



Australian Parachute Federation Incorporated

Wingsuit Training Guide



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STATUS: EDUCATIONAL

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Warning

Parachuting and flying in parachuting aircraft can be dangerous.

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Version Control

It is important that members refer to the current version of this guide. This guide is current only at the time of printing by the APF Office. This revision was published on 15 September 2014.

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Disclaimer

This guide has been produced for the information and assistance of APF members. The information it contains is based on the opinions of the writers: it does not necessarily represent APF policy. While the writers have attempted to ensure that the information in this guide is correct, it may contain information which is out of date or incorrect.

This guide is not a do-it-yourself guide to skydiving but should only be used while under the supervision of a qualified APF instructor or wingsuit coach. Individual skydivers should check the information in this guide and assess the risks involved before carrying out any of the procedures or manoeuvres described.

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Credits

This guide was originally developed by Lawrence Hill as a part of his Instructor A Thesis. It has been edited with assistance from Ben Nordkamp and includes guidelines for wingsuit choice compiled by Ben.

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Regulations and Application

Like all other skydiving disciplines, wingsuit skydiving is controlled by APF regulations, especially relating to the responsibilities of Wingsuit Coaches. APF regulations and the Training Operations Manual define the prerequisites and details for “training descents”, the Wingsuit Training Table and that trainees will be thoroughly briefed by a Wingsuit Coach before being permitted to undertake a wingsuit training descent.

This guide is not designed to replace the Wingsuit Training Table delivered by a Wingsuit Coach. It does however, examine and discuss the numerous aspects specific to the discipline of wingsuit skydiving.

In interpreting the material in this guide, the interpretation that would best achieve the purpose or object of the guidance (whether or not that purpose or object is expressly stated in the guidance) is to be preferred to each other interpretation. Where an inconsistency arises between this guide and APF regulations, the regulations will prevail.

1. SAFETY

Wingsuit flying is a relatively young branch of the ever evolving and changing skydiving family tree. The first ever commercially available wingsuit was manufactured in June 1999 by Bird-Man Inc, and so we have a little over 10 years of experience to draw on when we look at the discipline to see how we can operate with “best practice” in mind. We must then take into consideration the lessons learnt here and around the world so we can have safety conscious, well organized wingsuit skydiving here in Australia to clearly demonstrate that wingsuit flying deserves its place alongside the older disciplines.

1.1 Currency

As with all branches of skydiving, currency allows us to show our potential and get much more out of our jumps - and also react to stressful or unexpected situations in a relatively calm manner. This is of even greater importance with wingsuit flying, due to the restrictive nature of the suits and high level of flight power we have at our disposal.

- **Initial Jumps at a new DZ:** it is a good idea to make 1 or 2 jumps at a DZ before you fly your wingsuit. This gives you a chance to acclimatize to the new DZ, learn to navigate in new surroundings, get used to the landing areas, local rules and generally blow out the cobwebs. When you zip up your wingsuit ready for a flock or solo flight, you will do it with a clear head and not be trying to get used to everything all at once.
- **Initial Wingsuit Flights at a new DZ:** should be easier small flocks (2 – 4 way) to get the feel for your wings and also tune in your navigation to a new area. A flight with an APF Wingsuit Coach would be recommended for novice wingsuiters, especially those who may, for example, have only leant at the last boogie and haven’t flown a wingsuit since. This is a good chance for a refresher on general and emergency procedures. To jump straight in and expect to be as good as you were at the end of the last Boogie may leave you open to simple errors or even dangerous situations that can easily be avoided.

1.2 Canopy Selection for Wingsuit Flying

It is important that you consider which canopy you will use for your initial and early wingsuit flights. For a novice wingsuit pilot there is a lot to remember during these flights. On opening there is not full access to risers until the wings have been unzipped (unless using a training wingsuit).

- **Select a relatively docile canopy with ‘consistent on heading openings’.** A PD Sabre or Storm, or Icarus Sapphire are styles of canopies that are more forgiving of asymmetrical body positions or a wing that is left slightly open during deployment. If you normally have to get your hands on your risers quickly on opening to control the canopy, then a change in canopy would be recommended for your wingsuit flights.
- **Square or semi-elliptical** is recommended rather than elliptical or cross-braced: line twists, which can be caused by a number of factors before and during deployment, can be the cause of a cutaway on these canopies. Once the canopy is open and the arm wings unzipped there is still a need for time to unzip the legs and clip then up for landing. High performance canopy’s will be using altitude and turn every time the harness is moved in these post deployment procedures.

1.3 Audible Altimeters

- **It is mandatory that audible altimeters are used when flying a wingsuit.**
(as per Operational Regulations)

1.4 New Equipment/Demo Suits/Borrowed Suits

Wingsuits to be worn by trainees must be approved by the Wingsuit Coach in accordance with manufacturer's guidelines and considering other factors that may affect trainee safety and performance. (See [APF website](#) or Appendix D for recommended guidelines.)

- **The recommendation to use these suits should come from an APF Wingsuit Coach**, who can assess the suitability and provide training on the set-up and use of the wingsuit. Any differences from the equipment used in the past can be discussed and new ideas on flight and performance can be shared.
- **It is HIGHLY RECOMMENDED that a full practice with the wing cutaway system:** (where the wings are ACTUALLY cut away) is performed, so that should their use be necessary on a subsequent flight, there will be muscle memory and knowledge to use them effectively and safely. Some suits require different cutaway techniques and angle of pull to others. During a flat spin or out of control moment is not the time to find this out. Standing on terra firma in a briefing by an APF Wingsuit Coach is a much better option.
- **Normal emergency procedures:** Canopy cutaway and reserve deployment must also be practiced while wearing the suit.
- **Pilot Chute:** Practice locating and using the pilot chute, with actual practice throws. Assistance with this step is important, to ensure a good and effective pilot chute throw, especially when moving onto a wingsuit with greater performance and larger wings.
- **The first flight on any new wingsuit:** It is recommended that a solo flight be made whenever flying a new and unfamiliar wingsuit. This will allow an opportunity to assess and become familiar with the new suit's capabilities.

1.5 Tail Strikes / Exits

There have been two tail strikes by wingsuiters at boogies in Australia in the last 6 years. Fortunately in both cases the only damage was to their pride and wingsuits, and one in America last year where the jumper was not so lucky. This then raises a red flag as a subject that must be taken seriously and those using unfamiliar aircraft need to gain instruction on how to safely exit these planes, whether doing as a solo or involved in a large flock. In any aircraft other than the Skyvan, premature opening/partial/full inflation of the wings of a wingsuit in or just off the door can result in striking the tail of the aircraft. Jumping up off the door can also be considered a problem.

- **Case 1:** Wingsuit Weekend 4/9/04, Nagambie, 2004, from the XL. Male, 20yrs, 267 jumps, 5th on his new wingsuit, visiting from the USA. Quote from Bobby Gill USPA C-33909 *"I exited the side of the plane in what should have been a proper position with wings closed, facing the relative wind. From watching my video in slow motion I must have jumped up slightly when trying to get a good launch out the door. That, along with my wings opening early (how else could they have struck) caused me to go up about two feet and then back down. As I came down, the back right of my leg wing struck the tail of the plane, whipping me around to the left. Luckily, neither I nor the plane were damaged."* The leg wing was torn in half.
- **Case 2:** Boogie in Bachelor, July 2009, from a Caravan. Male, experienced wingsuit pilot, had been jumping with same group all day, over amped on exit, inflated wings off the door, flew straight backwards with the rig hitting the tail, nearly went over the top but the wind on the leg wing pivoted him back underneath. Apart from a few bruises, no injuries – VERY LUCKY! There was a dent in the tail of the plane.

- **Case 3:** Skydive Elsinore, California, USA, Nov 2009 from a Twin Otter. Male, experienced wingsuit pilot, inflated wings as he exited the plane. Presumed dead on impact of the tail (horizontal stabilizer), cypress fired but he landed away from the DZ, about 800ft up in the Ortega's.

Circumstances: long spot 3.6 miles out – this may have influenced his rush to get his wings out, largest wingsuit on the market – this may have accentuated the problem.

1.6 Side Door Exits

Rushing an exit to follow others is a contributing factor that could increase the risk of tail-strike, **stay calm, stay focused:** you have 2 minutes of flight ahead of you.....plenty of time.

- **The preferred exit from a side door** turbine aircraft (XL, Caravan, Beaver, Cresco, Twin-Otter) is to be facing the front of the aircraft, have hold of your wings(if needed) hands on chest – elbows at sides – wings closed, ankle and knees together - leg wing closed, then a bunny hop out the door, head high, chest into relative wind, **WAIT 2 SECONDS** or until you see the tail of the plane go past then open your wings symmetrically and fly away....Yee-hah!



Photo by Paul Morton

- **If exiting from outside the aircraft:** facing the front is recommended, wings must be kept closed during climb out and during the exit, and then opened after **WAITING 2 SECONDS** (check you can reach the bar and are comfortable with this sort of exit on ground/mock-up). This is usually done for bigger flocks, but even then the exit will be staggered to prevent exit collisions and allow room to open your wings, with wingsuit exits – unlike Formation Skydiving (FS) - half a second between exits is not a problem, the pilots leaving the plane later will effectively be above and in front of those that left earlier. It is easy to turn and use the extra height to catch the flock and take your slot.

1.7 Tail Gate Exits

The preferred aircraft type for wingsuiters! (Skyvan, C 130.....wish there were more). Exiting this type of aircraft allows us to inflate our wings much sooner with NO chance of a tail-strike, it is still recommended to exit facing forward.

- **Rear facing or dive exits:** make it difficult to co-ordinate exits with others and increase the chance of collision: also if you have your leg wing open on exit the relative wind will push on it, putting you in a more head down position than required causing a sudden loss of height.
- **Exiting the Skyvan:** you stand close to the edge facing forward, wings out and ready to fly. Hop back (poised) off the plane, as you do this bend your legs back at the knees so the leg wing will only partially inflate, at the same time be strong with your arms, as you feel the pressure in the wings and you start to fly, extend your legs and push toes outwards. You will feel the extra lift created by the launch from the Skyvan: you can turn and locate the leader of your flock. Done effectively, enough lift can be gained to rise above the plane you have just left.....AWESOME!

1.8 High Opening Canopies / Malfunctions

It usually takes more than one factor to tip the scales enough to cause an incident and this situation would need at least two factors (probably more) to occur together.

- If a wingsuit flyer were to stray from the flight path they are on, which should be parallel to jump run, and end up flying back near jump run and potentially above/near groups which were the first out of the plane.....
- If one of the skydivers in the earlier groups has a premature opening or malfunction then there is a chance that a collision could occur.....Very Scary

At boogies where there are many different types of disciplines, exit orders, experience levels and conditions, it is paramount that different flight modes – **FS, Atmonauti, Track, Freefly, Skysurf, CRW and Wingsuiting** are able to communicate and stay in their predicted flight areas.

1.9 Low or Chasing the Formation at 6000 Ft

After discussions with wingsuit instructors, and hearing a few anecdotes (thanks Andy Weal BMI), this situation has produced some very scary close calls. When wingsuiters leave a formation at break-off, they turn and fly away from the centre (see Flocking/Break-off), those at the side or back will turn between 90 and 180 degrees. This means if there is anyone following then a collision course is possible and some very dangerous situations could be created.

