

# Learning to fly



☆

## An introduction into Canopy Formation

see CF2 page on <http://CaTo.makes.it>

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**Building formations  
under your canopy**





# CF Flight program - 1



## 1. On the ground

- Getting started
- Gear
- Wind
- Spotting
- Briefing



## 2. In the plane

- Pilot info
- Exit order

## 3. In the air

- Canopy check
- Basic approach
- Building a formation

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# CF Flight program - 2



## 1. Safety

- Basic procedures
- Types of problems
- Solutions



## 2. Landing

- Choosing your landing area
- Final approach
- Flaring

## 4. Packing

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# **Section 1**

## **On the ground**

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# **On the ground**



- **Level of experience to get started**
- **Gear**
- **Wind**
- **Briefing**


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# Level of experience





- **A-License:**

- **Stable exit and controlled opening**
    - Clear-and-pull
    - Quickly recover from an unstable position
  - **Being in control of your canopy**
  - **Being aware of your position in the air**
    - including those of other jumpers
  - **Able to make a safe and controlled landing in all circumstances**
  - **Able and allowed to fly a suitable wingload / canopy size according the BVR**
- 

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# Canopy essentials

- 
- **Types**
  - **Characteristics**
  - **Wingload**
- 

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# CRW canopies

- **Today's examples:**
  - PD Lightning & Storm

- **Aerodyne Triathlon**



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# CRW canopy characteristics

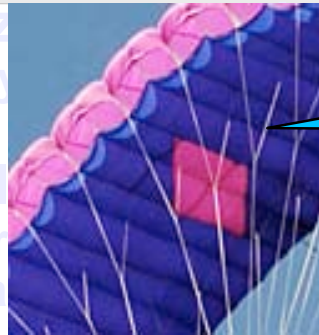
- **7 cell – zero porosity**
  - **Stability**
- **Dacron lines**
  - **Thicker than micro-lines, to prevent burning skin & material**
- Non-cascaded center cell A and B lines
- Retractable pilot-chute system
- Front-riser tabs / toggles
- Reinforced nose
- Mesh-slider or spider

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# CRW canopy characteristics

- 7 cell – zero porosity
  - Stability

- Dacron lines
  - Thicker than micro-lines, to prevent burning skin & material



non-CRW canopy with cascades

- **Non-cascaded center cell A and B lines**

- Retractable pilot-chute system

- Front-riser tabs / toggles

- Reinforced nose

- Mesh-slider or spider

- Speed-up opening,



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# CRW canopy characteristics

- 7 cell – zero porosity
  - Stability

- Dacron lines

- Thicker than micro-lines, to prevent burning skin & material

- Non-cascaded center cell A and B lines

- **Retractable pilot-chute system**

- Front-riser tabs / toggles

- Reinforced nose

- Mesh-slider or spider

- Speed-up opening, clear view, no dragging

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# CRW canopy characteristics

- 7 cell – zero porosity
  - Stability
- Dacron lines
  - Thicker than micro-lines, to prevent material
- Non-cascaded center cell A and B
- Retractable pilot-chute system
- **Front-riser tabs / toggles**
- **Reinforced nose**
- **Mesh-slider or spider**
  - Speed-up opening, clear view, no dragging



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# CRW gear - Harness

- **No hooks to snap lines onto**
- **No RSL**
  - you may need to 'get free' before deployment of your reserve
- **AAD**
  - Cypress NO problem, preferable no Hitec FXC (hook!)

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# CRW gear - Clothing

- **Helmet / cap**
  - Make sure hearing is as good as possible
- **Dark goggles / Sun glasses**
  - You will find yourself looking into the sun in >75% of the time
- **Gloves**
  - Warm hands and firm grip on front riser
- **One-piece jumpsuit**
  - Cover your body against line burns
- **Ankle protectors = e.g. high socks**
  - to prevent line burning of skin
- **(Leather) shoes without hooks**

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# CRW gear - Instruments

- **Visual Altimeter**
  - Mostly used on chest strap
- **Hook knife**
  - Plan B....
  - Attached to chest strap
  - Secured with rope
  - Used in case of an emergency.....



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# What a CreW-dog looks like....



