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INVESTIGATION REPORT

# Accident to the Stampe SV4 registered F-BAHL

on 30 May 2015
at Blois-Le-Breuil (Loir-et-Cher)

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| **Time** | Around 14:25[1] |
| **Operator** | Private |
| **Type of flight** | Rehearsal flight |
| **Persons on board** | Pilot |
| **Consequences and damage** | Pilot fatally injured, aircraft destroyed |

**This is a courtesy translation by the BEA of the Final Report on the Safety Investigation published in March 2020. As accurate as the translation may be, the original text in French is the work of reference.**

[1] Unless otherwise stated, all times given in this report are in local time.

## Uncontrolled spin during aerobatic manoeuvre, collision with the ground, during a rehearsal formation flight prior to an air show

### 1 - HISTORY OF THE FLIGHT

The day before an air show at Blois aerodrome, three pilots performed a formation flight for the flight director's validation. The F-BAHL pilot was the lead pilot of the formation consisting of two Stampes and one Bücker Bü 131 Jungman.

Once grouped after take-off at 14:20, the formation accelerated into its descent to the lower flight limit established by the organizer at 330ft (100 m)[2], on a heading of 030° perpendicular to runway 30, facing the control tower, and then performed a pull-out.

Shortly after the three aircraft had simultaneously started their ascent, the wingmen simultaneously left the lead pilot, who first performed a half loop. At the top of this loop, at an estimated height of 500 ft, the aircraft entered a half-roll[3] in an anti-clockwise direction in order to finish on its belly, continue its ascent to the planned height of 2,600 ft (approximately 800 m) and start a series of solo aerobatic figures.

As it rolled over onto its belly, the aircraft entered an uncontrolled left spin, and made four complete turns before colliding with the ground, its wings practically level and with a nose-down attitude of around 30°.

[2] Article 31 of the order of 4 April 1996 on air shows states that the minimum flight height is set at 30 m (100 ft) for straight passes (...) and 100 m (330 ft) for all other manoeuvres.

[3] This figure consisting of a half-loop followed by a half-roll is called a "straight recovery".

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## 2 - ADDITIONAL INFORMATION

### 2.1 Pilot and aerobatic training centre information

The 48-year-old pilot, who was the owner of the aeroplane, had held a PPL (A) private pilot licence since 2003 and a first-level aerobatic rating since July 2014. He had logged a total of 540 flight hours, including 162 hours on type and three hours, all on type, in the last three months. He had stated on his flight display form for the air show that he had participated in a public air show within the last 12 months.

The pilot's first-level aerobatic training was undertaken at the Centre de perfectionnement et de voltige aérienne (CPVA) located at Angers-Marcé aerodrome (Maine-et-Loire). This training centre is the only one in France that provides aerobatic training on the Stampe.

The pilot's training was therefore completed entirely on Stampes, the general characteristics of which are similar to his aircraft.

The first-level aerobatic training programme at the CPVA includes learning the following figures: inverted flight, spin, roll, loop, straight recovery and 45° split-S. The minimum safe height established by the CPVA is 1,700 ft (518 m) for all manoeuvres performed with the centre. Formation flying is not part of the first-level aerobatic training programme taught by the CPVA.

The pilot had used eight flights between 7 March and 23 May 2015 with two instructors from the CPVA to train for a first-level aerobatic display in preparation for the Blois air show. Five of these flights took place between 14 May and the date of the accident.

The lead pilot had not received any specific training in formation flying. One of the wingmen indicated that the most recent two-aircraft formation flight practice session had taken place on the Thursday before the accident and that they had been practicing[(4)] twice a month since the end of winter. However, these practice sessions were never followed by the straight recovery manoeuvre or by a sequence of aerobatic figures.

At the CPVA, straight recoveries are started into the wind and must not be undertaken at speeds below 180 km/h. The wingmen of the formation were unable to determine the speed at which the climb was started.

[(4)] The general training programme involving two or three aircraft comprised a staggered take-off followed by the following manoeuvres: wingover, configuration change, trail formation, pursuit, crossing, grouping, breaking off and staggered landings.

### 2.2 Meteorological information

The meteorological conditions at the aerodrome for take-off, communicated by the AFIS to the pilot, were: wind 270°, 10 to 18 knots, visibility greater than 10 km, temperature + 19° C, dew point temperature + 8° C.

