BEA
Bureau d'Enquêtes et d'Analyses
pour la sécurité de l'aviation civile

www.bea.aero

SAFETY INVESTIGATION REPORT

Accident to the Dudek Warp 2 identified 95AKI on 10 May 2024 at Auvers-sur-Oise

Time	20:28[1]
Operator	Private
Type of flight	Cross country
Persons on board	Pilot
Consequences and damage	Pilot fatally injured, microlight destroyed
This is a courtesy translation by the BEA of the Final Report on the Safety Investigation. As accurate as the translation may be, the original text in French is the work of reference.	

In-flight loss of control, collision with ground

1 HISTORY OF THE FLIGHT

Note: the following information is principally based on statements and GPS[2] tracks from navigation tools.

The pilot wanted to test his recently purchased wing on his private strip. He was accompanied by another paramotor pilot who took off first and that he was to follow during the flight.

The pilot inflated the wing twice to check the suspension lines and correctly position it for take-off, carried out the engine tests and then started to take off. He rejected his first take-off as the wing had not correctly inflated and folded during the manoeuvre. The second take-off was at 20:22 (see **Figure 1**, point 1). Once the two paramotors were in flight (point 2), the pilot carried out a figure of eight by making a right-hand and then a left-hand turn. During this manoeuvre, the microlight descended around 140 m in roughly 50 s to finish at an altitude of 280 m.

A few minutes later, the accompanying pilot looked behind him to check the position of the pilot and saw him rapidly descending in a steep left-hand turn (point 3), until he struck the ground. After landing as quickly as possible, he rapidly removed the paramotor battery which was melting and producing white smoke before providing assistance to the pilot. The engine was no longer operating at this time.

[1] Except where otherwise indicated, times in this report are given in local time.
[2] The glossary of abbreviations and acronyms frequently used by the BEA can be found on its web site.