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# Find your CF partner

- **Experience**
  - At least one experienced CF jumper
- **Material**
  - **Wingload**
    - Comparable wing loads are essential for building formations
  - **Canopy characteristics**
    - Same types of canopies are easier to work with

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# Wing load

- 
- 
- **Exit-weight of the person divided by the size of the canopy (lbs/sq-ft)**
    - Higher wing load = steeper fly angle
    - Using kilo's = **(exit-weight kg \* 2.2)/sq-ft**
      - exit weight = approx weight + 12 kilo
  - **In the Netherlands the typical wing load used in sequential formations is between 1.30 – 1.45**
    - Students: 1.15 – 1.25
    - World record: 1.300 - 1.375

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# On the ground

- 
- 
- Level of experience to get started
  - Gear
  - **Wind**
    - Direction and speed
    - Spotting
  - **Briefing**

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# Wind direction and speed

- Check the ground-wind direction before you take off
  - Relative to the sun
  - Relative to the runway / hangars
- Be prepared for out-landings!
- Keep in mind that wind-speeds and -directions can vary in time & between altitudes
  - Check before you jump!
  - If possible, change your heading into the wind during flight

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# Different wind directions

```
707      Teletekst vr 16 mei      3/7
KNMI Luchtvaart

HOOGTEWINDEN EN TEMPERATUREN:
          06 UTC:      12 UTC:
0500VT  050/10  +11  360/05  +13
1500VT  080/05  +10  350/05  +11
3000VT  200/05  +09  280/05
FL 050  240/05  +06  260/05
FL 100  230/05  -03  240/15

THERMIEK: Tot 12 UTC niet of nauwelijks
ontwikkeld/bruikbaar.

MAX. TEMPERATUUR: 17 gr. C.

VOORUITZICHTEN VOOR DE PERIODE VAN
161200/161800: Kans op enkele
geïsoleerde (verscholen)
(onweers)buien, geleidelijk verder
noordwaarts uitbreidend.

waarschuwing  nieuws  index  sport
```

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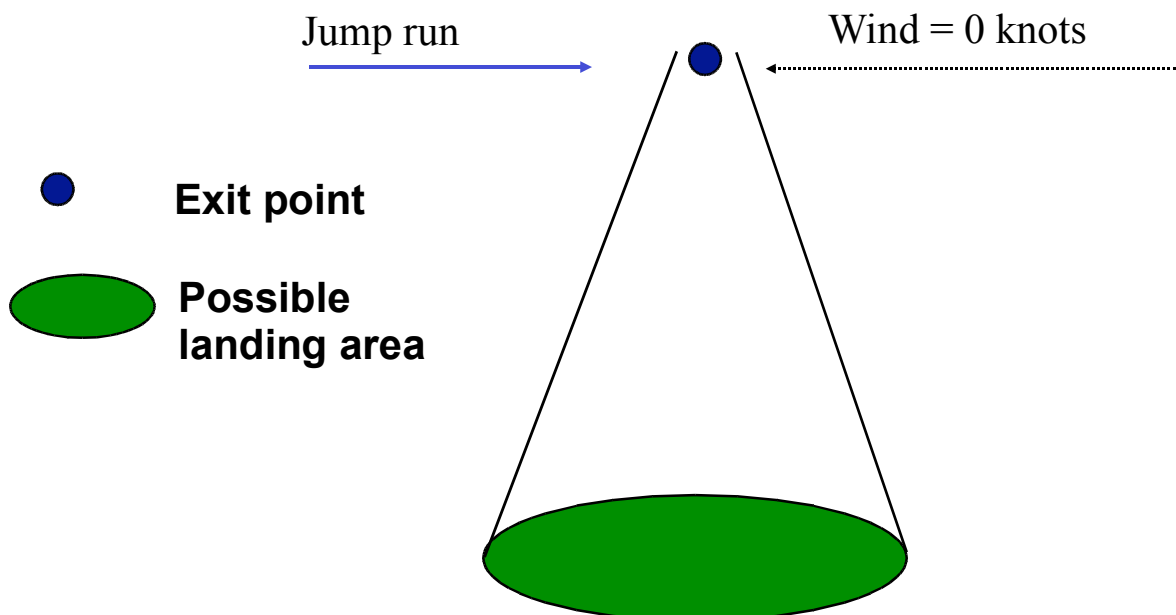
# Spotting

- You will be under your canopy far longer than with the typical freefall jump
  - 1000 ft descent = approximately 1 minute flight
- Average forward speed canopy = **20 knots**  
1 knot = 1 sea mile/hour = 1.8 km /hour
- Rule of thumb:
  1. Wind >20 knots: exit **AFTER** the DZ
  2. Wind <20 knots: exit **BEFORE** the DZ