- **If you have gone low on the formation after exit or during the flight:** there may be time to fly behind or to one side of the formation and use maximum lift (de-arch, dig wings in, relax) to gain enough altitude to be able to rejoin the flock.
- **If you are still low at 6000 ft:** it is time to accept that you will not be rejoining the flock and clear the area **BEFORE** the formation reaches break-off height. You **MUST** turn and fly at an angle away from the flock **clearing the area:** you should be able to watch the formation as you do this. This is similar to training we are given in FS, if you are low and can't get back up you must track away from the formation.
- **If you are chasing the formation at 6000 ft:** it is time to accept that you will not be rejoining the flock and clear the area **BEFORE** the formation reaches break-off height. You **MUST** turn and fly at an angle away from the flock **clearing the area.**

1.10 Closing Speeds / Freefall Collisions

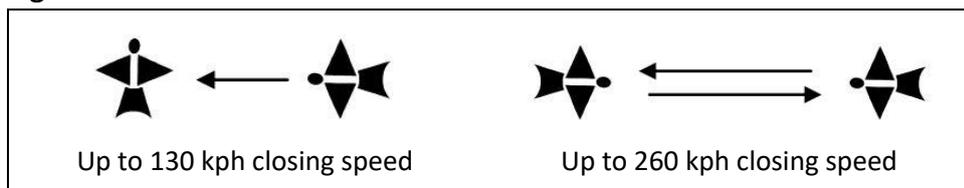
The wingsuits give us a huge range of speed, acceleration and the ability to turn VERY quickly, this power is one of the reasons we fly wingsuits. We must have great respect for these abilities and fly in such a way that we do not put the other wingsuit pilots in the sky at risk. A collision between two wingsuit pilots is a VERY dangerous situation and could even be fatal.

Food for Thought: (remembered from an ASM “no shit there I was!” approximately 4 years ago) An Australian skydiver was on holiday in America and had his wingsuit with him, he met two American’s who asked him on a 3-way wingsuit jump. They exited the plane, the Aussie was moving towards the one of the wingsuiters but could not see the other, he saw something out of the corner of his eye, felt an impact, and next thing he knew was coming to, laying on the ground with his reserve flapping behind him. He was knocked unconscious by the other wingsuiter and his life was saved by his Cypres. Luckily there were no serious injuries.

This is a dramatic example of what could possibly occur.

- **Never fly straight at another wingsuit flyer or formation.** ALWAYS aim to one side or behind.
- **“No Zooming Around”.** Fly in a predictable manor, if you do not know where the other wingsuiters are, fly very carefully until you find out!
- **Be careful about what size formation you attempt.** Larger formations require good wingsuit control and a high degree of AWARENESS to fly safely with the other pilots. In FS (REL) you would not expect to do your first 3 way, then straight on to an 8 way, so don’t expect to do so in wingsuit flying.
- See **“Safe Approaches” - Chapter 4 -Flocking**

Figure 1: Freefall Collisions



1.11 Flat Spin/Out of Control Recovery Technique

Sooner or later there will be a situation which will surprise you and remind you of the size of the wings and power that is contained in your wingsuit.

My wake-up call came after roughly 60 wingsuit flights, after watching a friend of mine back flying his wingsuit and making it look easy, I decided to give it a try myself. On a solo at 9000 ft, I rolled my Blade over expecting to backfly away, I didn’t arch my back enough and dropped into a cork screw head first towards the planet, no matter what I did, it got faster and wilder, I was out of control..... I remembered my training and curled up into a ball, knees on chest, elbows in and waited..... It all stopped, I was on my back falling, so I rolled over, opened my wings and flew away, and I was now at 6500ft. My pro-track recorded a change of freefall speed from 59mph to 143mph!

As we explore the different flight modes and discover new ways of flying our wingsuits, we may end up in an out of control situation, we need the techniques to get back in control. In your AFF course you were taught to recover from instability, wingsuit flying should be the same, if we fly around in fear of losing control we will never be able to explore our full potential.

- **Out of control:** There are many different ways to achieve an out of control situation, for some of the less dramatic types arching your body and closing your wings may work. In general there are two ways you can respond:
- **Cut away your arm wings** and close your legs, with knees bent (use the leg wing cut away if you have one), this will enable you to use your arms and normal skydiving skills to regain control.

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- **Roll into a ball, recovery position:** When you ball up, elbows in - knees towards chest, it closes your wings and puts you on your back (similar to recovery position in Freefly), from here you can roll over and fly away or cut your wings away if you prefer or there is some problem with the wingsuit.
- **Flat spin:** This is where you end up rotating around a point in the middle of your torso, flat facing the planet or knife edge-90 degrees from the earth. See fig 2. **The "ball"** position is the preferred way out of a flat spin.

Figure 2: Flat Spin



This is what a flat spin would look like from above: the rotation is fast due to the low amount of drag or resistance in this position.



Photo by Paul Morton 2014

2. APF WINGSUIT COACHES

APF Wingsuit Coaches play an integral and very active role, as well as their involvement in training being prescribed by APF regulations. Their involvement will increase as the discipline gets bigger and we learn more about the amazing suits we fly. We are starting to see record attempts, artistic wingsuit competitions (2-way), 3-dimensional flocking, and this is only the beginning.

As we are involved in a relatively new discipline, the learning curve is steep and it is important that the Wingsuit Coach is there to bridge the gap between the established disciplines and the new flockers. If there is a good spread of information and understanding of what we are doing, it is much easier for us to work with everyone else at a boogie and to have a safe and FUN time. Also, just as we have interests in other types of freefall, we are hoping to see many others try our discipline.

2.1 Initial Training: The Wingsuit Training Table

Before a skydiver undertakes their first wingsuit jump, they must meet the prerequisites set by APF regulations, i.e. hold at least a Certificate Class D, have equipment that is suitable for wingsuit flying, and have completed a course of instruction in accordance with the Training Operations Manual (TOM).

For up-to-date requirements, check the latest version of the Operational Regulation and Regulatory Schedules on the [APF website](#), with a Chief Instructor on the organisation's TOM, and with a Wingsuit Coach.

The TOM contains the necessary training progression (delivered by a Wingsuit Coach) in the Wingsuit Training Table. This Training Table is divided into 3 parts:

- PART A: First flight and basic wingsuit flying – 3 initial stages (minimum 3 descents);
- PART B: Consolidation and Restricted RW - Building experience and confidence (no fixed number of descents); and
- PART C: Wingsuit Crest – 4 stages (minimum 4 descents).

Following successful completion of Part A (which starts with the First Flight), the trainee must obtain the written and signed approval of a Wingsuit Coach and a Chief Instructor in order to participate in restricted relative work during wingsuit descents defined in Part B. Each stage of the Training Table must be completed to the satisfaction of the Wingsuit Coach and DZSO before progression to the next stage, and signed-off in the trainee's log book by the Wingsuit Coach.

- Wingsuit flying is certainly not "just another skydive". So it is very important that the skydiver is competent and able to:
 - Recover from spins and other unstable free fall manoeuvres
 - Demonstrate and ability to correctly respond to emergency procedures in a calm, confident and calculated manner.

2.2 Training by an APF Wingsuit Coach

The following topics are covered in training by a Wingsuit Coach:

- Introduction to Wingsuits and Wingsuit Flying
- Safety – Issues specific to flying wingsuits
- Gearing up – check gear for compatibility, learn to attach the Wingsuit
- Check handle placement – practice emergency procedures with the Wingsuit on
- Wingsuit cutaway handles – learn new emergency procedures and handle placement
- Pilot chute – learn modified pull sequence

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- Training sequence – practice new techniques
- Exits – general and specific to the aircraft being used
- Turn technique
- Practice touch – an in-flight practice deployment
- Body position – arms, body and leg positions, how to create lift and speed
- Wave off
- Deployment sequence
- After deployment
- Possible emergencies

2.3 First Wingsuit Flight

Your Wingsuit First Flight involves the following (Stage 1, reproduced from the TOM):

Prerequisites:

- First Wingsuit jump course, including:
 - Equipment, accessories and appropriate choice of wingsuit
 - Basic flight characteristics of wingsuits
 - Jump run, exit point, flight path and landing pattern
 - Emergency procedures for aircraft, freefall and under canopy.
- Exit height to be minimum of 10,000 feet AGL.

Aims:

- Exit the aircraft stable and demonstrate control
- Fly the planned flight path (left or right hand circuit)
- Time/altitude awareness maintained
- An effective Practice Pull
- Demonstrate 3 heel clicks as part of deployment procedure at correct pre-planned altitude
- Maintain stability throughout opening of the parachute
- Wingsuit emergency procedures.

Minimum requirements:

- Able to demonstrate appropriate emergency procedures
- Stability during exit, descent and deployment
- Height awareness maintained
- Control demonstrated during execution of flight plan
- Correct use of deployment signal and opening at pre-planned altitude.

2.4 Demo Suits / New Wingsuits

- **Demo suits will be provided by a Wingsuit Coach.** These may be their own or supplied by one of the wingsuit manufacturers, they will be in control of making sure everyone gets a turn and the right wingsuits are used according to experience and size. Sometimes these suits will be for sale, this works well as you know what you are getting and can have it NOW.
- **New wingsuits** may be available to try and buy or can be ordered through your Wingsuit Coach. They will recommend what is best for you and have information on the different designs/types. See Appendix D as a guide.

Megan and Riss looking happy after their first flights
Afterlife Boogie 2009.



2.5 Novice Wingsuit Pilots

Generally the novice period is from 3 wingsuit flights to 30 flights, which initially involves completion of the 8 stages in the Wingsuit Training Table. Progression will depend on the individual and how often they are flying. The learning curve is steep and there is a need to learn from a Wingsuit Coach and experienced wingsuit pilots. This will prevent us from all making the same mistakes. It is much easier to learn from each other, accept some assistance and maybe a little mentoring during this period.

As per APF regulations, participants in RW descents involving more than 10 skydivers must hold an Australian Star Crest or foreign equivalent acceptable to the APF.

Guidance should be sort regarding:

- **Weather:** wind strength at different levels and suitability for someone of your experience.
- **Flight Plan:** current jump run being used, and the expected flight plan to suit the conditions.
- **Flock selection:** it is important to try and have an experienced flyer in the flock, to assist with navigation and provide a stable base to work from. Similar to Freefly, too much inexperience on a jump will make it dangerous and very little will be achieved.
- **Jump design, type and size:** something that will enable you to improve your flight skills, gain experience and is achievable.
- **More than one jump with the same people:** if possible, a few jumps with the same small group will enable you to get used to each other's styles and find a pace that works for everyone. This will create better flocks, more fun and better learning.

3. FLIGHT PLAN AND NAVIGATION

These 3 words are an essential part of the wingsuit pilots jumping life, whether you are leading or following, an understanding of where you are in relation to the DZ and why, is important information you need to know. If wingsuit pilots start landing off DZ, the DZSO will be asking questions, if it happens frequently (apart from being dangerous) there will be a loss of trust and the DZSO may start restricting wingsuit flights. It is the responsibility of all pilots to work together and stay safe.

Information on current wind, weather conditions and expected jump run direction can be gained from the Wingsuit Coach or the DZSO and load organizers. It is essential that each wingsuit pilot consults an aerial photograph of the DZ and local surrounding area.