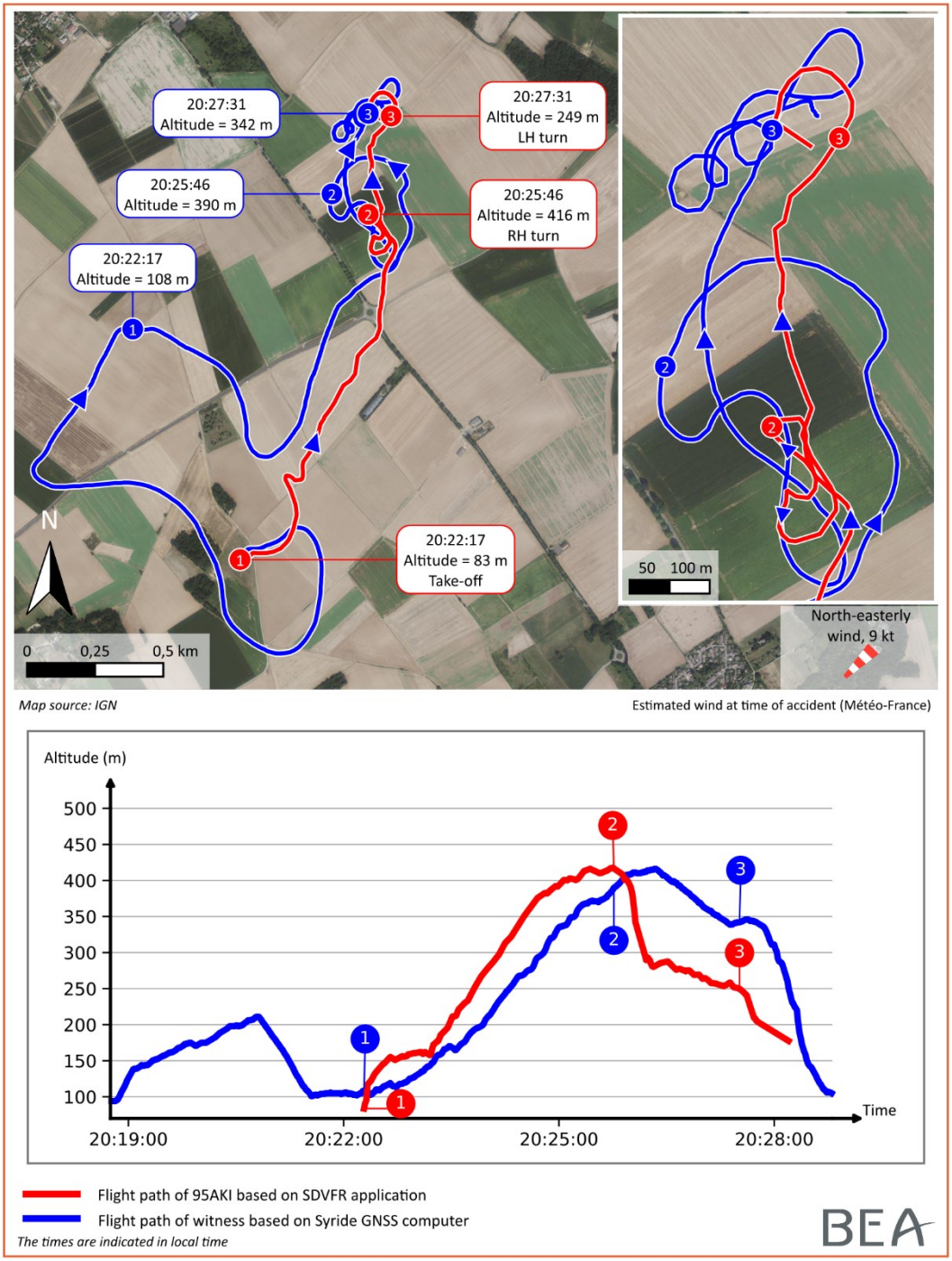

Figure 1: flight paths and vertical manoeuvres of the two paramotors

2 ADDITIONAL INFORMATION

2.1 Meteorological information

The weather conditions were as follows: CAVOK, a north-easterly wind of approximately 9 kt and a temperature of 21 °C.

No particular weather phenomena were reported by the accompanying pilot.

2.2 Pilot information

The 65-year-old pilot held a microlight paramotor pilot licence obtained in 2006 and had flown approximately 1,500 paramotor hours. He was not a member of the FFPLUM. As a consequence, he had no obligation to hold a certificate indicating that there were no contra-indications to him flying microlights or to provide a 'QS — SPORT' health questionnaire.

The pilot owned six wings, including the one used on the day of the accident. He had tried it out seven months earlier with the intention of buying it, but this flight was his first with this wing since purchasing it. According to statements, he had bought it because he was looking for a higher-performance wing than his previous wing, a 18 m² Dudek Hadron 3[3], purchased in 2020.

The pilot did not take part in competitions and flew for leisure carrying out cross-country flights often accompanied by two friends.

The pilot had suffered a heart attack in 2012. Since then, he had been taking medication that included a beta-blocker.

2.3 Paramotor information

2.3.1 Paramotor

2.3.1.1 Warp 2 Dudek wing

The wing used during the flight was a 18 m² DUDEK WARP 2. This is a high-performance wing designed for experienced pilots, used for paramotor cross-country flights and competitions.

According to data from the manufacturer's flight manual, when a pilot begins a turn, he may rapidly enter an accelerating spiral dive, which can surprise a pilot with little experience. An accelerating spiral dive is equivalent to reaching the highest possible sink rates and is one of the manoeuvres that generates the highest G-forces.

2.3.1.2 Engine, harness and accessories

The paramotor was equipped with an Air Conception[4] Nitro 200 engine and an electric starter powered by a Li-Po battery[5]. The battery offered for sale by Air Conception is a 22.2 V, 1500 mAh, six-cell Li-Po battery. According to the information gathered, the pilot had purchased a new battery in 2024, which he probably used during his flight.

The harness was also an Air Conception product and sold with the engine. The pilot did not carry an emergency parachute on this flight.

2.3.2 Examination of paramotor

The BEA did not go to the accident site.

Examinations of the wing at the BEA found that it was in almost new condition. There was no damage to the wing, suspension lines and risers. The brake pulleys were set to the middle position

[3] Wing with a reflex airfoil for experienced pilots.
[4] Paramotor designer and retailer.
[5] Lithium-ion polymer battery.

of the three possible settings, which corresponds to the factory settings according to the manufacturer's documentation.

The accelerators and the “Power Attack”[6] system were not installed and the trims were in the “closed” position, corresponding to the wing's configuration when it left the factory. The trims were in a symmetrical setting, in the highest nose-up position. This configuration is the simplest, and the piloting mode is called “slow” mode.

The BEA's examination of the engine did not reveal any anomalies that could have caused an in-flight malfunction. The ignition, engine shutdown switch and starter were functional.

Heat damage was observed in the battery area. The heat emitted was intense enough to penetrate the harness backrest and melt the cable sheaths in that area. Three of the six battery cells were found intact, the other three had very probably melted. The battery connector on the chassis side showed no signs of internal overheating.

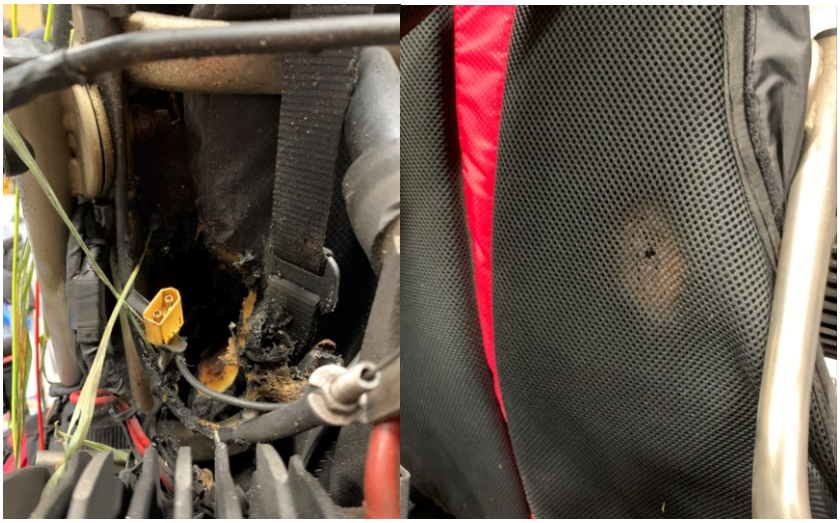

Figure 2: front and rear view of the paramotor seat (source: BEA)

After the accident, neither the pilot who witnessed the accident nor the gendarmerie brigade who attended the scene found the fireproof bag or any debris from it near the wreckage (see paragraph 2.3.4).