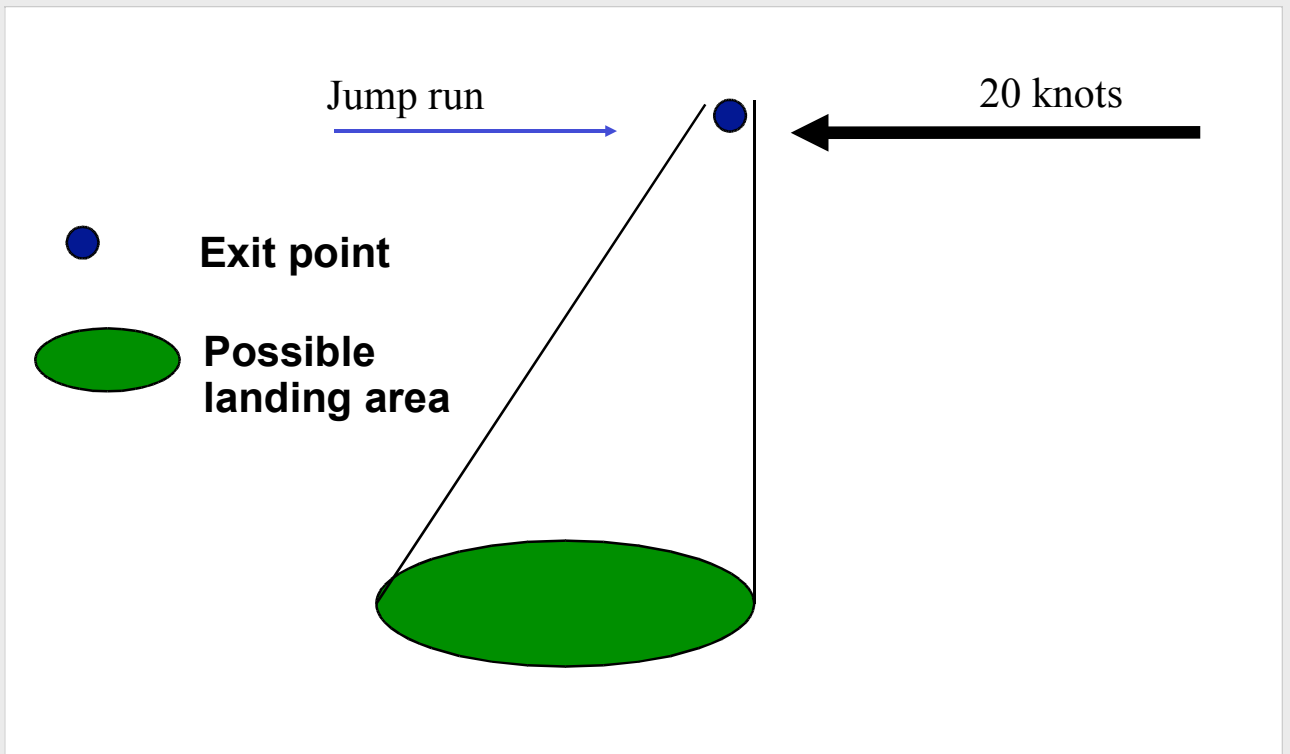


jumpru

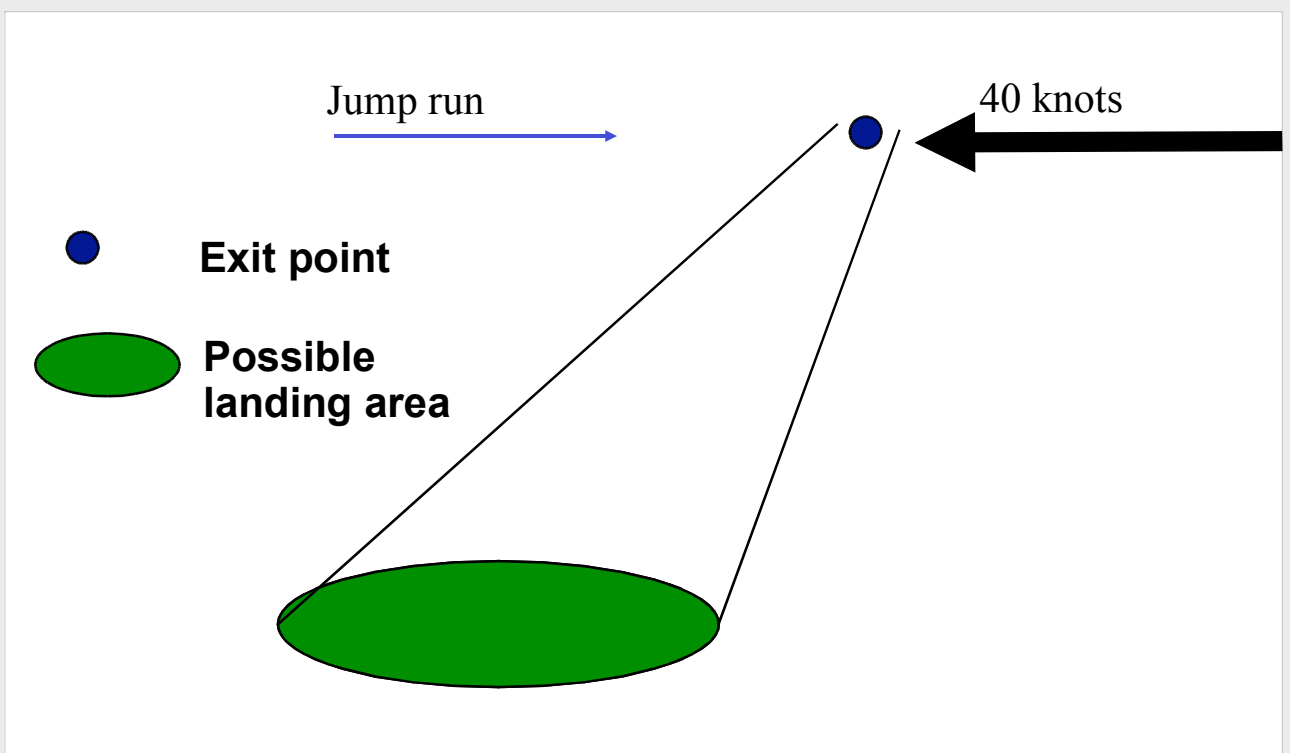
# Area in reach – no wind



# Area in reach – 20 knots



# Area in reach – 40 knots



# Calculating the exit point

- **Average forward speed canopy**
  - 20 knots
- **Average descending speed**
  - 1000 ft/min
- **Minutes in the air \* ground speed per minute**  
**(exit altitude/1000) \* (20 - wind speed) / 60**

**Negative value**

**= Mile exit AFTER dz**

**Positive value**

**= Mile exit BEFORE dz**

1 knot = 1.1 mile/hour = 1.8 km/hour

1 mile = 1.6 km

1 km = 0.625 mile

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# On the ground

- Level of experience to get started
- Gear
- Wind
- **Briefing**

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# Briefing

- 
- 
- **Wind**
    - Direction & speed
  - **Exit point - spotting**
  - **Landing area**
    - Wind direction
    - Obstacles
  - **What formations to build**
  - **Exit order**

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## **Section 2**

### **In the plane**

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# In the plane

- 
- 
- **Exit altitude**
    - Competition altitude = 6000 ft
    - Minimum working altitude = 3000 ft
  - **Important: vertical separation with freefall skydivers:**
    - Descent speed of CF = 1000 ft per minute
    - Climbing speed of plane = 1000 ft per minute
    - CFers should be below opening altitude (2500 ft) before freefallers are at same altitude!
      - Example 1: CF exits at 7000 ft, 5 minutes later:  
CF at 7000-5000 = 2000 ft, freefallers exit at 12:00ft
      - Example 2 CF exits at 9000 ft, 3 minutes later:  
**CF at 9000-3000 = 6000ft, freefallers exit at 12:00ft:**

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# In the plane

- 
- 
- **Exit order**
    - In own team
    - In plane
      - Strong wind = first in - last out
      - Low wind = last in - first out
    - Since CRW openings are high, there is no real problem with other non-CRW jumpers on exit
  - **Let the pilot know**
    - That you are doing CRW
    - What your exit point is
      - Especially when this differs from the freefall exit point

