Accident to the Schempp Hirth - Nimbus 4DLM registered **D-KXXY** on Wednesday 10 July 2024 at Vars

Time	Around 15:55[1]
Operator	Private
Type of flight	Local
Persons on board	Pilot and one passenger
Consequences and damage	Pilot and passenger fatally injured, glider 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.	

Collision with terrain, slope soaring

1 HISTORY OF THE FLIGHT

Note: the following information is principally based on statements and data from the on-board LX8000 computer.

The pilot carried out a towed take-off at 12:57 from Aspres-sur-Buëch aerodrome to perform a circuit in the Alps.

At 15:48, he headed for the Queyras mountain range, initially following the ridges from above before slope soaring from 15:53 onwards. At 15:55, when facing a ridge sloping down from Heuvières peak, he turned right into the valley (see **Figure 2**, point 4).

The glider collided with the terrain close to the last point recorded by the on-board computer (see **Figure 2**, point 7).

When the glider did not return to the departure aerodrome in the evening, the pilot's relatives raised the alert by contacting the aeronautical emergency number, 191. Search operations were started. The glider wreckage was found two days[2] later, close to the last recorded point.

[1] Except where otherwise indicated, the times in this report are in local time.

[2] For an unknown reason, very few of the FLARM signals sent by the glider during the flight were received by ground stations or by other gliders. This meant that they could not be used to precisely locate the wreckage. The glider was not equipped with an emergency locator transmitter. The wreckage was found using the pilot's telephone.