3.1 Aerial Photograph + Grid

- **Aerial Photograph:** Once the flight plan has been decided upon, then use of aerial photograph of the DZ to gain a sight picture of what you expect to see as you exit the aircraft and during your flight. This is essential to good navigation. A grid can be super-imposed on the aerial photograph to show distance (0.5 nm and 1.0 nm circles) and also compass bearings. See Figure 3.
- **The grid** assists with an accurate sight picture. In Figure 3, you can see that if the spot is 1 nm south, then the exit point is half way down the main runway. For a left turn flight plan, you would exit then turn towards the coast fly 10 seconds then turn back on the south bearing and expect to deploy inside the 0.5 nm circle.

Figure 3: Aerial Photograph with Grid



Coffs Harbour is a good example of the uses of grid, as without the grid you expect north and south to follow the coast, but as you can see this is not the case. If you attempt to navigate using this assumption it would be easy to make an error and have difficulty making it back to the DZ. (especially in strong winds)

The following are some example flight plans based on varying wind conditions that I have compiled.

3.2 Light Winds / “Normal Conditions”

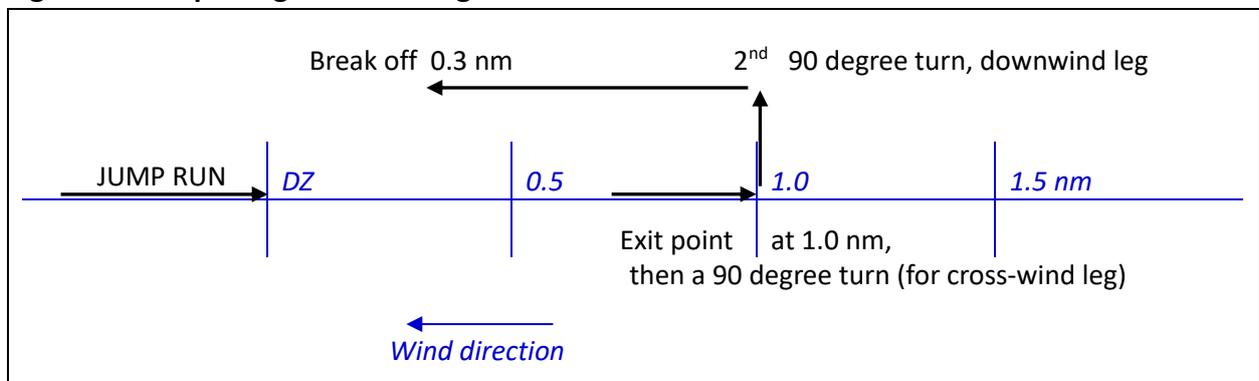
Winds of 0 - 15 knots on the ground, 10 - 20 knots through to jump height and the same or similar direction to the ground winds. (This is intended as a guide only.)

Example flight plan for light wind conditions

In these conditions a general flight plan can be used and adjusted to suit the wind directions of the day, and also adjusted if the conditions change during the day. Other considerations would be the experience of the wingsuit pilots, as with all skydiving, the plan must be based around the least experienced pilot. Generally with lesser experiences pilots or flocks, a shorter flight plan is needed as they are likely to cover less distance with less flight time, experienced pilots and flocks will generate more speed and lift extending their flight times and allowing for a longer spot.

- The Flight Plan:** the basis for most wingsuit flights is an exit from the aircraft, upwind of the DZ, on jump run, after the other disciplines have exited, followed by a 90 degree turn to take the flyer off jump run, then another 90 degree turn so the wingsuit pilot is now flying parallel to jump run and back towards the DZ. This is done to ENSURE that there is separation between the wingsuit pilots and the other disciplines exiting the aircraft, the turns can be to the left, for a left hand circuit or to the right, for a right hand circuit. See Figure 4.
- Exit Point:** would generally be between 0.7 nm and 1.3 nm, with break-off at 5000ft, deploy canopy by 4000ft and expect to be between 0.2 nm and 0.5 nm from DZ, upwind and easily able to make it back onto wind line.

Figure 4: Sample Flight Plan for Light Winds



The numbers used here are based on a 14,000 ft exit. If a lower altitude exit is used (due to weather, cloud, air traffic, other), then the exit point must be shortened due to less flight time. The flight plan is based on an 8 – 10 second cross-wind leg. If this leg is extended, then this will also require a reduction in the exit distance.

3.3 Strong Winds

Example flight plan for STRONG GROUND WIND

Winds of 15 - 25 knots on the ground and up to 1500ft.

In this example we have strong ground wind but light wind conditions from 1500ft up to jump height.

- The flight plan** will be very similar, with an emphasis on making sure everyone has canopy deployed and able to make it back close to wind line before the ground wind kicks in, this will generally require a slightly longer spot than in light winds.

Wingsuit Training Guide

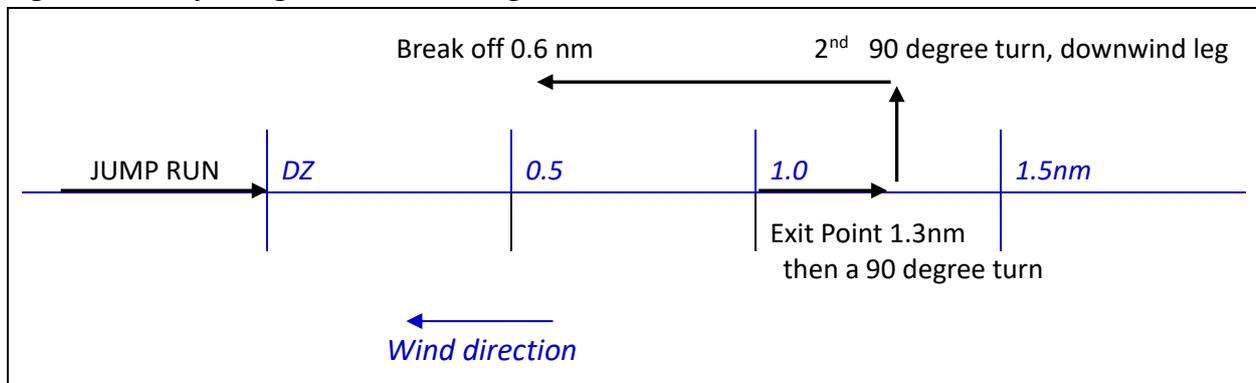
- **Exit Point** would be 0.8nm to 1.4nm from the DZ and you would need to be under canopy 0.3 – 0.6nm from the DZ.

Example flight plan for STRONG WIND FROM 1500FT – 5000FT

In this example we have winds of more than 20 knots from 1500ft – 5000ft, the wind at all other altitudes fits into the Light Wind category. (This is a guide only.)

- **The Flight Plan:** these winds will require a longer spot as the opening point must be moved further up wind to allow time for the wingsuit pilots to unzip wings, control canopies and fly back onto wind line, being too far off wind line will result in not being able to make it back to the DZ. These conditions would not be suitable for some wingsuit pilots, as greater accuracy of opening point will be required. See Figure 5.
- **Exit Point:** would be 1.0 - 1.6 nm from the DZ and you would need to be under canopy 0.4 - 0.7nm from the DZ.

Figure 5: Sample Flight Plan for Strong Winds from 1500 ft – 5000 ft



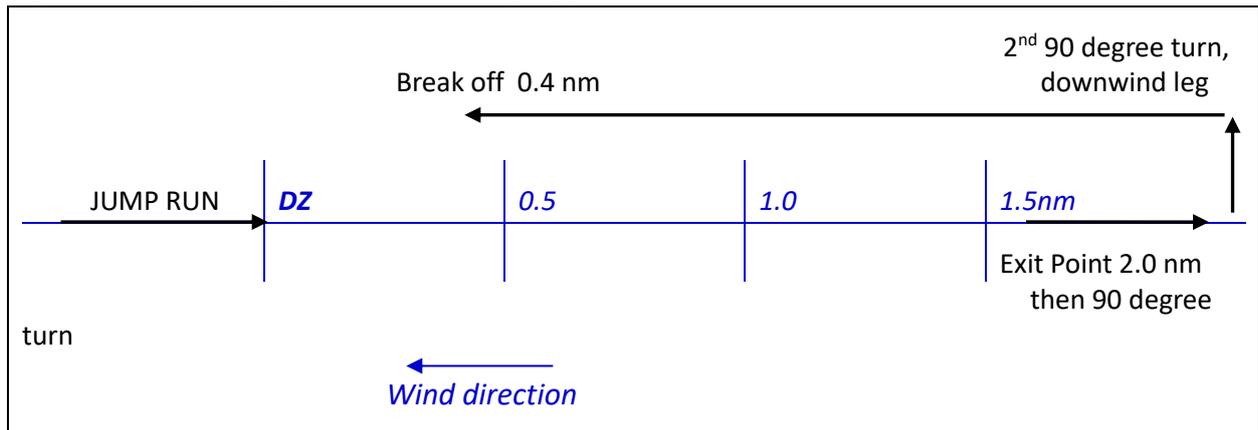
Example flight plan for STRONG WINDS ABOVE 5000FT

In this example we have winds above 5000ft of more than 20knots (this can get up to 50 knots or more), winds below this altitude fit into the Light winds category, and is in the same direction. (This is a guide only)

- **The Flight Plan:** These conditions would not be suitable for some wingsuit pilots. They will require the exit point to be moved further upwind as there will be much greater freefall drift and much higher speed on the downwind or main leg of the flight and more distance will be covered in the same flight time. Due to this, the direction of flight and in air navigation are much more critical as a change of 10 -15 degrees from the flight plan could mean the opening point would be 0.5 nm further away from the DZ than predicted. See fig 6
- **Exit point:** would be 1.5 nm to 2.5 nm (this will vary according to the speed of the uppers) and the opening point would be 0.2 – 0.5 nm from DZ.

Another issue that must be considered is that if the winds are stronger than predicted, with the extra speed of the tailwind – 130 kph (average speed) + 40 knots tailwind = approx. 210 kph ground speed – it is REALLY easy to fly past the DZ!

Figure 6: Sample Flight Plan for Strong Upper Winds



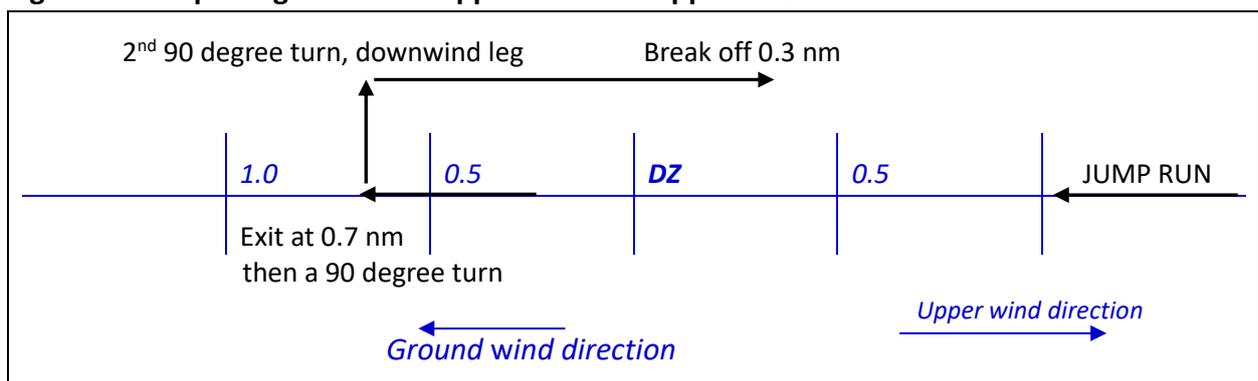
Keep your eyes and your mind OPEN looking for a change from what you expected, just because it worked on the last load doesn't mean things are exactly the same now, the sky is constantly changing and adjusting, especially when the winds are strong and any little shift will have an effect on our flight plan and position in the sky.