Consequently, the wind at the beginning of the straight recovery was a 60° left tailwind.

### 2.3 Aircraft information

The Stampe is a two-seater tandem biplane with dual controls and a cruising speed of 140 km/h. It has been used in particular for aerobatic training. The pilot is usually seated in the rear seat, which was the case at the time of the accident. The aircraft is not equipped with a stall warning system. At full load, it stalls at 60 km/h on its belly and 110 km/h on its back.

The pilot's plane was manufactured in 1950. A major overhaul was carried out between 2012 and July 2014 by a restoration workshop for vintage aircraft in conjunction with the owner. At the time of the accident, the aircraft had flown a total of twelve hours since the major overhaul.

Its restricted certificate of airworthiness for vintage aircraft was renewed on 26 September 2006 and was valid until July 2015.

For the flight in question, the aircraft was within its weight and centre of gravity limits.

### 2.4 Wreckage and site information

An examination of the wreckage at the accident site did not reveal any pre-accident technical failures, in particular with respect to the continuity of the flight controls.

The aircraft contained approximately 70 litres of fuel. The marks left on the propeller and on the ground upon impact show that the engine was providing power.

The pilot was strapped to his seat with his reserve parachute in a non-deployed position under his buttocks.

### 2.5 Survival aspects

The pilot died of his injuries after being transported to hospital.

No autopsy was performed on the pilot, but the various statements by the persons who had had contact with the pilot in the days preceding the accident did not reveal any physical or health conditions that may have caused a health event during the flight.

### 2.6 Flight recorder information

After the take-off, the pilot did not transmit any messages on either the aerodrome frequency or the frequency dedicated to the display flight.

The Stampe was not equipped with a recorder; it is not required by the regulations. The investigation was therefore unable to determine the airspeed at the beginning and end of the half-loop, the altitudes, the engine parameters or the pilot's inputs on the controls.

In many sport activities, the use of standalone video recording systems is becoming increasingly common and used for training purposes. These systems, easy to carry and inexpensive, can be used for post-flight analysis and thus improve training management and pilot progress. The BEA report[5] on the accident to the HKW prototype identified HKW-01 on 14 November 2015 in Erstein (Bas-Rhin) illustrates the added value of these video recordings in understanding such events.

### 2.7 Statements

Two witnesses (aerobatic pilots positioned at the foot of the control tower at the time of the accident flight) estimated that, at the start of the spin, the aeroplane was flying at a height of about 500 ft and that the time from the end of the half-loop to ground impact was four to six seconds. They did not see any control movements to recover from the four spin rotations (deemed to be very smooth), nor did they perceive any change in engine noise.

[5] https://www.bea.aero/en/investigation-reports/notified-events/detail/event/accident-du-prototype-hkw-identifie-hkw-01-le-14112015-a-erstein-67/

## 2.8 Regulatory information for the organisation of an air show

In accordance with the regulations relating to air shows in force on the day of the accident:

- The air show in Blois on 31 May 2015 was authorised by a prefectural order of the Loir-et-Cher prefecture based on the technical opinion of the regional civil aviation authority.
- The flight director must have the participants carry out, if necessary, a reconnaissance of the site or a rehearsal of the displays and must have received, no later than the day before the event, the detailed programmes for each display as specified on the forms provided in Annex IV of this Order[6].
- Each participant received a copy of this prefectural order as well as a map of the area in which the manoeuvres were to be performed and the display axis.
- Each participant must be able, for the class of aircraft to be used, to prove to the flight director […] that he/she has completed 200 flight hours as a pilot of a powered aircraft […], at least three take-offs and three landings in the three months preceding the show, as well as […] if performing at a show, practice training in the proposed programme within the preceding three months[7].
- The display form to be completed by each pilot must include, in particular, items relating to the description of the display and the date the proposed display was last performed and an undertaking, to be signed by the participant, to respect the flight envelope of the aircraft and the programme stipulated on this form as approved by the flight director.

This display form had been completed and signed by the pilot and the flight director. The description of the pilot's display stated only:

- Duration of the display: 12 minutes.
- Maximum level: 900 m.
- Description of the display: formation flying.