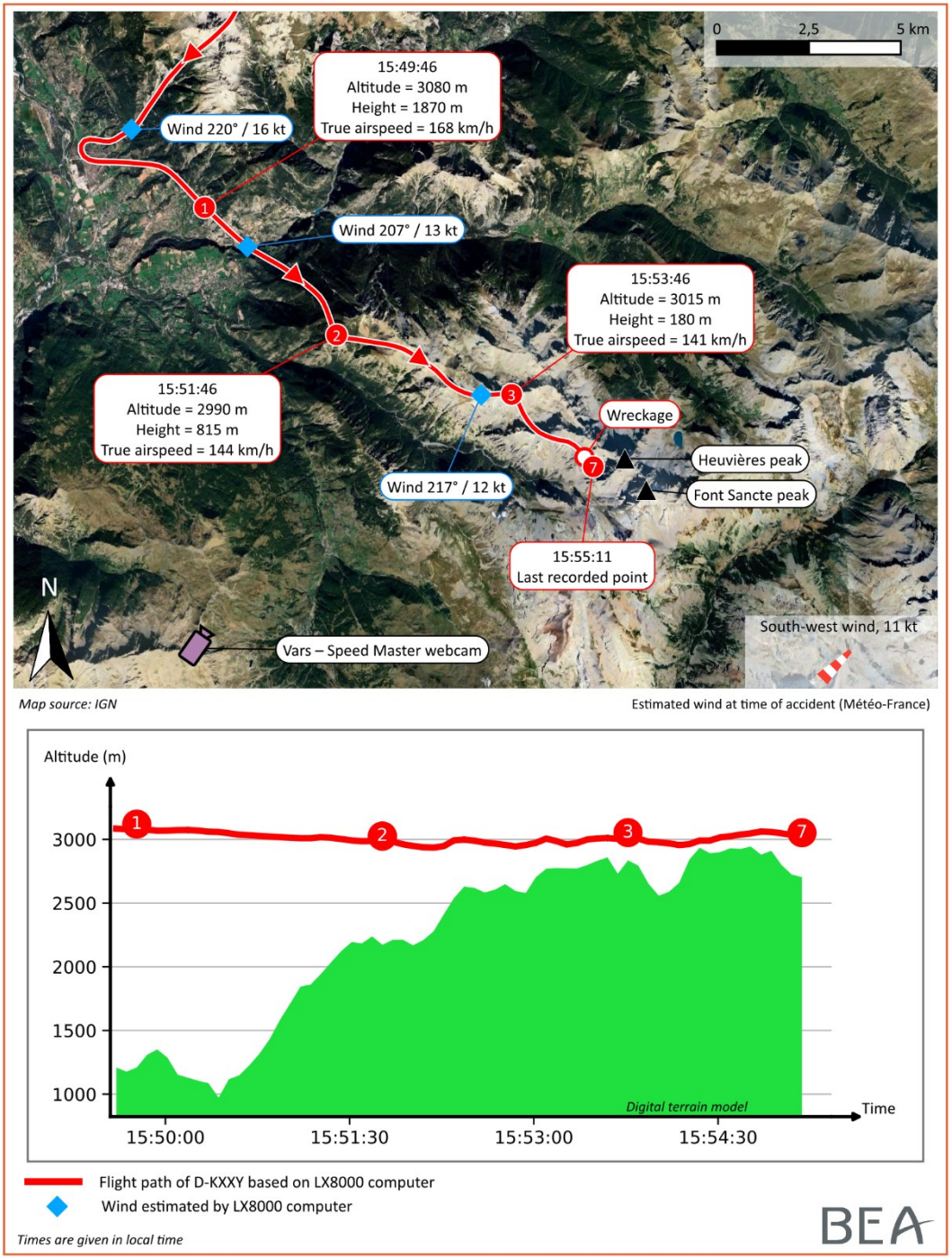

Figure 1: end of flight path

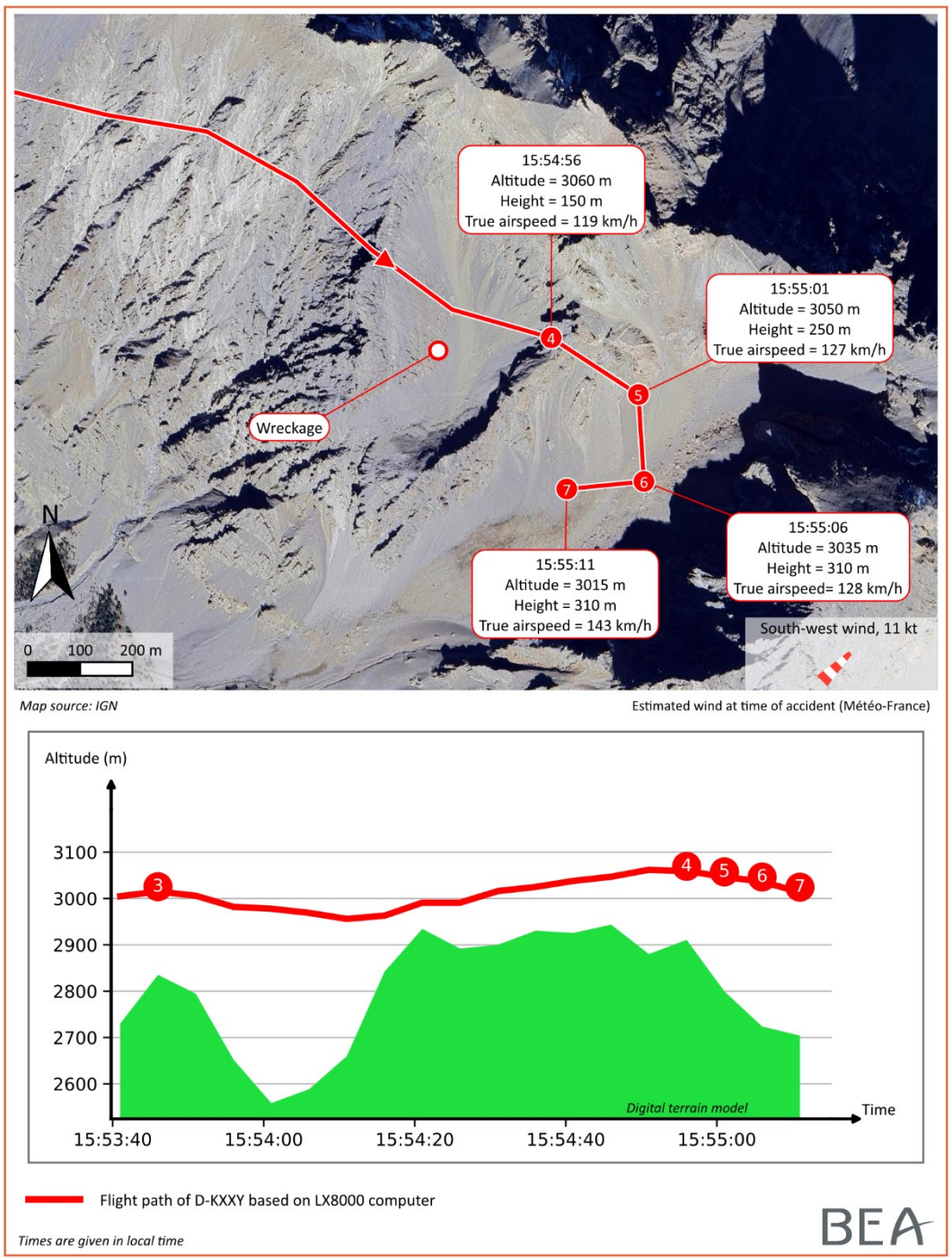

Figure 2: last minutes of flight path

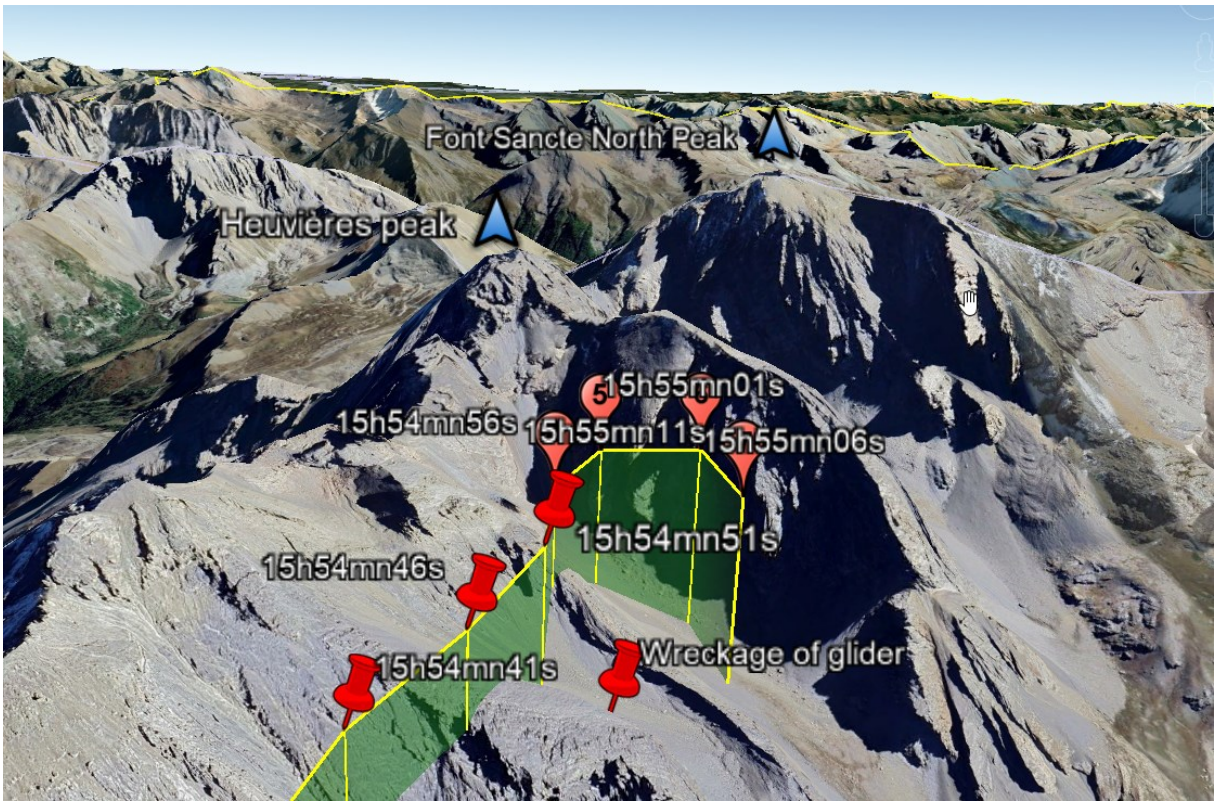

Figure 3: 3D view of end of flight path (source: Google Earth, annotations BEA)

2 ADDITIONAL INFORMATION

2.1 Glider information

D-KXXY was a Nimbus 4DLM, a high-performance, two-seat glider with a wing span of 26.5 m, equipped with upper surface airbrakes and wing flaps. The Nimbus is equipped with a combustion engine allowing it to self-launch. Its empty weight is 640 kg. Its wing loading is 46 kg/m^2 at maximum weight. The 4DLM version is a stretched fuselage version with respect to the 4DM version but with similar behaviour.