Example flight plan for UPPER WINDS IN OPPOSITE DIRECTION TO GROUND WIND

Winds of 15 – 25 knots on the ground, winds 15 – 20 knots through to jump height but in the opposite direction. (This is a guide only)

- **The Flight Plan.** As the jump run will be in the opposite direction to the ground wind and due to the strength of the ground winds we will still need to have our canopies open up wind of the DZ. These conditions would not be suited to some wingsuit pilots. Have a look at Figure 7: you can see the exit point has been shortened so the opening point will be the opposite side of the DZ.
- **Exit point** would be 0.4 – 1.0 nm downwind and the opening point would be 0.2 – 0.4 nm on the opposite side of the DZ, upwind.

Figure 7: Sample Flight Plan for Upper Winds in Opposite Direction to Ground Wind



A small miscalculation or error in navigation and it would be very easy to end up unable to make it back to the DZ.

These conditions probably present some of the most challenging flight planning for wingsuit pilots, DZSO's and aircraft pilots alike. As with many of the scenarios discussed here, is it highly recommended that guidance from a Wingsuit Coach is sort before flights are attempted.

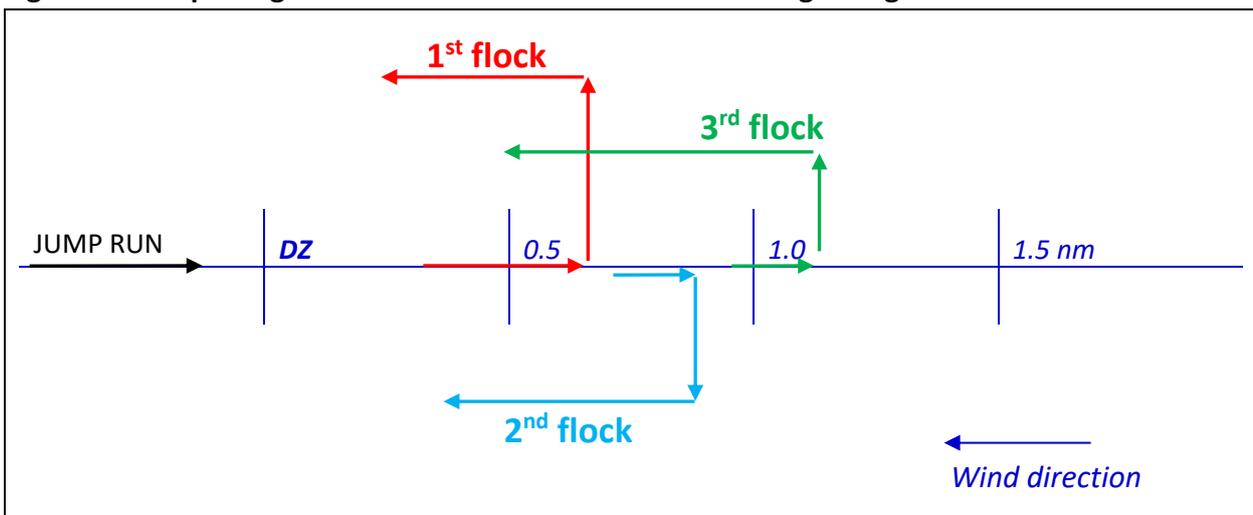
3.4 More Than One Flock Exiting a Single Aircraft

For this example we will assume we have Light Winds.

- **Flocks on opposite sides of jump run to maintain separation:** from each other and also from the other disciplines exiting the plane. Typically the **1st flock** would exit and turn left making a left hand circuit, the **2nd flock** would exit and turn right making a right hand circuit. See Figure 8.
- **3rd flock:** They could now exit and turn left and make a left hand circuit and this would still provide enough separation. The more experienced pilots would exit as the first group and less experienced pilots in the third group, this would be necessary to prevent the third group catching the first group. The difference in their opening heights will also assist, as the 1st group will travel further and open lower (3500 to 4500ft), the second group will travel less distance and open higher (4500 to 5500ft).

As you can see from the diagram, the 1st flock would exit early - 0.7 nm and turn left, then make a longer cross-wind leg. The 3rd flock would exit late – 1.1 nm and turn left, then make a shorter crosswind leg. This will assist with separation of the two groups and also help with still deploying their canopies in the correct area, even with two quite different exit points.

Figure 8: Sample Flight Plan for More Than One Flock Exiting a Single Aircraft



3.5 Multi Aircraft Boogies

In this example, there are two aircraft operating at a boogie and they will both be using the same jump run one after the other, with a time difference of 3 to 5 minutes. “Light Winds”

- **Wingsuit Flock in the second Plane:** If it can be organized and pre-planned with manifest, then having the wingsuits flyers on the **second plane** will allow a “normal” flight plan to be adopted.
- **Wingsuit Flocks in both Aircraft:** then the flock in the first plane can exit and turn left for a left hand circuit: the flock in the second plane can exit and turn right for a right hand circuit. This will maintain separation between the flocks, with each having a designated area to fly in. The wingsuit flyers from the first plane need to remain off wind line or jump run with their parachutes until approximately 1500ft, as they will be still be in the air when the second plane is on jump run.

3.6 Wingsuit Flying and Cloud

Flying wingsuits in cloudy conditions can present a range of experiences, from incredible visual opportunities and fun, through to abundant danger, depending on where the cloud is, what type and how thick it is. See APF regulations.

- **Scattered Cloud:** Usually not a problem to visual navigation, especially if you have already done a few flocks at the DZ and have a mental picture of the area, as long as there are not multiple layers.
- **Broken Cloud:** This very much depends where the cloud is, how much and how thick, in general if there is any doubt about your ability to maintain visual navigation back to the DZ, then you should not be flying wingsuits. Discussions with wingsuit instructors and the DZSO are recommended prior to flying in these conditions.
- **Overcast or Solid Cloud Layer:** If there is a solid cloud layer that cannot be avoided, then it is recommended that wingsuit flying should be postponed until conditions change. Solid cloud will prevent visual navigation and being able to see the reference points we need to safely navigate our way back to the DZ. At DZ's that have cloud jumping manuals, this may mean jumping can continue but for us it's time to go, change suits and get involved in Freefly or FS.



Photo by Scott Paterson

3.7 “No Turn” Flight Plan

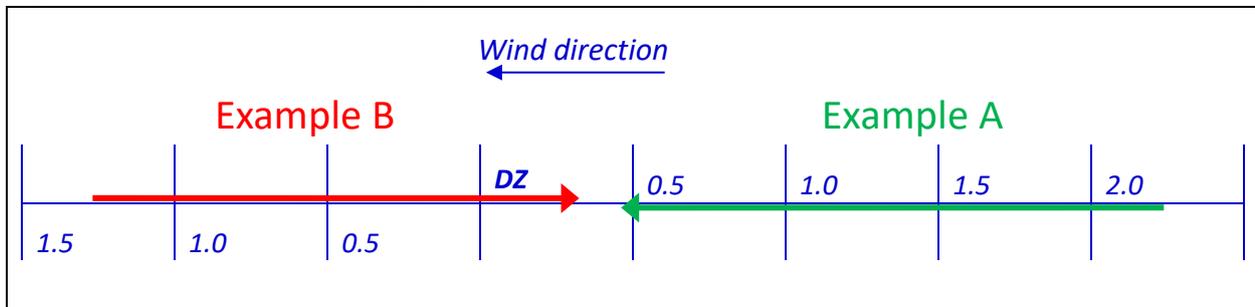
This flight plan is occasionally used for larger formations where everyone in the plane or planes is involved in the flock and there are no issues with avoiding skydivers from other disciplines or groups (sourced from an anecdote from Neil Fergie). For this example we will assume we have “light winds”.

- **The Flight Plan** is to exit the plane and keep flying in the same direction until break-off. This will allow the formation to build faster as there are no turns to negotiate and navigation is simplified to maintaining the bearing you are on.

Example A: Jump run would be flying towards the DZ running downwind, the opposite of a conventional jump run. See Figure 9. This would only be possible if the upper winds are not too strong.

Example B: Conventional jump run would be with the flock exiting before the DZ and flying over the DZ to the upwind area.

Figure 9: Sample “No Turn” Flight Plans



- **Exit Point: Example A,** 1.5 to 3.0nm up wind, with a flight path directly towards the DZ. Canopies open between 0.2 and 0.5nm upwind of the landing area. Example B, exit the plane between 1.5 and 1.0nm downwind of the DZ, canopies open between 0.2 and 0.5nm upwind of landing area.
- **Challenges with this flight plan:** working out the exit point, taking into consideration the extra plane speed due to the downwind jump run and the lack of turns for the flock, or the slow flight speed of the flock flying into wind.
- **Challenges for the Wingsuit Pilots:** as the base and the first row of wingsuiters leave the plane they will be flying straight ahead on jump run, (instead of turning 90 degrees) this means the flyers that leave mid-pack to last out will effectively be above and maybe in front of the formation. In this situation you would need to float, locate the base, be aware of the other pilots, then using your extra altitude make an effective approach towards the flock, get on level, take your slot.
- **If you get out late and dive hard in this situation, you could dive straight THROUGH the flock:** *when you leave the plane you would be directly above the formation!* If you are last out on any bigger formation, be it wingsuit flocking or large FS, instinctively we expect to get out and fly hard to catch the formation. With exiting above the flock and potentially a two minute flight ahead, we need a calmer mindset to make the most of our position and the performance we have available to us.

3.8 Communication with the Pilot

If we are all on the same page, it makes it easier to “plan the dive and dive the plan”. We need to communicate our intentions to the pilot, so we can work together to be in the right place at the right time. Experienced pilots can be a great source of information and assistance, especially in changeable weather conditions. Information the pilot should have:

- **How many wingsuiters.**
- **How many flocks.**
- **Left hand circuit or right hand circuit, both in the case of multiple flocks.**
- **Distance past the DZ you need to exit, or the first group needs to exit:** some pilots will call out the distance past you need, as an example, call out 0.8nm past so you can get ready to leave 1.0nm past the DZ or for multiple flocks call out 0.8 then 1.0 then 1.2nm past the DZ. Some pilots

may turn off the green light when the other disciplines have left and turn the green light back on when you are the correct distance out. You need to find out what system they prefer.

- **Has the jump run or wind strength changed from the last Flock?** This information is important as it may cause you to change your flight plan or exit point. By the second or third day of jumping, when you have been working with a pilot or pilots for a couple of days, it becomes easier as you both know each other's requirements. If there are any changes they will be discussed and adjustments made.



Equinox 2008



Photo by Paul Morton 2014

4. FLIGHT CHOICES

Even though flocking is an awesome pastime, it is good to remember that there are wealth of activities that can be attempted and in reality the only restraints are your imagination (and a healthy regard for safety). Wingsuit flying is full of **new horizons**: you just have to be willing to turn your head and mind in order to see them.

As the sport progresses we are starting to realize that these sorts of jumps are essential to the skill development of wingsuit pilots. Those who have spent time on flights with only a few people which require a lot of personal flight, will fly more instinctively and have access to the full range of the wingsuits capabilities. This awareness makes a huge difference when attempting bigger flocks or getting involved in competition.