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## **Section 3**

### **In the air**

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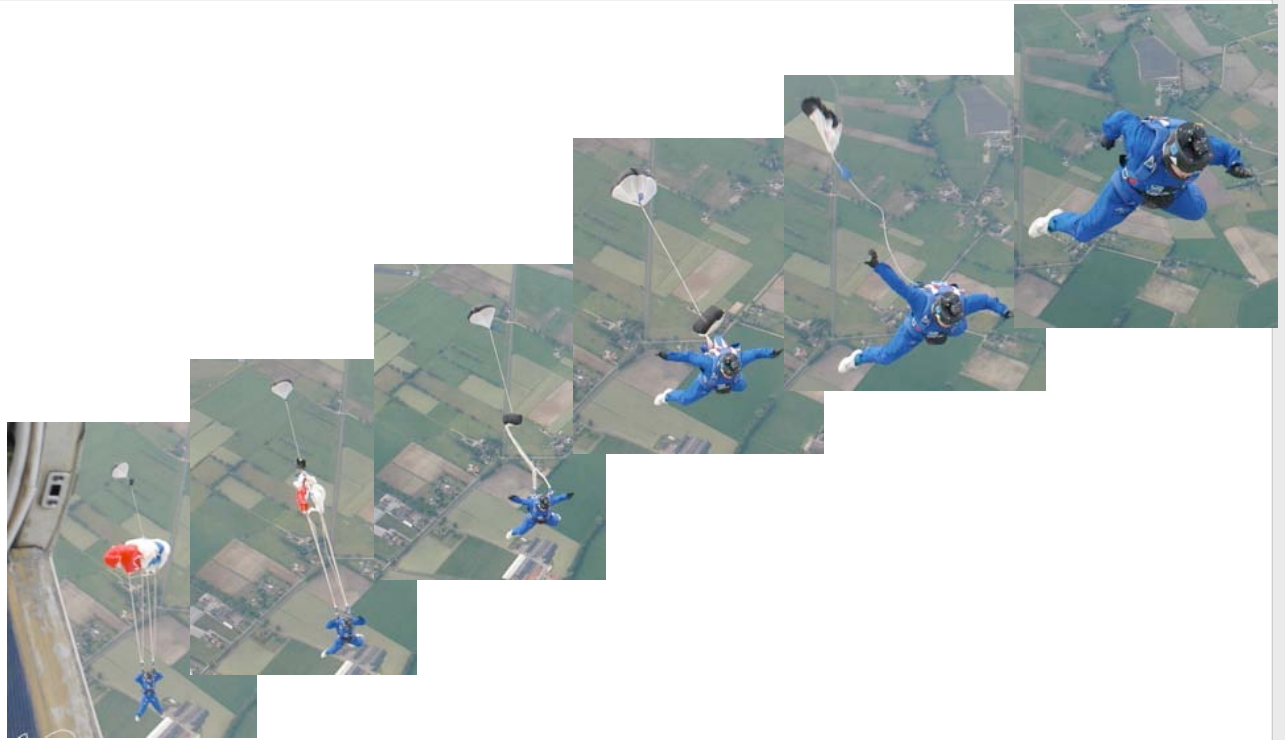
## **In the air**



- **Exit**
- **Opening and Canopy check**
- **Basic approach**
- **Building a formation**

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# Stable exit and opening



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# Opening and Canopy check

- **Do not throw your pilot-chute too early**
  - Not into the plane or over stabilo
  - Throwing the pilot-chute into the prop-wash will give you a harder opening
- **Opening shock**
  - 'Direct' 😊
- **Square shape**
- **Compare relative vertical speed**

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# In the air

- 
- 
- Exit
  - Canopy check
  - **Basic Flying techniques**
  - **Basic approach**
    - Setup point
    - Heading
  - **Building a formation**
    - Stack
    - Stairstep
    - Top docks

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# Canopy relative work is like..

- 
- 
- **Being a piece of a 3D puzzle, by going:**
    - Up
    - Down
    - Forward
    - Backward
    - Left
    - Right
  - **so you need to know the basic techniques to move around**

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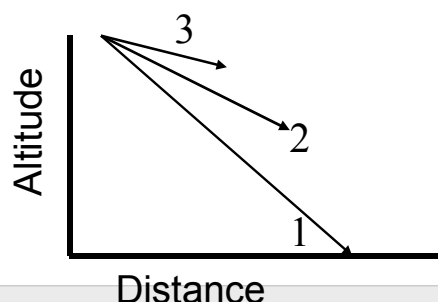
# No free lunch...