The indicated stall speed at the maximum take-off weight of 820 kg (Vs), with the airbrakes and propeller retracted is:

- 78 km/h with the flaps in position “+2”;
- 83 km/h with the flaps in position “0”;
- 88 km/h with the flaps in position “-2”.

The weight of the glider at the time of the accident was close to the maximum take-off weight of 820 kg, the centre of gravity was in the envelope given in the flight manual.

2.2 Meteorological information

The weather conditions estimated by Météo-France close to the accident site at 16:00 were:

- a south-westerly wind of 11 kt;
- visibility greater than 8 km;
- scattered to broken cloud cover over high ground with a cloud base between 3,000 and 3,500 m;
- temperature 13°C and QNH 1023 hPa;
- strong thermal lifts.

The modelling of turbulence between 15:45 and 16:00 produced the following chart:

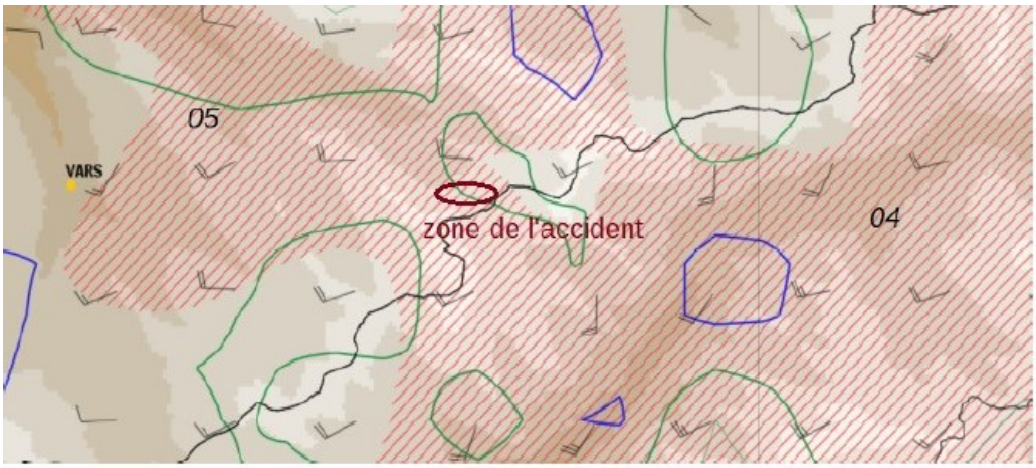

Figure 4: modelling of turbulence, the area with red diagonal lines corresponds to an area of light to moderate turbulence at a height of 20 m, the areas outlined in green correspond to areas with uplift and the areas outlined in blue to areas of subsidence
(source: Météo-France)

According to the turbulence chart provided by Météo-France, the accident site was in an area of light to moderate turbulence. The presence of westerly gusts reaching 20 kt and uplifts could have created surface windshear and increased turbulence.

The Vars skiing domain is equipped with various webcams which regularly record images. The Vars – Speed Master[3] webcam recorded the following image at 16:00:

Figure 5: recording of Vars – Speed Master webcam at 16:00
(source: Vars – La Forêt Blanche)

The various recorded images confirm that the peaks close to the accident site were not in clouds.

2.3 Pilot information

The 45-year-old pilot had owned D-KXXY since 2013. He was sat in the front (pilot) seat. He held a glider pilot licence obtained in 2006 (converted into a SPL in 2016) along with winched, towed and self-launch take-off ratings. He had logged 1,260 flight hours (including 1,160 hours as pilot-in-command), of which 17 hours in the previous three months on D-KXXY. He had totalled 625 flight hours on D-KXXY. The day before the accident, the pilot had carried out a five-hour flight unaccompanied, on D-KXXY.