The deformations of the chassis suggest a frontal impact with the ground, with the right-hand side striking the ground first. The cage structure was severely damaged on the left-hand side, near the area where the battery was attached.

2.3.3 Thermal runaway

The term thermal runaway is generally used to refer to overheating within a battery (particularly Li-Po batteries) and other accumulators. This overheating can be caused by several factors: an overload, short-circuit or impact. Just a few minutes, or even seconds, are enough to cause potentially substantial damage as a result of thermal runaway.

[6] The PA (Power Attack) system combines the trims and the accelerator, allowing the trims to be released smoothly when the accelerator is pressed.

Although rare, thermal runaway is possible in flight. The urgency of the situation requires quick decisions to be made in order to land. These decisions may lead to sudden manoeuvres, and the stress generated by the situation may reduce piloting abilities.

2.3.4 Use of a fireproof bag

A fireproof bag for the battery is supplied with the engine at the time of purchase and should be used when flying.

This fireproof bag is made of woven fibreglass. According to Air Conception, this material is designed to resist overheating and delays a potential fire for four minutes. However, there are no certification standards for general aviation or microlight aircraft regarding the resistance of fireproof bags to battery thermal runaway.

Figure 3: new fireproof bag sold by the manufacturer (source: BEA)

2.4 Accompanying pilot's statement

The accompanying pilot flew on a very regular basis with the accident pilot. According to him, the accident pilot was not in the habit of carrying out risky manoeuvres and only flew for leisure, without participating in competitions. Together with a third pilot, they used to carry out flights lasting several hours in the region.

The accompanying pilot added that he communicated with the accident pilot by radio, particularly when the latter informed him of his intention to make the first turn. The two pilots then communicated one last time to confirm the flight destination. There was no discussion about another possible manoeuvre.

The accompanying pilot witnessed the paramotor's accelerating spiral dive. After landing to give assistance to the accident pilot, he disconnected the battery, which was emitting a large amount of white smoke and generating a lot of heat. He did not hear any unusual noises when the battery melted, such as an explosion or a hissing sound.
He added that the accident pilot had his lap belt fastened, which was necessary to keep him in the harness.

2.5 Spiral dive

The spiral dive is a manoeuvre usually used to rapidly lose altitude by performing 360° turns. The rate of sink can reach between 10 to 20 m/s according to the type of wing used. The average load factor is 3 to 4 G according to the speed and rate of sink. To enter a spiral dive, the pilot mainly uses the brakes to initiate the turn and the rotation. A pilot can also transition to a spiral dive by shifting his weight and placing more weight on the side of the desired turn.

An unwanted spiral dive can also occur following a turn if the turn is not correctly controlled. This spiral can sometimes be unstable and require a quick reaction from the pilot to effectively counteract this phenomenon and regain control of the wing.

During this manoeuvre, the pilot may experience blackout. This is a physiological phenomenon that occurs in flight conditions with a high load factor When the brain is no longer sufficiently supplied with blood, vision becomes blurred and the field of vision may narrow significantly. This phenomenon precedes loss of consciousness, which may occur if exposure to high accelerations is prolonged.

2.6 Medical information

Medical examinations carried out during the autopsy revealed advanced coronary artery disease. A second-degree burn approximately five centimetres below the left shoulder blade, which occurred after the pilot's death, was noted.

Risks associated with the pilot's condition and his medication were identified:

- with respect to his coronary artery disease: a risk of feeling faintness during unusual physical exertion, resulting in varying degrees of incapacitation;
- with respect to his medication: beta-blockers can impair a pilot's ability to adapt to acceleration and increase his reaction time.

3 CONCLUSIONS

The conclusions are solely based on the information which came to the knowledge of the BEA during the investigation.

Scenario

During a cross-country flight to test a new wing, the pilot performed figure-of-eight turns during which the microlight descended 450 ft in less than a minute. He and the pilot accompanying him then coordinated on the flight destination, with no mention of any intention to perform additional manoeuvres. A few dozen seconds later, while the microlight was in a left turn, the wing entered an accelerating spiral dive. The pilot was unable to regain control of the wing and the microlight collided with the ground. The low height at the time of the spiral dive left the pilot little time to exit it.

The thermal runaway of the battery was very probably caused by the microlight hitting the ground.

Contributing factors

The following factors may have contributed to the pilot not exiting the spiral dive:

- a pilot incapacitation when exposed to a load factor due to his state of health and his treatment to slow down the heart rate (beta blocker);
- the pilot’s lack of experience with this wing.