

# Aviation Safety Information Leaflet

## Formation Flying



## Introduction

In response to several accidents related to formation flying, the Belgian Civil Aviation Authority (BCAA) composed an Aviation Safety Information Leaflet (ASIL) for general aviation pilots. The BCAA also received a safety recommendation from the Belgian Air Accident Investigation Unit (AAIU(Be)) which was the result of the investigation of a midair collision that occurred in Les Moères (France) in 2010, with a Cessna 172 and Aveko VL-3, both Belgian registered that were flying in formation.

The intention of this leaflet is to inform on the existing regulation, highlight the associated risks and to provide guidance on the preparation of formation flying to the general aviation community. The BCAA calls upon all Belgian federations, organizations and instructors active in civil aviation to limit formation flying among their community to a minimum and to accurately brief the hazards.

Formation flying is the disciplined flight of two or more aircraft under the command of a flight leader. The decision-making ability is taken away from the individual pilot and is put in the hands of the leader. The lead aircraft, in turn, has to navigate, communicate, and think for the group, all while having to operate the aircraft with consideration to other(s) in the formation.

In general aviation, formation flying is often observed for 2 reasons: taking photos of each other's aircraft and because it is more challenging than simply flying solo from point A to point B. Be aware that once you have planned to take pictures of another aircraft in flight, even for a short while, this must be considered as formation flying and has to be prepared as such.



## Regulation

In the Standardized European Rules of the Air (SERA) there are 2 rules that are applicable to formation flight;

### **SERA.3205 Proximity**

*An aircraft shall not be operated in such proximity to other aircraft as to create a collision hazard.*

### SERA.3135 Formation flights

Aircraft shall not be flown in formation except by **pre-arrangement** among the pilots-in-command of the aircraft taking part in the flight and, for formation flight in controlled airspace, in accordance with the conditions prescribed by the competent authority. These conditions shall include the following:

- (a) one of the pilots-in-command shall be designated as the flight leader;
- (b) the formation operates as a single aircraft with regard to navigation and position reporting;
- (c) separation between aircraft in the flight shall be the responsibility of the flight leader and the pilots-in-command of the other aircraft in the flight and shall include periods of transition when aircraft are manoeuvring to attain their own separation within the formation and during join-up and breakaway;

'Moreover the Belgian Royal Decree of 19 December 2014 contains in Article 17 §1 the additional restriction that formation flights are only allowed under Visual Meteorological Conditions (VMC), that take-off and landing in formation are subject to prior permission by de Director-General and that formation flights are forbidden for aircraft that carry passengers against remuneration.'

## Hazards and risk

It is obvious that a formation flight adds a new set of hazards in comparison with a routine navigation flight. The risk of a mid-air collision leading to uncontrollable aircraft and subsequent crash is substantially larger. Risk mitigation can be done by among others:

- Specialized training
- Strict standard operating procedures (SOP)
- Years of experience
- Reduction of aircraft flying in formation
- Flying aircraft with similar performance characteristics
- Reduction of maneuvers during formation flight
- Preparation of the flight
- Pre-flight briefings as part of the mandatory pre-arrangement

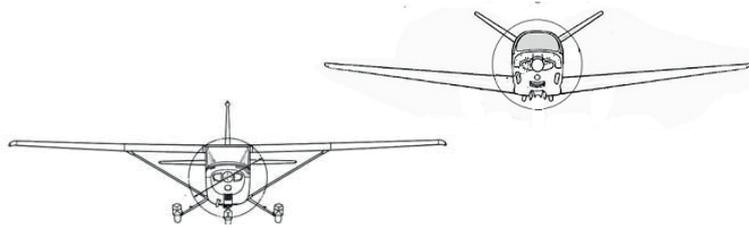
However, for general aviation, as strongly opposed to military (and aerobatic) teams, there are no specialized training material nor standardized SOP's available for formation flying and national and international legal guidelines are insufficiently detailed. Formation flying training is not recognized within European civil aviation as a specific discipline and there is no endorsement on licenses for it, as exists for aerobatics, towing, etc. This means that less resources are available to mitigate the risk.

### Formation flying

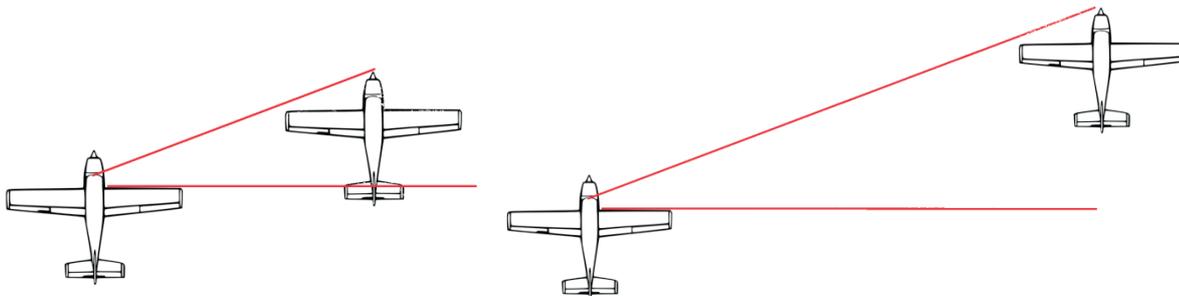
For above mentioned reasons, **BCAA is reluctant towards formation flying** in general aviation.

Anyone who however does consider undertaking formation flights should consider following aspects:

- **How well do you know the other pilot?**
  - His/her total flying experience, background, as well as recent experience.
  - Personality: is the other pilot a risk taker, or meticulous pilot?
  - How capable is the other in maintaining heading, speed, altitude, attitude?
- **Suitability of the aircraft**
  - Formation flying with mixed categories of aircraft (certified airplane, ULM, helicopter, balloon, sailplane...) must be avoided at all times. Different categories of aircraft generate and react differently to wake turbulence, causing additional difficulties to fly in each other's vicinity. The same rule applies for high wing/low wing airplanes; the different locations of the wings create blind spots for the pilots. In the situation below, neither pilot has visual contact with the other airplane and is hence oblivious to the other airplane's relative position.



- o An assessment should be made, of the design of the aircraft to identify reference points (e.g. landing gear...) that can be helpful to assess relative distance and position during the formation flight.



### • Flight preparation

A formation flight must be thoroughly briefed, among the pilots, willing to endeavor on a formation flight. This briefing should at least address the following aspects:

- o **Meteo, Notams:** General aviation formation flights in IMC (Instrument Meteorological Conditions) are not allowed, so VFR-minima apply - clear of clouds, below the ceiling, with visual reference to the ground, during the entire formation flight. The wind must be steady (no gusts). Crosswinds with respect to the chosen heading may cause extra problems for the formation flight.
- o **Take-off sequence:** For general aviation pilots, take-off and landing in formation are not allowed.
- o **Type of formation and number of aircraft involved – aerobatics:** Attempts at formation flights with more than 2 aircraft, or performing combined maneuvers in close vicinity must be avoided.
- o **Tasks of leader/wingman:** Each formation flight must have a “leader” that focusses on maintaining flight parameters (heading, altitude, attitude, speed, ...) and navigation. The “wingman” focusses on the relative positions of the aircraft and maintains separation.
- o **Area and duration:** General aviation formation flights in controlled airspace can be refused by an ATC operator. Considering busy VFR-traffic at certain moments, the complexity and limited dimensions in the Belgian Airspace, only certain areas in G-class airspace seem suitable for formation flight.
- o **Communication (radio/visual):** Each aircraft taking part in formation flying should be equipped with 2 radios: 1 radio for monitoring and communication with Flight Information Services (FIS) and 1 for inter-pilot communication. The unassigned frequency 123.45 MHz can be used for inter-pilot communication, but be advised not to interfere with other communication on this frequency, that maybe of higher priority (relay between pilot/ATC/FIS, urgency, emergency, etc.).
- o **Always warn ATC before flight.** The flight leader is the only pilot who communicates with ATC during the formation flight. Inter-pilot communication should be reduced to a minimum.
- o **Airspeed to be flown**
- o **Break-off procedure:** Always agree on a clear and unambiguous break-off procedure during pre-flight briefing. What to do when the mission is aborted (e.g. due to technical problems) or finished and the aircraft are leaving the formation flight?
- o **Emergency procedures:** what in the case of radio failure? What if other aircraft lost out of sight?
- o ...

- **Formation flight**

- o Separation: a safe distance between the aircraft (e.g. in all directions a distance of 2 aircraft) should be defined during flight preparation, and possibly even visualized on the ground. Precaution distances to be adapted in function of the experience of pilots in performing formation flight (from rookies to active military pilots).
- o Speed: Joining up is a very delicate and intense maneuver and should be carried out with small corrections at a time. The join-up speed should be limited to 10 kts. Speed difference is very hard to assess as none of the pilots in the formation flight has any objective indication, regarding the join-up speed.
- o Turns: Making a turn in formation flight is completely different than in solo flights. As the leader makes a turn (banks), the reference points may no longer be visual to the wingman. So when following the leader, in a turn, not only the bank angle but also the altitude must be adjusted (e.g. when the leader makes a left turn, the wingman on his left side must fly lower to keep the reference points in sight). Even the slightest turn, or unanticipated maneuver by the leader, may trigger a surprise reaction with the wingman and unwillingly reduce the separation between the two aircraft. Therefore 2 aircraft should maintain at least a safe vertical separation, to allow overshoot/undershoots, in case of unexpected maneuvers: turn, early roll-out, unintentional turn due to wind/gusts, or evasive maneuvers.
- o Photography: photos should be taken by a photographer, not by the pilot flying. Professional cameras with telescopic lenses, and vibration reduction can be used to decrease the risk of a mid-air collision.
- o Landing: Landing in formation is forbidden in Belgium, for civil aircraft (unless there is specific permission by the BCAA Director-general, for example for airshows).

- **Other considerations:**

- If any of the parameters to be checked during the preflight briefing of the intended formation flight is negative, do not proceed, ask advice, or await better conditions.
- As a wingman, continuously keep visual contact with the flight leader! If visual contact is lost, report it via the radio and ask for a position update to the leader/wingman.
- Pay attention to the sun! When the sun falls in the wingman's field of view (when looking at the leader), the wingman may get temporarily blinded, leading to loss of reference and mid-air collisions.
- Avoid Instrument Meteorological Conditions (IMC), even for short periods, keep visual reference to each other, the ground and remain clear of clouds, stay below the cloud base.
- No aerobatics in general aviation formation flights. The only exceptions are granted to the military users of the Belgian Airspace (Belgian Air Force).
- Always be ready to use the agreed break-off procedure!
- Brief the flight and fly the brief.
- ALWAYS BE READY FOR EVASIVE MANEUVERS, AWAY FROM THE OTHER AIRCRAFT!

**Questions? Suggestions?**  
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