He also held a microlight pilot licence along with the fixed-wing rating.

[3] The position of this webcam is shown on **Figure 1**.

He had arrived in Aspres-sur-Buëch on 6 July to carry out flights in the Alps. According to the statements collected, the pilot was very cautious and had some apprehension about flying in mountainous terrain. He carried out the majority of his flights over flatland, out of Pirmasens in Germany. When he flew unaccompanied in the mountains, he limited himself to flights within reach of the departure aerodrome.

According to the pilot's relatives, in 2022 at Aspres-sur-Buëch, he had made the acquaintance of a pilot experienced in mountain flying (see paragraph 2.4). They decided to carry out circuits together in the Alps. This pilot shared his knowledge of mountain flying, aerology and navigating by reference to visible landmarks. During these flights, the owner of D-KXXY systematically sat in the pilot's seat, but they took it in turns to be the pilot-in-command during the flight.

2.4 Passenger information

The 69-year-old passenger was sat in the rear seat. He held a glider pilot licence obtained in 2003. According to the statements collected, the passenger had totalled 3,500 flight hours but it was not possible to determine his experience in an open class glider. In particular, he was used to carrying out large mountain circuits.

Between 2022 and 2024, the passenger and the pilot had carried out 79 flight hours together on D-KXXY divided between 12 flights.

2.5 Site and wreckage information

The glider wreckage was found two days after the accident. It was situated at an altitude of 2,820 m below a ridge line rising to around 3,000 m. As the site was difficult to access and did not lend itself to an examination of the wreckage, the BEA did not go to the site.

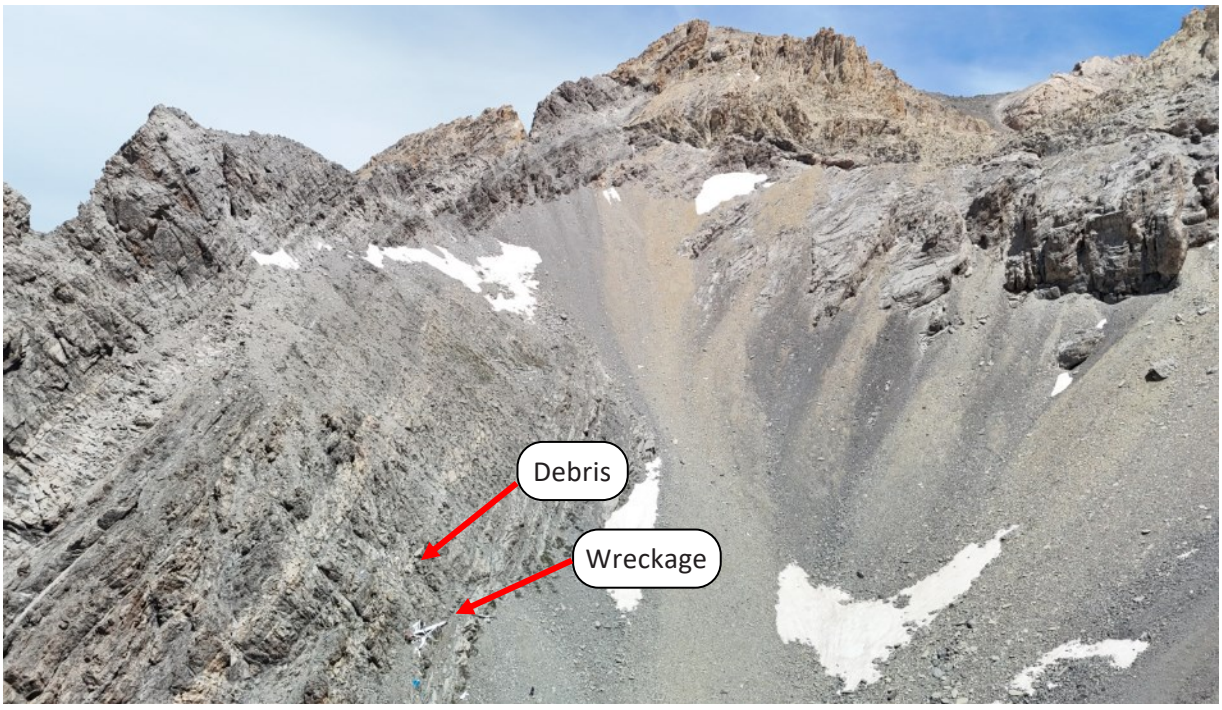

Figure 6: location of wreckage (source: SRTA, annotations BEA)