- There is no such thing as a free lunch with regards to speed and altitude
- Losing altitude increases your speed
- Losing speed increases your altitude

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# Brake settings



- Controlling your speed and angle of descent using your steering lines:
  - 'all up' : canopy will fly with maximum speed, losing maximum altitude
  - 'half brake' : canopy will fly with normal speed, losing normal altitude
  - 'full brake' : canopy will fly with minimum speed, losing minimum altitude



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# Normal CF flight

- 
- 
- **About 30% brakes**
    - Depending on other CF partners (wingload)
    - Will give your CF partners room to work
  - **Legs straight (not crossed)**
    - Crossed legs is sign of: “no grips please”

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# Steering lines

- 
- 
- **Using both steering lines at the same time will give your relatively:**
    - Normal input = **Slow down** & move up a little
    - Heavy input = **Move up** & slow down
  - **After letting go, the canopy will resume normal flying**
    - **Going faster + going down**

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# Turning



- **Controlling your turns:**
  - 'all up', turn with full input of steering line  
= **fast turn, losing maximum altitude**
  - 'half break', turn by opposite steering line go up  
= **slow turn, losing medium altitude**
  - 'full brake' , turn by opposite steering line go up  
= **flat & slow turn**

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# Front-risers



- **Using both at the same time**
  - Normal input = **Go faster** & move down a little
  - Heavy input = **Move down** & go slightly faster
  - Do not let go of your toggles
- **After letting go, the speed of the canopy will be converted into lift again: **You will go up!****
- **Using one front-riser will result in “diving” turn**

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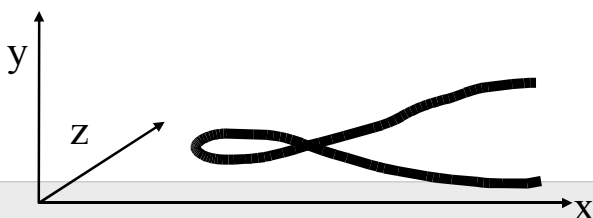
# Dynamics of the canopy

- Once a canopy obtains additional speed, it will take several seconds to lose this speed (without giving extra input)
- To lose speed you can use your brakes
  - Remember: just using your brakes will result in going up
- This can be prevented by
  - 'Snap' the canopy by giving a one-time heavy steering line input
  - Drastically let go of the front risers

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# Sashay - 1

- **Losing altitude** in the same vertical plane as the formation
  - Compare to front risers: down + speed
  - Need free air-space to left or right!
- **Basis: short & quick sideways movement, followed by the opposite action**
  - First turn will bring you down, second turn will bring you further down and back on track
  - e.g. left turn followed by right turn



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## Sashay - 2

- If you move drastically, your turns will result in
  - losing altitude AND
  - gaining speed
- Use stopping techniques to prevent ending up at your starting position

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## Relative Work compared

- Working relatively, compared to your flying buddies:
    - FS: working with your body
    - CF: working with your canopy, using
      - Steering lines
      - Front risers
      - Sashay
- |        | <u>Movement</u> | <u>FS</u>         | <u>CF</u>                |
|--------|-----------------|-------------------|--------------------------|
| - UP   |                 | = float / de-arch | = steering lines         |
| - DOWN |                 | = arch            | = front risers or sashay |

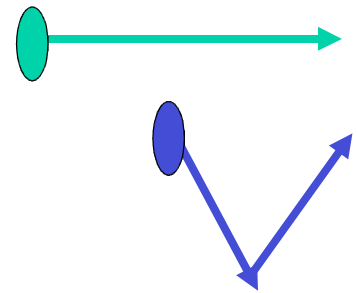
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# Pin-Base

- Finding each other in the air :  
Lowest canopy is “base”

- If lowest canopy is  
Behind you: Use  
'45-degree angle'  
to approach

In front of you: use front-risers



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# Basic Flying techniques

- It's all about Canopy Relative Work:

-

- Docking techniques

- Setup point
- Grips
- Wing

- Flying a formation



- Trim
- Incomming slots

- Breakdown

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# Docking techniques

- 
- 
- **“Dock-ing”:**  
*To couple (two or more spacecraft, for example) in space*
  - **“Grip”:**  
*A manner of grasping and holding*
  - **Make a dock by taking grips**
    - Foot grip
    - ~~Hand grip~~
  - **Do not use drastic movements**
    - Better safe than sorry.....