It is recommended that these jumps are attempted in Light Winds (see navigation section) and are discussed with a Wingsuit Coach before attempting.

- **2 Way – Air Time:** Try flying your wingsuit and maximize the lift, this will give less distance but more drag and air time. See how long you can fly for,(a slightly shorter exit point, standard flight plan) a Pro-Track Dytter or Neptune 3 can be used to provide freefall data, such as maximum and minimum freefall speed and freefall time. Try and keep your flight smooth, any dramatic reductions in fall rate may trick your Pro-Track into thinking you have opened your parachute, this will stop it recording.(video cameras can also be used to measure time)
 - **Technique is** - Shoulders rolled- elbows forward, tension wings and push down, pronounced bend at hips, head in-line with body, straighten legs and point your toes.....**RELAX!** If you push too far or you are not relaxed enough you will potato chip, feels as if you are on a giant beach ball – rocking around, arch slightly or relax more to stop this. What has happened is you have traded so much speed for lift that the wingsuit is close to a stall. Very cool for learning how much lift your suit has and where the optimum lift point is.
- **2 Way – Distance:** Try flying your wingsuit and maximize the glide ratio, for this you are trying to get the most efficient use of speed and lift possible, you will trade a little air time but will cover **much more distance**. (Use a slightly extended standard flight plan) A GPS can be used to calculate distance and if you have the right software you can plot your track using Google earth. Pro-track or equivalent can be used for freefall speeds and time.
 - **Technique is** – Shoulders rolled-elbows forward, spread wings but not too much tension, slight bend at hips, head bent forward chin almost on chest, legs straight-knees locked, toes turned outwards to tension the leg wing. Vary glide angle using your arm wings – pull back slightly to speed up – less lift , push down to normal position to slow down – more lift. ALL changes in body position **MUST** be made gently, the first time you try this it feels steeper than it probably is, you need to generate a lot of speed, this will allow you to create the lift and get your wingsuit flying at its optimum glide ratio. Learning how to fly this way is great for teaching you what the wingsuit is capable of, feels awesome too!
- **Cloud Flying 2 or 3 way:** Occasionally the atmosphere provides us with a real treat! A day when conditions are good and there are clouds within 0.3 – 0.7 nm of jump run and at a height where we can complete our turns and then vary our flight path enough to **Fly Near The Clouds** (not into them), run along the tops, down the side, through a valley, underneath and still have time to fly back to our predicted opening point.

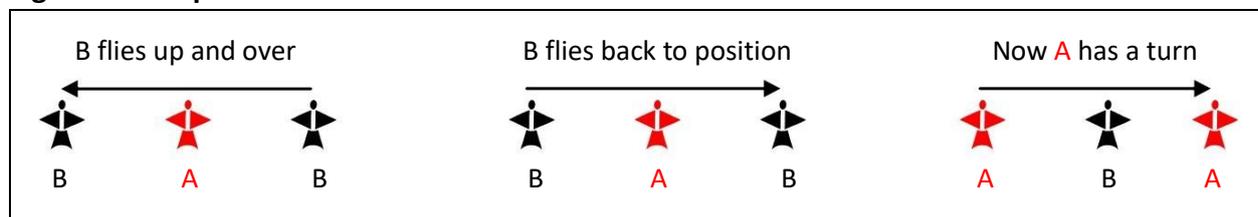
As if we weren't having enough fun at the Boogie, these are the flights when you are still laughing when you land and **you definitely know why the birds sing!** (Thanks Fergs)

- **Ribbon Jump:** 2 way, a very cool jump with an oz-tag feel. Both pilots have a “ribbon” 12 – 18 inches/300-500 mm, long enough to grab – not long enough to endanger equipment. The ribbon can be tucked in the wrist of the wingsuit or the shoe/bootie: they must NOT be tied on and must be visible, able to act as a streamer.
 - **Once both pilots are on the downwind leg** of their flight one will attempt to fly in and take the ribbon, as with oz-tag this is supposed to be a non-contact sport, so fly with care (see section on closing speeds and approaches), then the other pilot takes a turn (sequence is predetermined).

With time and experience up to 4 ribbons per person can be used and awesome flight plans envisaged!

- **Hop – Over’s :** 2 – way , on the downwind leg, wingsuiters flying 1 to 2 meters apart, one gains lift and Hops – over the other and stops on level, then hops back over to the starting position, now it is the other pilots turn. Technique is to go up, slightly forward and over if you slide back you will find the burble, non-hopping pilot to be aware of navigation.

Figure 10: Hop–Overs



4.1 Advanced Techniques

These skills are for experienced pilots who will be able to recover from an out of control situation: receiving training from a wingsuit instructor is highly recommended. They must be tried early in the jump when you have plenty of altitude.

- **Barrel Roll’s:** focus on the horizon, not the ground, this will keep your head up and chest high. Imagine there is a line that runs through your body to the horizon and you want to rotate around this axis, keep the speed on so you will have forward momentum during the manoeuvre. DO NOT drop/fold a wing to start the roll, this will cause you to tip downwards and can make the roll hard to control.
 - **Technique** for a right hand barrel roll: raise your left shoulder up, this will keep the wind on your chest, now your right hand comes in to your crutch (bending at the elbow) and your left hand comes in to your bum (elbow bent also), your right foot goes forward and your left foot goes back (half close your leg wing as you do this, to stop you tipping forward). Your body is now like a cork screw and will rotate, after 270 degrees you bring out your right wing, as you get close to level bring out the left wing (not too soon or you will get stuck on your back)and legs return to normal with wing inflated....done!
- **Back Flying:** your suit will need to have back vents. Once you are on your back you will need someone to navigate who can see the ground! Use the same technique as the barrel roll to start the rotation.
 - **Technique is:** after 90 degrees bring out your right wing, as you get close to level bring out your left wing, legs back to normal, de-arch a little with your bum down and chest up, shoulders back, pushing towards the ground with your forearms.... You are now flying on your back! Push chest up for lift, relax to go down. Use the same technique to roll back over onto your front when ready, at least 1000ft before break off height.

4.2 Wingsuit Flight Skills Check List

This list is intended to contain flight skills which are desirable, and will enable you to explore the capabilities that you and your wingsuit can achieve. They are not necessarily in the order they should be tried and there may be skills which are not mentioned. This list is intended as a guide to improving your abilities, once you feel you have mastered a skill, try another. These skills will build flight AWARENESS and provide a solid base that will allow you to really start to FLY, also they will enable you to be involved in bigger flocks and maybe YOU should try being involved in the Artistic Wingsuit Competition, as long as there are goals to try to achieve, it's easier to remain enthusiastic.

- Fly relative to another wingsuit flyer
- Get your wingsuit flying well then “breathe out and RELAX!” allow your shoulders to droop a little, you will be amazed at how much better you are flying now.
- Hand touch
- Hand docks / Foot dock
- Fly close behind another wingsuit flyer – on level 1 foot away
- Fly above another wingsuit flyer, stay directly above or slightly in front to avoid burble
- Side slide – by pulling in one wing in a little to go that way. Small changes yield big results.
- Learn techniques to recover from “out of control” situations.
- Up and over’s (see Flight Choices)
- Master exiting from a variety of aircraft, especially side door.
- Try different exits including a dive exit.
- Exit the Skyvan, use maximum lift, see if you can float up above the plane!
- Fly your wingsuit with and without using the wing grips (if you have them), this prepares you for docking.
- Fly for Distance (see flight choices)
- Fly for Time (see flight choices)
- Get in the burble – fly through it.
- Get in the burble – loose control, then recover.
- Be able to blow an exit, recover the height and still take your slot in the formation.
- Deliberately leave plane late, then chase formation using your wings to change the angle of dive to reach the formation.
- If you drop below the formation, be able to move to the side, gain height and then rejoin.
- Navigate a course you have designed on the aerial photo, i.e. follow highway, fly across to river, follow river back to DZ.
- Try different wingsuits, this will improve your skills with your own suit.
- Act as base, set the pace and navigate.

- Fly with a variety of different wingsuit pilots and types of wingsuit.
- As you exit with a group, try to be AWARE of ALL the other pilots, know where they are.
- Try flying above a backflyer, see if you can get within a meter, stay in front a little to avoid the burble.
- Hold position in a flock using the smallest inputs possible.
- Try being involved in a formation stack, 2 or 3 in a vertical stack.
- Try a rotation, go from beside another pilot, up and over, down and under, back to where you were. Be careful coming back up as it is hard to see the other person.
- Try high speed turns, on a solo or following a friend, you must still maintain your navigation and separation from the other flyers.
- Dive steeply then pull up with a lot of lift, feels like you can fly upwards for a few seconds.
- Learn to do barrel rolls.
- Learn to backfly.



The Flock. Afterlife Boogie 2008.

5. FLOCKING

Flocking: The art of flying your wingsuit across the sky, in close proximity to other wingsuits, creating geometric designs at 130+ kph.



The information contained in this section looks at the fundamentals of wingsuit formation flying or **Flocking**, how to plan and fly flocks in a safe and enjoyable way. It is intended as a guide only and as the sport progresses some aspects may change or be updated.

Flocking is an exciting discipline to be involved in, as much of what we are doing is new and we are just starting to scratch the surface of what may be possible in the future (see Australian Records). As new techniques are learnt or new directions are conceived and put into practice, the discipline grows. Advances in suit design now means we are flying faster and with more lift than ever before, giving us longer freefall times and greater possibilities of what can be achieved in our sport. The current world record is a 68 way built in the USA, November 2009 (see raisethesky.org)

5.1 Leader / Navigator

As with all formation there must be a leader or base for the formation to build from, they will be controlling the speed and lift of the flight: with flocking they have the added task of Navigation as well, including keying the break-off. This means the person must have a high level of experience, preferably a Wingsuit Coach, to ensure the safe flight of a larger flock. (5 and above)

For smaller flocks (2 to 4) it is still recommended that there is an experienced wingsuit pilot involved, especially in the flight/flock planning and weather assessment, but as we all need to learn to lead and trust our navigation skills, this is a good place to start. If there is an experienced pilot/Wingsuit Coach in the flock then if the leader starts to stray from the plan, they can fly alongside and indicate a change in direction is needed.

An experienced leader will provide consistent speed and lift, this will enable the flock to build more quickly. They will be VERY stable to follow, not drifting from side to side, if the leader moves the formation follows. Also a more accurate flight path will have less turns and adjustments in it. As with all forms of skydiving, if you fly or jump with people who are more experienced than you are, things seem to occur more easily and you lift your own game to fly with them, this effect is VERY apparent in flocking.