The wreckage was recovered by helicopter and then examined by the BEA in a hangar. This examination and the photos taken by the emergency services on the accident site made it possible to determine that the glider very probably collided head-on with the rock face with high energy. Following this first impact, the wreckage experienced other damage when it fell towards the point where it finally came to a stop lower down. The examination of the flight controls found that all the ruptures were characteristic of a sudden overload and therefore very probably a result of the impacts with the ground. The position of the flaps could not be determined.

The engine pylon was in the totally retracted position at the time of impact.

2.6 Analysis of LX8000 computer data

The glider was equipped with a LX8000 flight computer, an on-board navigation system which records the GNSS tracks. It also calculates the direction and strength of the wind and displays this information for the pilot. The various flight paths and 3D views were produced based on the recorded data.

When the glider started the turn at point 5, it was at an altitude of 3,060 m:

- facing a ridge of an altitude of between 3,200 and 2,800 m, descending from the Heuvières peak;
- facing the ridge between the northern peak of Font Sancte and the Panestrel peak of an altitude of between 3,350 and 3,100 m.

The pilot and his passenger very probably did not have a view of the natural horizon.

Between points 4 and 7, the true airspeed of the glider was between 119 km/h and 143 km/h. This corresponds to an indicated airspeed of between 100 and 120 km/h, i.e. 1.20 Vs[4] and 1.45 Vs.

2.7 Slope soaring flight and associated hazards

The Safety in Mountain Flying guide, available on the CNVV website, contains fundamental recommendations on mountain flying techniques. In particular, it addresses the techniques of flying near the terrain and aerological traps. This guide recommends holding a minimum speed of 1.45 Vs in flight close to the terrain. It also warns that, "*The evolution of the air masses in mountains is complex. Local phenomena, linked to the shapes of mountains, and to the interactions between winds, valley breezes, the nature of the ground, the influence of the sea, different climatic areas etc. are sometimes more important than the general meteorological situation. This results in situations that evolve unpredictably and sometimes for the worse*."

The presence of a convective phenomenon along a slope is one of the hazards of slope soaring, the fatal trap of displaced thermals according to the book, "*Dancing with the Wind*"[5].

[4] Vs = estimated indicated stall speed based on flight manual, in the conditions of the day of the accident with flaps in position 0.

[5] Jean-Marie Clément, Dancing with the Wind. Published by Topfly, 2015.

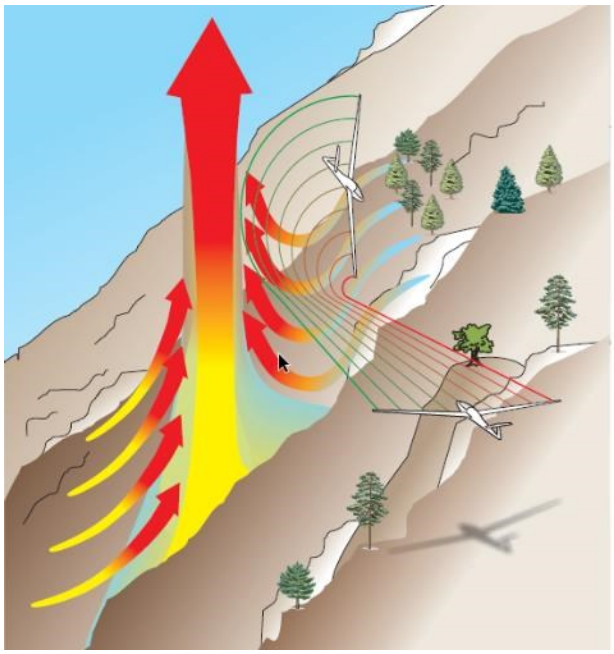

Figure 7: diagram showing the hazard of a displaced thermal in slope soaring flight with high thermal activity (source: Dancing with the Wind)

This phenomenon can generate a high rotational torque on the glider's roll axis. In addition, if the area of lift is situated below the area of sink, this torque will be stronger and may override roll control.