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# Setup-point

- 
- 
- Go to your **setup point** = ‘known’ point relative to, and depending on the formation you are going to build
  - Wait, stabilize, and prepare
  - Start your final approach to the formation

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# Stack



- **Approach**

- Use **toggles** to approach from the side (same level)
- Dock should be straight from behind
- Larger stacks sink: approach from below

- **Grip:**

- Both feet around the (red) center lines



# Stairstep

- **Approach**

- Use **toggles** to approach from the side (your canopy on 'butt'-level)
- Dock should be smooth and without momentum
- Large formations: use a 45-angle below (and outside) the formation

- **Grip**

- one foot hooked in outside line



# Lockup

- Positioned between two canopies



- Stabilizes formation

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# Flying formations

- **Stack:**
  - Stable
  - Highest flyer is in charge
- **Stair-step**
  - Less stable than stack
  - Lower person also has to fly his canopy
- **Lock-up**
  - Once docked in the formation: enjoy the view 😊

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## **Section 4**

### **Safety**

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## **Safety**





- **Types of problems**
  - **Funnels**
  - **Wraps**
  - **Entanglements**
- **Handling problems**
- **Avoiding problems**

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# Type of problems

- 
- 
- **Funnels**
    - Collapse of an improperly flown canopy
    - May result in a wrap or entanglement
  - **Wraps**
    - A parachute is wrapped around a body, or is not flying anymore
  - **Entanglements**
    - Two or more parachutes are entangled with each-other
    - One jumper passed through the lines of another jumper's canopy

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# Funnels



- 
- 
- **Collapse of an improperly flown canopy**
    - Funnel may result in wrap or entanglement
    - Rule of thumb for funnel only: no cutaway necessary, canopies start flying again after being released

Video

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# Wrap



- 
- 
- **A parachute is wrapped around (a part of) a body**
    - Often the top jumpers parachute will remain open
    - Similar to low speed malfunction
    - Rule of thumb: Bottom jumper cuts away first
    - Do not try too long: cut-away jumper needs altitude to deploy it's reserve, and you may need time to get rid of the cutaway main

Video

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# Wrap - examples

- 
- 
- **Canopy wrapped around a foot**
    - **1 : lower canopy still flies**
      - Communicate!
      - Lower pilot relieves the tension by applying extra brakes
      - Remove foot from lines (often a shoe gets released also :-)

Video



- **2 : lower canopy does not fly anymore**
  - Communicate!
  - Try to release foot, if not possible:
  - lower person should cutaway

Video

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# Entanglement



- 
- 
- **Two or more parachutes are entangled with each-other**
    - One (mostly top-)jumper passed through the lines of another jumper's canopy
    - Rule of thumb: both jumpers need to cut away, top jumper first
      - After first cut away, that parachute will pull itself out of the mess after being released

Video

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# Handling problems

- 
- 
- **Most important: Don't panic!**
  - **If it starts funnelling, try to GET OUT**
  - **Rule 1:            **HOLD ON** until said to let go!**
  - **Rule 2:            **COMMUNICATE****

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# Rule 1: HOLD ON

- 
- 
- **Do not 'just let go'**
    - Uncontrolled letting go can result in even more problems
      - Below
      - Rest of the formation
  - **Often the wrap or entanglement still has at least one flying canopy on top**
    - Altitude = time
  - **Person with the problem does not need to worry about heading**

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# Rule 2: COMMUNICATE

- 
- 
- **Altitude**
  - **Problem**
  - **Plan of action**
  - **Give clear commando's**
    - Do not use 'negative' sense: 'don't let me go' can sound as '....let me go'
  - **Talk regular**
    - Other person can have problems talking / breathing, etc

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# Avoiding problems

- 
- 
- **Use CF material**
  - **Smooth flying**
  - **Anticipate on others**
  - **Minimum working altitude = 3000 feet**
    - **Enough altitude to handle a problem**

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## **Section 5**

### **Landing**

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# Landing

- 
- 
- **Choosing your landing area**
    - Decide before 1000ft
    - Check wind-direction / obstacles
    - Stay together
  - **Final approach**
    - Full flight
    - Straight in
    - Land if possible towards the wind
  - **Flaring**
    - Landing is complete when parachute has landed

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# Landing a Lightning



## A lightning needs:

- **SPEED** for proper flare
  - You can use a little bit front riser input, but let them go smoothly before flaring!!
  - Do not let go of your toggles when using front-risers!!
- **TIME** to build-up a flare
  - Start with flare, feel reaction, continue complete flare

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## Section 6

### Packing

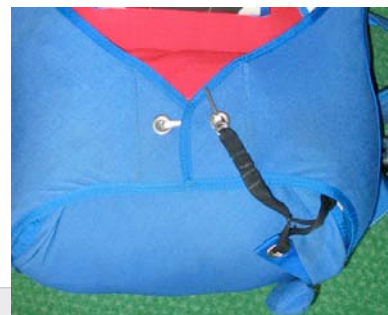
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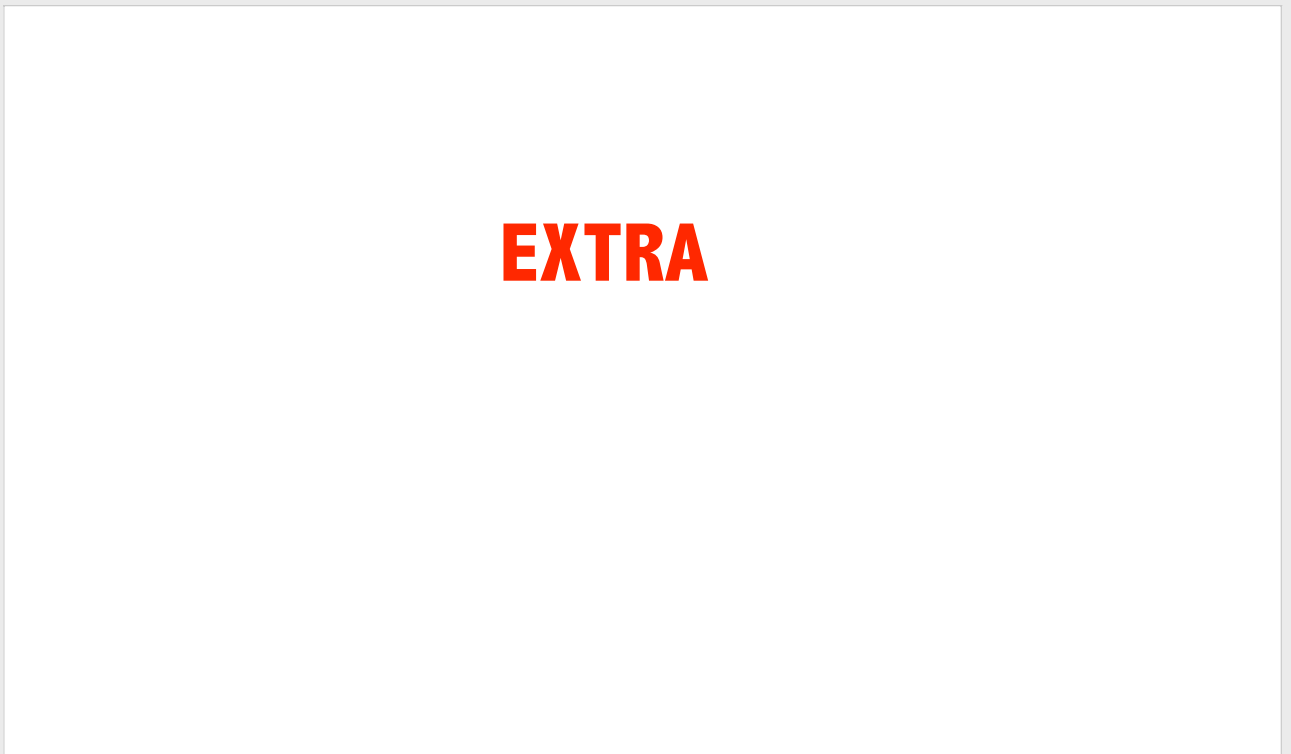
## Packing and deployment



- **Main objective:**  
**Maximum opening consistency and minimum inflation time of the canopy after exit**
- **Tail-pocket**
  - No bag, using a **tailpocket** to store the lines
- **Pull-out deployment system**
  - Direct opening container by releasing pin manually



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**EXTRA**

# Canopy Formation

- **Competition**
  - CF2
  - CF4 – Rotation
  - CF4 – Sequential
  - CF8 – Speed
- **Big Formations**
- **Formations**
- **Fun :-)**

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## Competition - CF2

- **Objective:**
  - a point is scored for each formation correctly completed in accordance with a draw made at the start of the event
- **Working time: 60 seconds**
- **Draw is made out of pool of 2 x 6 possible CF2 formations**