5.2 Getting Started

- **On your 1st flight with your wingsuit coach:** flying next to another person, feeling the power you have at your disposal and air across your wings, can be a life changing experience. Usually one that means you would like to learn more about flocking.
- **Basic skills:** you need to put the time and energy into learning the basics that will be the foundation that you can build upon to be a great wingsuit pilot. **See Flight Choices and Skills check list, previous chapter.** This means a combination of 2 or 3 ways with experienced pilots and hopefully video for you to watch and see how you are flying. Interspersed with solos, so you can try out the things you have been taught and get a feel for how the wingsuit reacts to changes in body position. These jumps will give you many skills you will need, don't be in a rush to get to big formations.
- **Bigger is not always better:** In FS you spend time on smaller less complex formations to develop the flight skills you will need to be invited on larger jumps. Wingsuit flying and flocking should be no different. On smaller flocks there is often more opportunity to have transitions or multiple points which will require more active flying and teach you more about the wingsuit you fly. In bigger flocks you will fly one slot from exit to break-off and they are time consuming to organize. Also if your group is attempting bigger flocks that are not working out, this can become disheartening. Some of my best flights have been 2 or 3 ways where we flew fast, really stretched our wings and our minds.
- **Awareness:** can be described as the combination of all your basic skills and having spent enough time flying your wingsuit that you can start to take notice of the small details. You can judge the approach towards the flock, you know where the other pilots are, and you can judge where to brake and then manoeuvre into your slot. You can instinctively make small adjustment to remain in position. These are the sort of skills you need to work on as you are invited on bigger flocks.
- **From this point on:** it is necessary to use common sense and take the advice of wingsuit instructors. If it is towards the end of a Boogie and you are CURRENT, then being invited on a bigger flock, (maybe 6 or 7) with some of the people you have been flocking with, then it's a good idea. If you haven't flocked since the last Boogie and are UNCURRENT, then do some smaller flocks first and get acquainted with the area and your wingsuit again, is a much better idea!
- **Above all have Fun and Stay Safe!**

5.3 The Flock

Things to consider when organizing a flock

- **Compatibility of experience levels of the flockers:** if there is a high percentage of inexperience in the group then splitting into 2 smaller flocks may be more effective.
- **Positioning according experience:** generally more experience in the front row and less towards the back where approach and time taken to get into your slot is less critical.
- **The type of formation** being attempted: 2 dimensional /all on one level or 3D, with layers or stacks (this type of formation should only be attempted by experienced pilots who have flown 2D together before) see appendix for some possible formations.
- **Types of wingsuits being used:** some older types i.e. Birdman Classic have small wings and may not be able to produce enough lift and/or speed to flock effectively or at the other extreme , some of the new breed of suits i.e. Phoenix-Fly Stealth produce so much lift/speed it can make it difficult to flock with.
- Another variable is body size, smaller people can achieve amazing lift and speed from a mid-range performance wingsuit, where a larger person will require a much higher performance wingsuit to achieve the same flight times and flock easily.
- **Type of aircraft** the flock will exit from (see section on exits)
- **Camera person:** important for debrief and seeing how cool we look! Formations can be filmed from above or if the camera person is able to back-fly and film from under the formation some great shots can be achieved. Learning to fly camera with a wingsuit takes some getting used to, if you move your head, especially upwards, this affects your body position and will change how much lift you can generate, making it challenging to stay above or near the flock.
- **Dirt dives:** Essential to successful and safe flocking (as with all disciplines) and must include the entire process , exit sequence and stack-up (including camera flyer), exit, flight plan/turns, approaching and building the formation, flying your slot, break-off, deployment, landing .

Wearing wingsuits for the dirt dive assists with recognizing your slot in the formation, lying on the ground in formation positions is a great way to visualize the sight picture/sight lines you will have in the air and the reference points you will need to see. This can also be done by laying the wingsuits/rigs on the ground in the formation positions allowing flockers to check it out from all angles.

5.4 Safe Approaches

Wingsuits give us the ability to fly through the air at incredible speeds with acceleration and high G turns at our disposal.....with this awesome ability comes a **big responsibility to make SAFE APPROACHES** and be aware of the other pilots we are flying with, maintaining a SAFE and FUN environment for wingsuit pilots. (See Safety-Closing Speeds)

From when you leave the plane until when you have a parachute above your head ***you must be aware of those around you***, during approach - flying your slot – break off.

- **Approaches** need to be made to the area or vicinity of the flock/person, trying never to fly directly at the person or formation, pick a spot to one side or behind the person/flock you are approaching, fly to this point, **get on level first**, then side slide or manoeuvre into your slot. Even with side sliding it is possible to generate a lot of speed very quickly, so care must be taken as you edge across. See Figure 11.

- **Above or Below:** Approaching a formation from below or above is more difficult and makes it hard to know where the whereabouts of other flyers approaching the flock, increasing the chance of collision and should be avoided.
- **Burble:** The burble of a wingsuit flyer is much larger than other skydivers and is at a 45 degree angle behind the flyer. See Figure 12. Approaches need to be made with this in mind, if you are above and behind a formation/wingsuiter you are liable to find the burble. 3D shapes are possible due to being able to work around the burble and fly above or below another wingsuit pilot – make a stack.
- **Fly predictably – no Zooming around!** No radical turns or changes in fall rate, this will make it easier for those around you to react and everyone can approach the flock safely.
- **Use The 90 Degree Turns To Your Advantage:** If you are exiting the plane in a later slot or don't have a great exit, there is no point trying to catch the flock on the cross wind leg, instead fly to where you think the formation will be after its turn onto the downwind leg effectively cutting the corner and allowing you to catch up easily and take your slot.

Figure 11: Safe Approaches

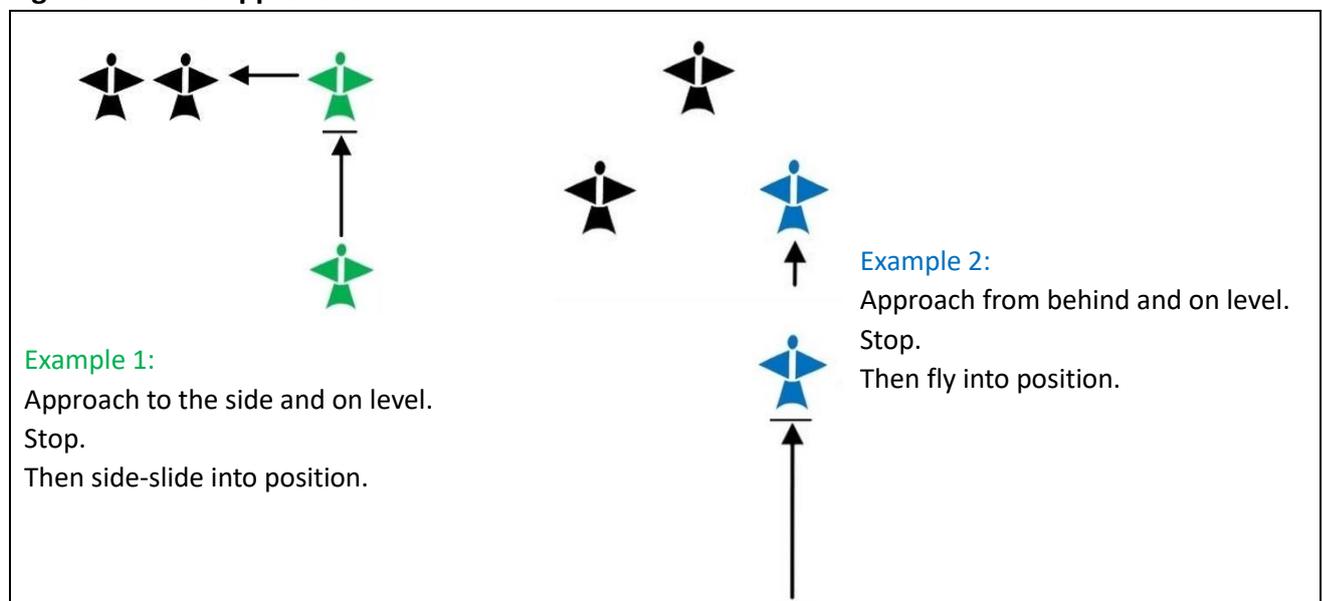
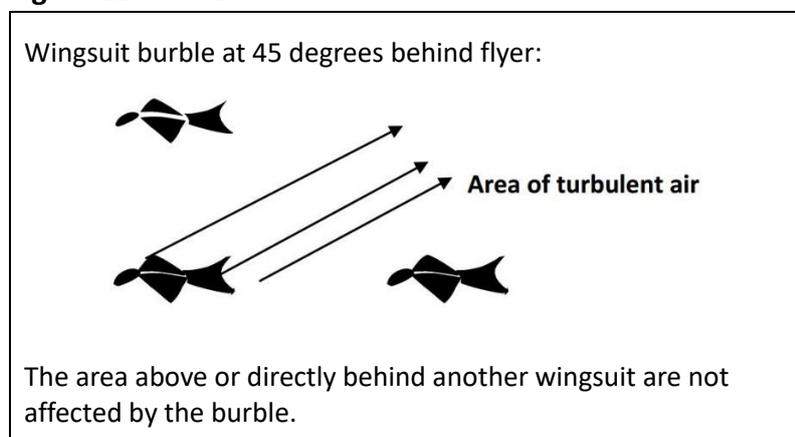


Figure 12: The Burble

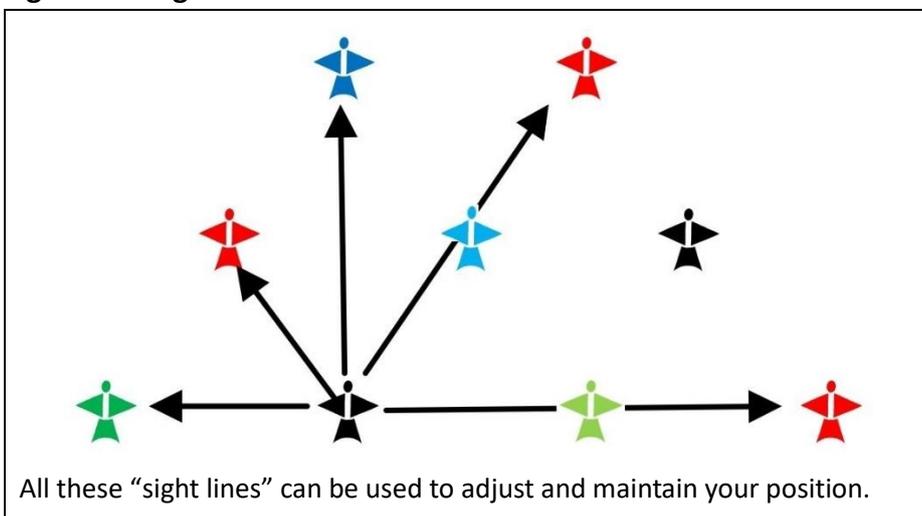


5.5 Flying Your Slot

With everyone constantly making small adjustments to their speed and lift to stay in position, the flock will always have a certain amount of movement, we say that the formation “Breaths”. The more experience there is in the group, then less the movement will be. Feeling the flock move and reacting to stay in your slot, looking at your mates around you and knowing you are FLYING in formation is one of the most amazing and rewarding feelings possible.

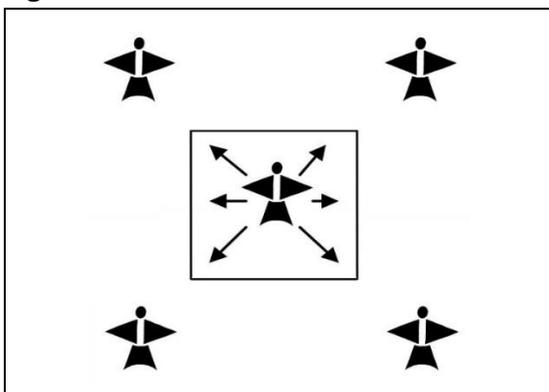
- **Leader/ Base:** you need to fly with the leader as your reference point, if you can maintain a constant distance from the base, rather than reacting to the movements of those around you and the other wingsuit pilots can do the same, the formation will fly well.
- **Sight lines:** these give you points of reference to keep you in position in the flock, unlike other disciplines there are no grips taken, just an agreed on distance from your fellow flockers – 1m or 1.5m or even 2m – larger gaps allow for movement of pilots in their own “box” without affecting the overall formation. See Figure 13.