Given the strong thermal lifts estimated by Météo-France in addition to the dynamic activity on the slope caused by the west to south-westerly wind, the presence of displaced thermal lifts was possible in the area of the accident.

2.8 Hypoxia and supplemental oxygen in gliders

As the altitude increases, the partial pressure of oxygen in the air inhaled by a pilot decreases, resulting in a reduction in the quantity of oxygen carried to the organs. When the organs do not receive a sufficient quantity of oxygen for their needs, they find themselves in a situation of hypoxia which impairs their operation on a more or less lasting basis. Hypoxia can lead to a progressive impairment of physical and mental abilities.

The French glider pilot manual[6] specifies that signs of hypoxia can appear as low as 1,500 m.

In the SAO (*Sailplane Air Operations*) annex, commission implementing regulation 2018/1976[7] specifies that, "*The pilot-in-command shall ensure that all persons on board use supplemental oxygen whenever he or she determines that, at the altitude of the intended flight, lack of oxygen might result in impairment of their faculties or harmfully affect them*." (SAO.OP.150).

[6] Published by CÉPADUÈS, 15th ed., June 2024.

[7] Commission implementing regulation of 14 December 2018 laying down detailed rules for the operation of sailplanes (Version in force on the day of the accident).

It is also indicated in its AMC that, "*When the pilot-in-command cannot determine how the lack of oxygen might affect the persons on board, he or she should ensure that all occupants use supplemental oxygen for any period when the pressure altitude is above 10,000 ft*." (AMC1 SAO.OP.150).

The analysis of the recorded flight data found that the pilot and his passenger had flown more than two hours above 2,500 m which included more than an hour above 3,000 m. The pilot and passenger were not equipped with an oxygen distribution system. The Safety in Mountain Flying guide recommends using this type of system from an altitude of 1,500 m.

In the section Safety Lessons General Aviation, the BEA identified the theme of pilot incapacitation and hypoxia in its glider reviews of 2022 and 2021.

2.9 Statements from experienced pilots

During the investigation, the BEA consulted experienced pilots in mountain flying and flying a heavy open class glider[8] with a wide wingspan and high wing loading.

All of the pilots consulted indicated that the ridge followed by D-KXXY before the collision with the terrain (points 3 to 8) was steep and often the seat of a very complex and changeable, even rough aerology. For this reason, they advised against using this ridge, in particular for slope soaring flight with a wide-wingspan glider.

All of the pilots consulted indicated that as for a majority of open class gliders, the Nimbus 4DM was a complex glider to fly and very different from a school glider. They explained that it was a heavy glider with substantial inertia and that the pilot has to make a significant rudder input for it to start turning. However, if the input on the pedals is held for too long when starting the turn, these pilots indicated that it is possible to put the glider into a sideslip and that it is also possible that a substantial aerodynamic load on the rudder in the event of a sideslip in a turn, will prevent the pilot from countering the sideslip with the pedals. Exiting a sideslip turn can then prove complex and lead to, if there is no quick reaction from the pilot, an asymmetric stall, the start of a spiral dive or an autorotation in the direction of the turn.

The BEA contacted the manufacturer, Schempp-Hirth about this subject. The manufacturer replied that to avoid excessive roll once in the turn, the ailerons must be slightly deflected in the opposition direction to the turn. It added that this phenomenon, linked to the aileron effect, is more pronounced as the glider's wingspan increases and that this is the case whatever the glider model.

[8] The FAI (World Air Sports Federation) defines open class gliders as gliders with no restriction on wingspan or aerodynamic design. This class uses advanced technologies to maximize performance which makes it the highest performance category for gliding. These gliders can reach lift-to-drag ratios of more than 60 and generally have a wingspan of more than 25 m. The Nimbus 4, the Lange Antares 23^{E} as well as the ASH-25 are in this class.