This succinct information, provided by the pilot to the flight director, did not allow the flight director to identify the risks associated with this programme and to take appropriate action before the display began.

Not being a qualified aerobatic pilot, the flight director, in making his decision on this formation flying display, relied on the technical advice of his deputy flight director, who was one of the wing pilots in the biplanes taking part in the formation, while also requesting a rehearsal flight prior to the air show.

In October 2013, the DGAC also published two best practice guides[8] for air show pilots and flight directors. These two guides provide recommendations on the specific features of flying displays.

[6] Article 22 of the Order of 4 April 1996 on air shows.

[7] Article 26 of the Order of 4 April 1996 on air shows.

[8] Flying Display Guide - Pilot https://www.ecologie.gouv.fr/sites/default/files/guidePILOTE-2_web.pdf Flying Display Guide - Flight Director https://www.ecologique-solidaire.gouv.fr/sites/default/files/guide-directeur-des-vols-2_web.pdf

The first guide, intended for pilots, is designed to draw the attention of qualified pilots to the specific features of an activity that is subject to little technical supervision. It applies first and foremost to individual displays. It states that it goes without saying that displays involving several aircraft have specific features that can only be addressed in an appropriate study, even though the general aspects mentioned in the guide still hold. It thus provides simple but rigorous rules for preparation and training prior to flying displays in order to compensate as far as possible for the increased risks linked to the specific environment in which air shows are held while maintaining a satisfactory level of flight safety.

The second guide, intended for flight directors, emphasizes the need to ensure that each pilot has prepared properly for his or her flying display. It also advises undertaking a rehearsal flight, especially when a flight director does not know a pilot.

The order and the best practice guides focus on the air show itself as well as on the context of the arrival and departure of aircraft at the site of the air show, which are recognised as particular risk factors. They do not make any specific provisions for rehearsal flights preceding the show.

### 2.9 Information about display crew rescue arrangements

During the three days prior to the air show, which included the rehearsal flights, the fire fighting and rescue arrangements complied with the regulatory requirements for the operation of this type of aerodrome, namely a fire fighter with a 250 kg dry powder fire engine.

Specific reinforcements were planned for the day of the air show, primarily for the benefit of the public.

### 2.10 Spin information

The following information about the spin is taken from the pilot's handbook used by the CPVA: the definition of a spin indicates that it is a continuous stall of one wing relative to the other. The spin is the result of two actions:

A. Creation of a stall by increasing the angle of attack.
B. Creation of a side-slip induced oblique angle of attack.

The aircraft will always spin on the pedal input side, either intentionally or otherwise. Stopping and recovering from the spin is achieved by removing its two causes by:

1. Determining the direction of engine rotation at low speed.
2. Pedal input on opposite side to the rotation (eliminating the oblique angle of attack).
3. Moving the stick forwards (reduction of the angle of attack).
4. As soon as the auto-rotation is over, bringing the pedal input back to the middle.
5. Very gentle pull-out and progressive go-around.

In the case of the accident, the witnesses did not report any movements of the control surfaces which could indicate that the pilot was trying to recover from the spin.

The unintentional entry into a spin on a Stampe, at 500 ft, at the top of a half-loop, leaves little chance for a possible recovery.

### 2.11 Execution of the straight recovery figure

In accordance with the sequence chosen by the pilot, the straight recovery was to be started at 330 ft. This unusual height meant that it was difficult for him to regain control of the aircraft if it went into a spin.

Moreover, due to the unusual proximity to the ground prior to undertaking the half-loop and the tailwind, the pilot may have had the impression that his speed was quite high. Rehearsing the display in these conditions was a significant change to the pilot's practice training habits.

## 3 - LESSONS AND CONCLUSION

The entry into the uncontrolled spin at the end of the split-S is probably the result of too low a speed at the start of the figure.

The following factors may have contributed to this loss of control:

- A lack of training in the transition between flying in formation and a solo aerobatic flight, especially when performing manoeuvres at a low height.
- A mistaken sensation of speed due to the unusual proximity to the ground and the tailwind on the axis of the display.

The low height at the beginning of the aerobatic manoeuvre, and thus the low height at which the spin started, did not allow the pilot time to recover from the spin or attempt to eject.