Figure 13: Sight Lines



- **“The Box”:** We refer to the area you move around in when flying your slot, as the “box”. See Figure 14. As you make small adjustments in your speed, lift and in relation to other pilots, you move side to side and up and down. More experienced pilots will have a smaller “box” and will be able to fly in tighter formations without affecting others.

Figure 14: The Box



If the wingsuit flyer only moves in this area it will not affect the formation. Diagrams do not include changes in lift and fall rate that may also be occurring.

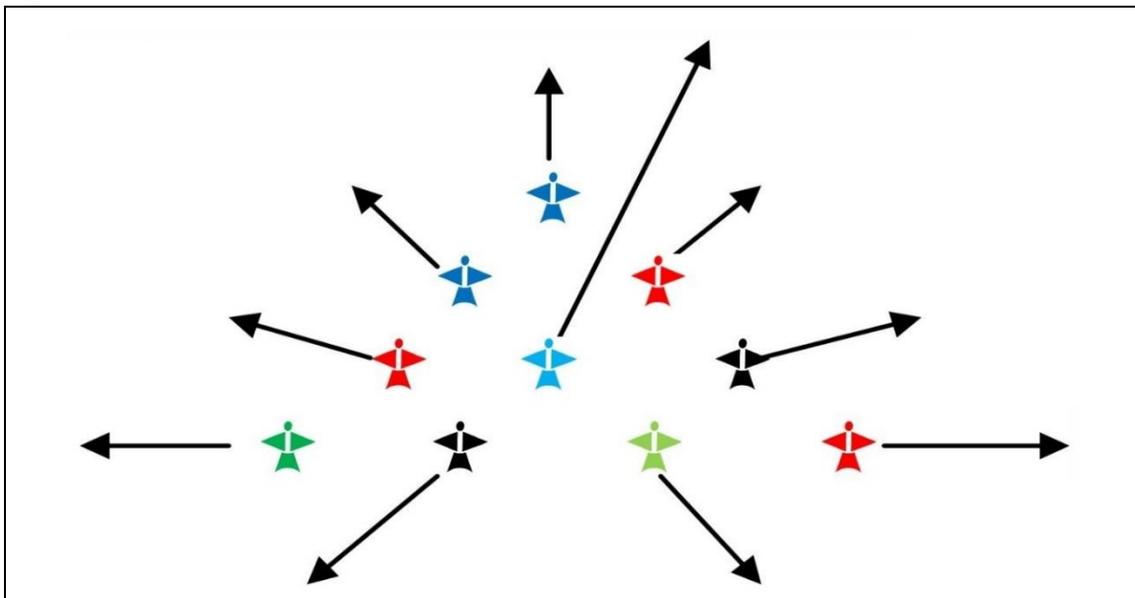
- **Relax:** take a big breath and RELAX , the more relaxed your body and mind is , the easier it is to make the small adjustments necessary to stay in the flock , the smaller the “box” you move in.
- **Comfort zone:** flocks will generally fly slower than your optimum speed, so you need to be comfortable flying your wingsuit through a range of speeds and still be able to create the lift you need.

5.6 Break Off

At the pre-determined break off altitude, usually 5000ft, the leader will kick heels together three times and accelerate away from the flock. As with any formation, it is now time to find clear air to deploy your parachute , with the speed and agility of the wingsuits, it is easy to gain large separations, very quickly even with bigger formations.

- **Fly away from the centre:** those at the front fly ahead or 45 degrees, at the sides 90 degrees, at the back 180 degrees. See Figure 15.

Figure 15: Break-off



- **Turn and accelerate gradually:** don't max out straight away, there could be people closer than you think or even above you. Keep your eyes OPEN as you accelerate away.
- **Heel click before deploying:** people need to know when you are going to deploy!

5.7 Landing

According to DZ rules, and be aware of many canopies in the air. Usually all but the slowest canopies will be on the ground before we arrive.

- **High-five, hug, shout, yee-hah:** Enjoy the moment: it's the best there is! No matter if all went according to plan or not, leave that for the debrief, there are always positives to be enjoyed.
- **Account for the flock:** At big DZ's there can be multiple landing areas and people can be missed, if someone on your flock had an off DZ landing or a malfunction, you need to know immediately.

5.8 Debrief

Hopefully there was outside camera, or at least from the participant's head-cam. Even if this is not the case it is still VERY IMPORTANT to get together and debrief the jump , this enables everyone to learn and grow from the experience , also if someone was less than happy with the jump they can see what happened and go into their next flock with a more positive spin.

- **Review:** exit, how the flock was built, formation, break-off and navigation.

Chatting and laughing with your wing brothers and sisters after a jump is always a pleasure!
OK lets pack, manifest and brief for the next flight!



Photo by Scott Paterson 2013

6. SUMMARY

We have looked at the many and varied facets of wingsuit flying, learnt about safety, wingsuit coaches and their roles, flight planning and navigation, flocking and other flight choices.

With this information and a “tool box” full of new techniques and possibilities, you will be able to approach wingsuit flying in a positive and confident manor, safe in the knowledge that if you progress through your learning curve, without skipping any steps and use the wealth of experience and assistance that is available, you will reach your wingsuit flying potential.



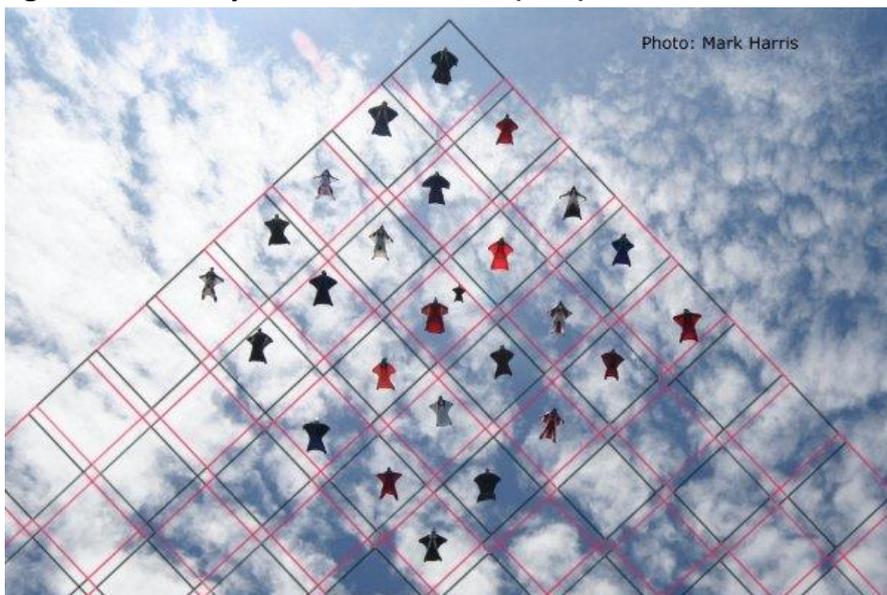
APPENDICES

Appendix A: Record Attempts

In Australia for a wingsuit formation record to be validated you need:

- **Panel of three Australian judges:** one must be on site, the other two need to be available by phone and online for consultation.
- **Lodge the details of the record attempt:** with the onsite judge before the jump. Details needed are a drawing of the formation design, number of participants, names of participants, and names of camera persons, plane/s to be used and proposed time of the attempt.
- **Still photographs and Video:** of the jump will be needed for judging, preferably 2 camera people to give different angles, if possible shots from a wingsuiter back-flying under the formation are usually the best.
- **How the attempt is judged:** the judges will use a still photograph of the formation with the video as backup. Currently the “Grid System” designed by Taya Weiss is used in Australia: this is where a grid is super-imposed over the still photo to allow the judges to decide whether the participants are in their designated slots. Because wingsuit formations do not take grips, a new way of judging had to be developed. For a full description of the grid system, see www.raisetheky.org

Figure 16: 25-way Diamond with Grid (USA)



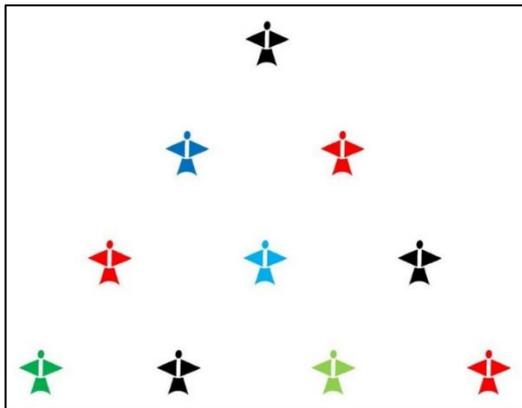
Appendix B: Current Australian Records / Notable Events

On the 24th October 2009, the following Australian records were set at the Afterlife Boogie, Coffs City Skydivers, Coffs Harbour NSW (see Figures 17, 18 and 19).

We spent 3 days training with Jari Kuosma (bird-man) and Neil Fergie BMCI, getting used to exiting the Skyvan and working with each other, learning to effectively get from exit to take our slot in the flock, flying our slot and break-off. By the third day things were really coming together with some tight flocks.

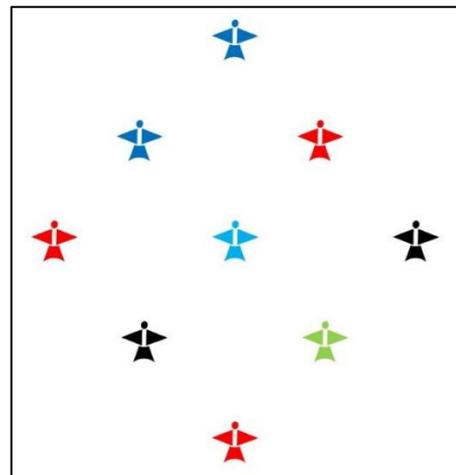
First jump Saturday morning, 24th, we managed the 10 way!

Figure 17: 10-way Australian Record



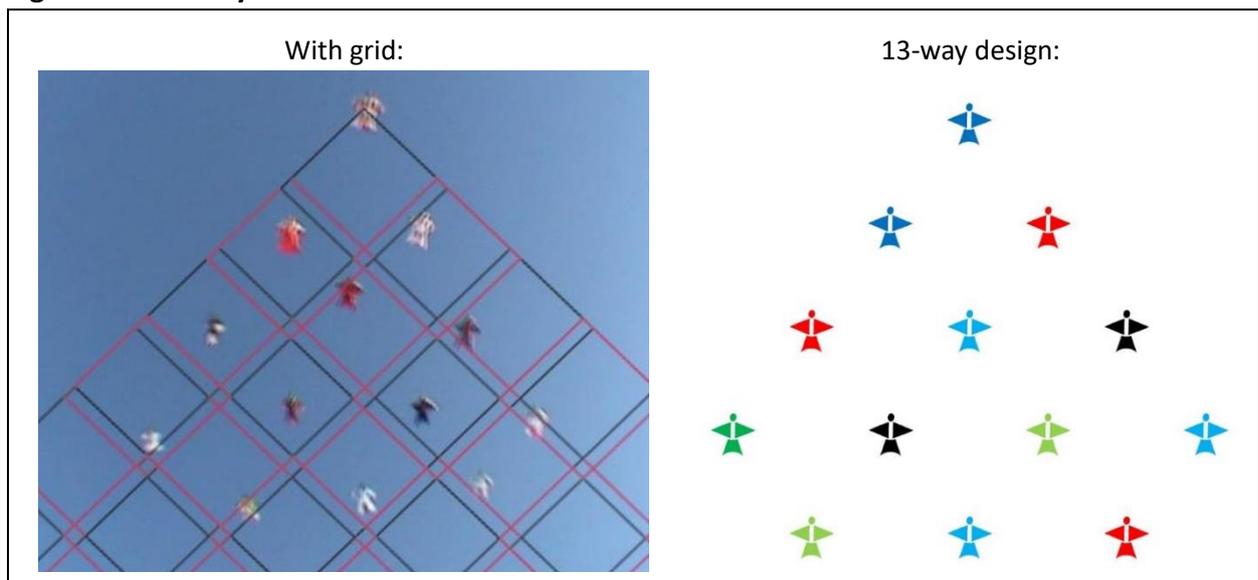
Next we attempted a 12 way, close but no prize. We realized we had enough POPS to get a world record; so this was our next jump!