2.10 Similar accidents

A search for occurrences linked to a loss of control of a glider with similar characteristics to D-KXXY brought to light the following two accidents:

- Fatal accident on 12 April 2022 to the Nimbus 4DM registered D-1380 in Italy. The investigation carried out by the ANSV was unable to determine with certainty, the cause of the accident. However, it is possible that the glider stalled in a turn leading to a quick loss of altitude. The low height of the glider probably did not allow the pilot to carry out a stall recovery manoeuvre.
- Accident on 11 January 2016 to the Nimbus 4DM registered D- KCIT in Namibia. No safety investigation was carried out. However, the BEA was able to talk to the pilot during this investigation. He explained that when he wanted to exit a left-hand turn, the glider had become uncontrollable and started turning flat around itself in an unstable manner. It had seemed to him that he could not make a right-hand input on the pedals and he did not manage to recover control of the glider. The glider's wings ruptured. The two occupants managed to eject themselves and deploy their personal parachute.

3 CONCLUSIONS

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

Scenario

The pilot, the owner of the glider, undertook a circuit in the Alps, accompanied by a passenger who was an experienced pilot and familiar with flying in mountainous terrain. After a flight time of three hours, including two hours at an altitude of more than 2,500 m and more than one hour at an altitude of more than 3,000 m, the glider collided with the terrain in an area of steep slopes which could have a complex aerology in the conditions of the day.

The recorded flight path seems to show that a right-hand turn towards the valley had been started when the pilot was facing two ridges rising to an altitude that was higher than that of the glider's. It is probable that control of the glider was lost during this turn. The glider's low height and proximity with the terrain probably did not allow the pilot to regain control of it.

The investigation was not able to determine who had the controls at the time of the loss of control or the nature of the interactions between the two pilots.

Contributing factors

The investigation was not able to determine the cause of this loss of control. However, one or more of the following factors may have contributed to it:

- slope soaring with a heavy, unwieldy glider with a wide wingspan, in an area of steep slopes with a complex aerology;
- a possible situation of moderate hypoxia which could have affected the pilot's and passenger's physical and mental abilities.

Safety lessons

Piloting an open class glider

Flying a glider with a wide wingspan and high wing loading is very different to flying a two seater school glider or a single seater glider. In particular, the authority of the roll control is limited: around seven seconds are required for a glider with a wingspan of 26.5 m (such as the Nimbus 4DM) to roll +/- 45° whereas a single seater glider with a wingspan of 15 m only requires around four seconds[9].
The inertia and behaviour when starting and during a turn can also be very different. These particularities must be taken into account when flying, especially in a mountainous region.

Slope soaring and safety margin in relation to terrain
It is usual for a glider to use thermal and dynamic lift close to the terrain. Slope soaring is a phase where the safety margins are reduced, and particularly calls on the pilot's attention and cognitive resources. It is essential that pilots are aware of these specificities and their risks, particularly after a long flight in high mountains.

The Safety in Mountain Flying guide (CNVV) sets out basic recommendations for the mountain flying technique. Likewise, the book, Dancing with the Wind, details the specificities of mountain flying such as the numerous hazards of slope soaring.

Carrying an emergency locator transmitter (ELT)
It is not mandatory for a glider to carry an ELT. Gliders often fly in a mountainous environment over areas which are sometimes difficult to access. In the event of an accident, it may prove difficult for the emergency services to locate a glider and its occupants from the ground or the air.

Equipping a glider with an ELT and switching it on before taking off means that it will be automatically activated in the event of a collision with terrain. The signal transmitted by the ELT will then allow the ARCC-Lyon to locate the accident site and quickly initiate search and rescue operations.

Flight carried out by two pilots: division of roles
Although the investigation did not determine that the division of roles on board the glider could have contributed to the accident, it may be useful to recall that on board a two-seater but single-pilot aircraft, the status of the occupants is either pilot-in-command, instructor, student pilot or passenger. Outside of an instruction flight, the configuration is generally pilot-in-command/passenger. When a flight is carried out with two pilots on board, it is important, before departure, that the role of each pilot is clearly expressed. The pilot-in-command must take decisions and in particular, decide who has the controls should a particular situation arise.

The FFVP has published an article on this subject, *"Mais qui est… commandant de bord"* in a special edition of *Actions Vitales* of January 2019.

The BEA investigations are conducted with the sole objective of improving aviation safety and are not intended to apportion blame or liabilities.

[9] Dancing with the Wind – Jean Marie Clément