **Position in the door**

When getting into position aim to have your right foot in the centre of the door with your centre of mass directly above your right foot. Get balanced then take up grips or present them depending on the formation. Try to be presented to the relative air without sacrificing your balance.

#### **On the launch**

If you are giving the count don't rush it, give the other jumpers the chance to read it. Your placement depends on the formation but you should think about getting your hips away and out from the door to give space to the inside centre. As you launch look across at Inside Centre.

## **Inside Centre**

The Inside Centre's (I.C.) job on exit is to leave with the Outside Centre and in a position between Point and Tail.

### **Position in the door**

You will usually be the last to take up a position and take grips. As the inside jumper, it's usually easier to get balanced. Pick up grips and look to the Outside Centre.

### **On the launch**

Get eye contact with O.C. in the door and maintain this on the exit. Watch the count and move with the Outside Centre leaving at the same time. To avoid tension on the grips think about getting your hips through the door. Your placement depends on the formation being launched but you should be level with Outside Centre.

## **Tail**

The Tail's job on exit is to be the lowest jumper in the formation in relation to those you are jumping with. In order to achieve this the Tail needs to leave the aircraft ever so slightly earlier than the Outside Centre.

### **Position in the door**

When getting into position, firstly get balanced to the rear of the door than present or pick up the grip depending on the formation. Lastly try to lower yourself in relation to the Outside Centre but if you have a grip on him or if he has a grip on you, be sure not to pull him down with you. Once you are in position look for the pulse or count.

### **On the launch**

Whatever count is used, move with it, whether it is up down out, or out in out, just be in time with the count but remember to be slightly early when the formation hits the air. With this slot, anticipation is THE top tip and by getting low in the door you will give yourself a head start. Your placement depends on the formation but whatever it is you should be looking up at the formation trying to make eye contact with Point as soon as possible.



Fig. G.20