Figure 18: 9-way Australian POP'S Record and a POP'S World Record!



We were feeling pretty good by now, so we went for the big one to break our earlier effort and we all agree it was by far the best jump we have done together!

Figure 19: 13-way Australian Record



Wingsuit Training Guide

In August 2014, West Australian wingsuit fliers broke the national record while achieving the first-ever state record with a jump involving 16 people. Organiser and flier Scott Paterson said the group gathered in York, east of Perth, and spent a few weekends together practising for the WA record attempt, successfully forming a 16-way unlinked diamond.



Photo by Paul Morton 2014

We hope to see wingsuit flying in Australia continue to grow, to allow this to happen ***we must provide the opportunities*** for flyers to get involved at Boogies, Competitions and potentially have a chance to be involved in Record Attempts. If there are goals to strive for and other wingsuit pilots to train with, the skies the limit.

Appendix C: Wingsuit Flying Competitions

The first wingsuit competition to be held in Australia was at World Pop's Meet and Championships, Toogoolawah, April 2008, it was a 2- and 3-way Wingsuit Formation Competition, designed by Andy Weal BMI. This was an awesome step forward for wingsuit flying in Australia, giving people a new reason to train and fly together with specific goals in mind.

The second competition was held at Willowbank QLD, April 10th and 11th 2010, it was organised by Hayden Galvin and Paul Tozer. It is called an Artistic Wingsuit Competition, which is 2-way with artistic camera, the dive pool is made up of 3 rounds consisting of hop over's with a 1 second hand grip between each move.

The competition used the first round of the international competition, A "up and over" see figure 15, this was flown anti- clockwise for round 1, and clockwise for round 2. Round 3 was be G "déjà vue" or as we say Tick – Tacks. There was 1 safety point for each team per round, so as long as they navigated safely back to the DZ, they got a point. There were no off DZ landings.

7 teams competed with people from as far as Darwin and Victoria: it was an awesome learning experience, as most of us had not taken docks in a wingsuit until the week before. We found the faster we flew, the more airtime we had and the docks were easier than slowing down to dock. Definitely this style of competition contains part of the future of wingsuit flight! See Figure 20

Figure 20: First Australian Artistic Wingsuit Competition

Teams	Round 1	Round 2	Round 3	Total
Munted	4	6	5	15
Paul+Coltech Experience	3	5	1	9
Team Darwin	1	2	1	4
Solflyers	1	1	1	3
Mexicans	0	1	-	1
Traffic	0	0	1	1
The Funksters	1	0	0	1

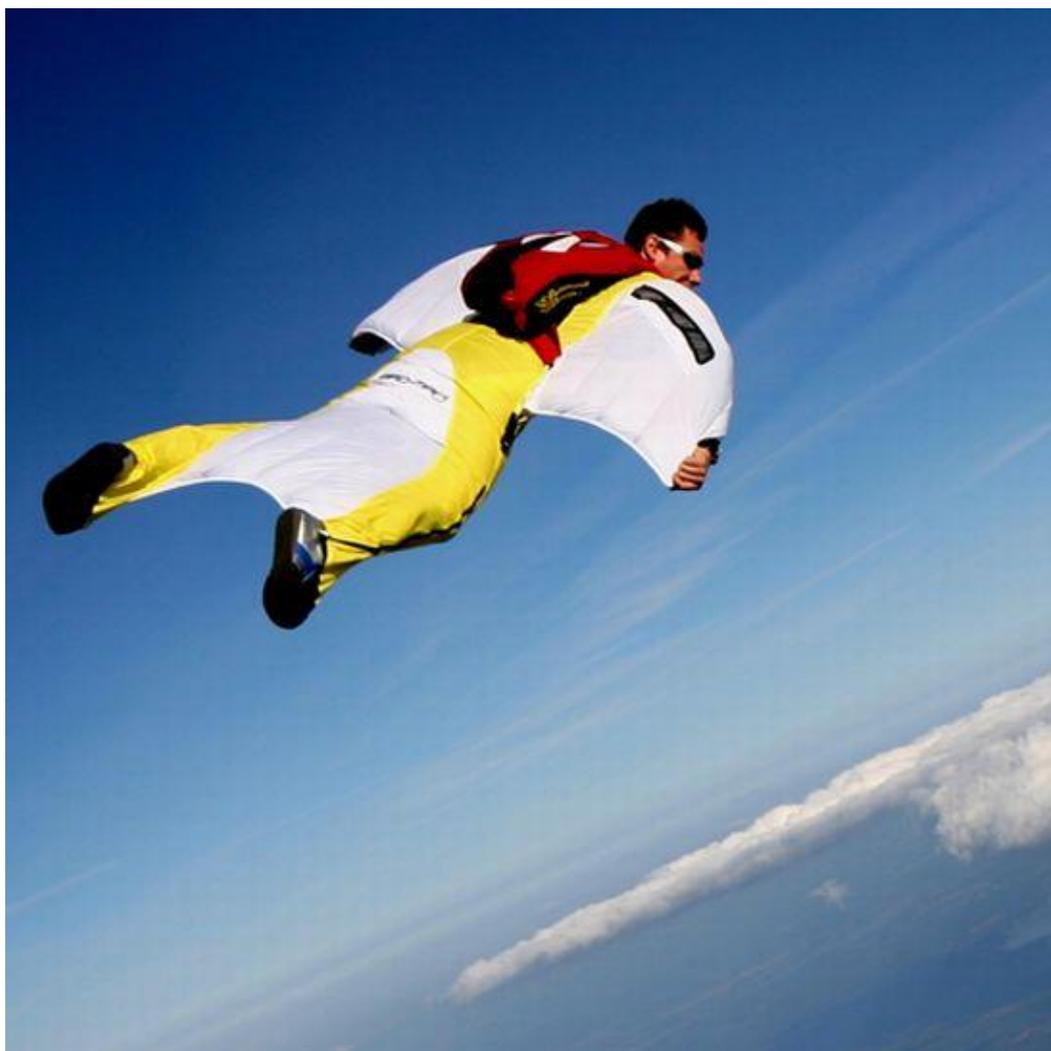
Camera flyers – Paul Tozer, Hayden Galvin, James Throsby

This is very exciting as it is based on the International Artistic Competition which is going into its third year, will be held in Terni, Italy on September 11-14, 2010 and has 7 countries already registered. Go to <http://www.wingsuitcompetition.com/wscomp2010/index.html> for more information.

We are hoping competitions will become available at some boogies: this will generate greater interest and excitement throughout the wingsuit community, with a view to taking an Australian team overseas to compete!

Figure 21: Rounds Used for Australian Artistic Wingsuit Competition

"Up and over"	
	<ul style="list-style-type: none"> • Hand dock, flyer A and flyer B • Flyer A transitions, up and over flyer B • Hand dock, flyer B and flyer A • Flyer B transitions, up and over flyer A (repeat)
"Deja vu"	
	<ul style="list-style-type: none"> • Hand dock, flyer A and flyer B • Flyer A transitions, up and over flyer B • Hand dock, flyer B and flyer A • Flyer A transitions back, up and over flyer B • Hand dock, flyer A and flyer B • Flyer A transitions, up and over flyer B • Hand dock, flyer B and flyer A • Flyer A transitions back, up and over flyer B (repeat)



Appendix D: Guide to Wingsuit Choice

Table 1: Wingsuits recommended for use by trainee wingsuit fliers

Wingsuits to be worn by trainees will be approved by a Wingsuit Coach in accordance with Manufacturers guidelines, the type of material used in construction and other safety factors.

Wingsuits suitable for trainees:

MANUFACTURERS						
Tony Wingsuits	Phoenix-Fly	S-Fly	Birdman	jii-Wings	Intrudair	Other
I-Bird	Prodigy 2	Access	Classic	(GS1) Rookie Wings	Piranha	
T-Bird	Shadow 2	Indy	GTI			
	Phantom 2*					
	Phantom 3					

Tables 2 & 3: Wingsuits recommended for non-trainee wingsuit fliers

Wingsuits suitable for novice/intermediate WS fliers:

Tony Wingsuits	Phoenix-Fly	S-Fly	Birdman	jii-Wings	Intrudair	Other
R-Bird 25	Ghost 2 50	Expert 25*	Skyflier TBA			
S-Bird 50		Verso 25*	Firebird TBA			
		Profly Big surface 50*				
		Elite Big surface 50*				

Notes: Minimum number of jumps recommendation shown below each style in bold italics.

* Number of jumps recommendation outside manufacture comments.

Wingsuits suitable for experienced WS fliers:

Tony Wingsuits	Phoenix-Fly	S-Fly	Birdman	jii-Wings	Intrudair	Other
X-Bird 1 150	Ghost 3 80	Fleet Very big surface 80*	Ninja TBA	(GL1) Super Glider Wings 80*	Shark 100	
X-Bird 2 150	Havok 80	Fury Very big surface 80*	Blade III TBA		Manta 100	
X-Bird 3 200*	Venom 180	Core Very big surface Not for skydiving	Samurai TBA			
Apache Rebel 200	Vampire 5 250					
	Viper 400					

Notes: Minimum number of jumps recommendation shown below each style in bold italics.

* Number of jumps recommendation outside manufacture comments.

References / Bibliography

Transcending Fear by Brian Germain

APF Operational Regulations and Regulatory Schedules

APF standard Training Operations Manual

APF - Wingsuit Flight Procedures by Neil Fergie

<http://www.apf.asn.au/Members/Information/Wingsuit-Flight-Procedures/default.aspx>

Bird-man.com

Bird-man - Wingsuit Flight Manual by Chuck Blue

Flylikebrick.com

<http://www.flylikebrick.com/safety-training.php>

Wingsuit Formation Flying by Jarno Cordia

Wingsuits Compared by Jarno Cordia

Fall Rates and Glide Ratio's by Jarno Cordia and Steve Bartels

Phoenix-fly.com

<http://www.phoenix-fly.com/media/articles>

Flocking Skills by Scott Bland, James Boole, Perry Trowbridge

Performance Flying

Wingsuit Flying and Basic Aerodynamics – 1

Wingsuit Flying and Basic Aerodynamics -2

2 and 3 way Competition, Australia by Andy Weal

3rd International Artistic Wingsuit Competition, Dive pool, rules, and videos.

<http://www.wingsuitcompetition.com/#>

Notes:

Notes: