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

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SAFETY INVESTIGATION REPORT

Accident to the Heli-Sport - Ranabot CH77 identified 974PT on Saturday 5 August 2023 at Saint-Paul (La Réunion)

Time	09:51[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.	

Rotor blade strike with tail boom en route, collision with ground, fire

1 HISTORY OF THE FLIGHT

Note: the following information is principally based on statements, radio-communication recordings and video recordings from a security camera at La Saline-Les-Bains microlight strip[2] and from the camera of a paraglider pilot in flight.

The pilot took off at approximately 09:45 from La Saline-Les-Bains microlight strip bound for a helipad located inside the Mafate cirque. He was to join a microlight instructor for an advanced flight in a mountainous environment. Four minutes after take-off, he announced on the A/A frequency[3] 123.5 MHz that he was at an altitude of 2,200 ft and climbing towards the named localities Hauts de Sans-Souci and Deux-Bras. Then at 09:51, he announced that he was climbing towards the named locality Deux-Bras[4]. A few seconds later, the rotor blades struck the tail boom and several components separated from the airframe. The microlight fell and a fire broke out after the collision with the ground.

[1] Except where otherwise indicated, the times in this report are in local time.
[2] The glossary of abbreviations and acronyms frequently used by the BEA can be found on its web site.
[3] On the Reunion Island, VFR pilots use the A/A frequency 123.5 MHz when flying outside areas or airspaces where radio contact is mandatory.
[4] Only the end of the message could be heard due to a simultaneous transmission.

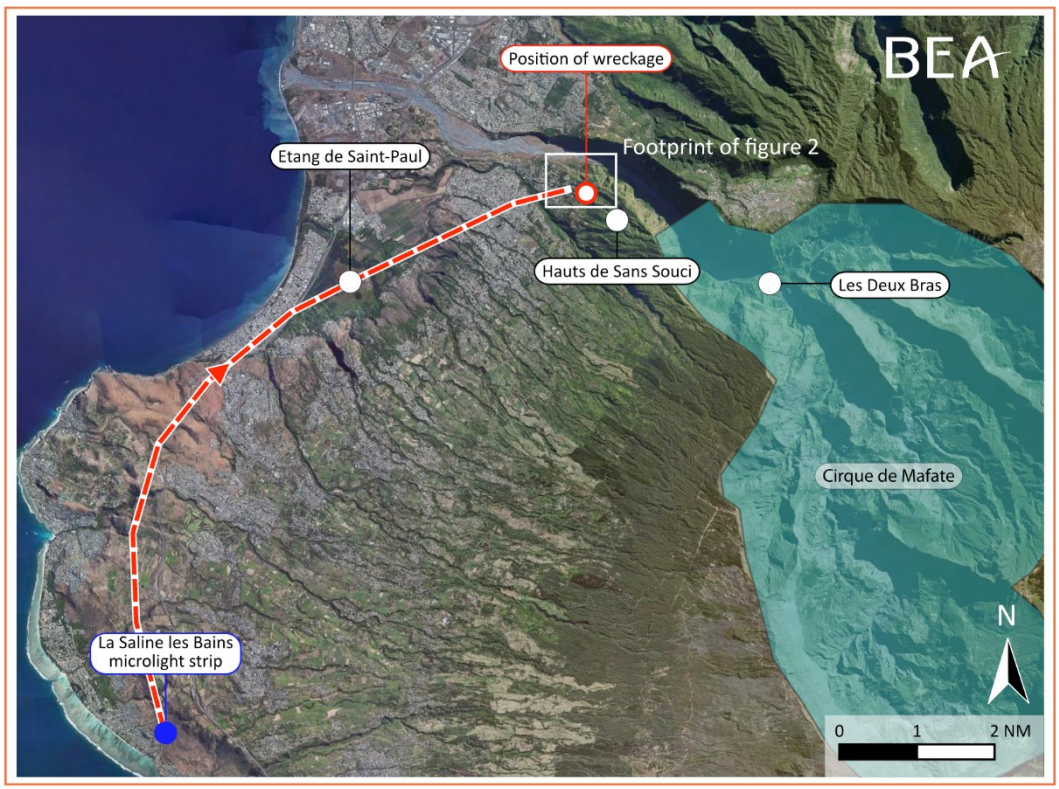

Figure 1: sector in which the pilot flew (map source: IGN)

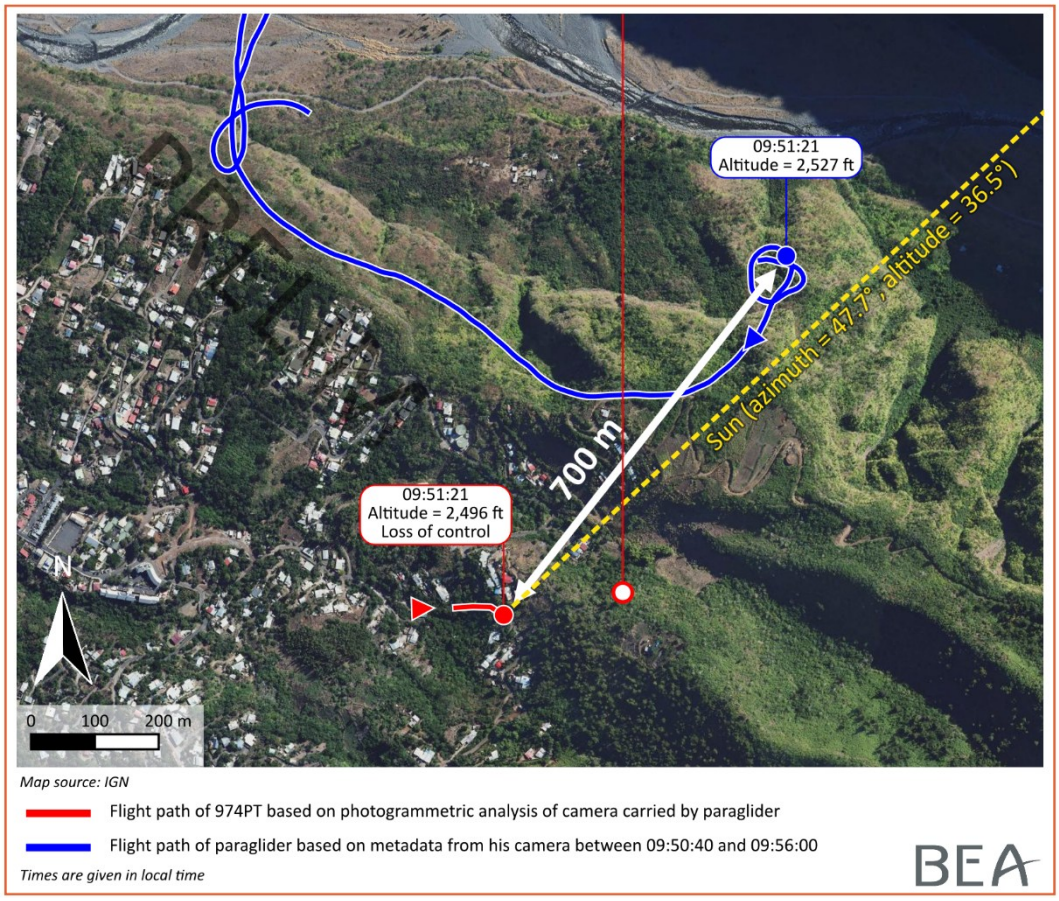

Figure 2: path of a paraglider pilot flying close to the accident site

2 ADDITIONAL INFORMATION

2.1 Site and wreckage information

Note: The exact distribution of debris on the site could not be established, as some debris was moved before the BEA could make its observations.

The microlight wreckage was found in a wooded terrain at an altitude of approximately 1,650 ft. The main wreckage was completely destroyed by the impact with the vegetation and the ground, as well as by the fire. The following components were found separated from the main wreckage, some of them approximately 100 m from it, with no signs of fire:

- one main rotor blade;
- the two doors;
- the tail rotor and the tailplane;
- a section of the tail boom;
- the two braces linking the tail boom and the airframe.

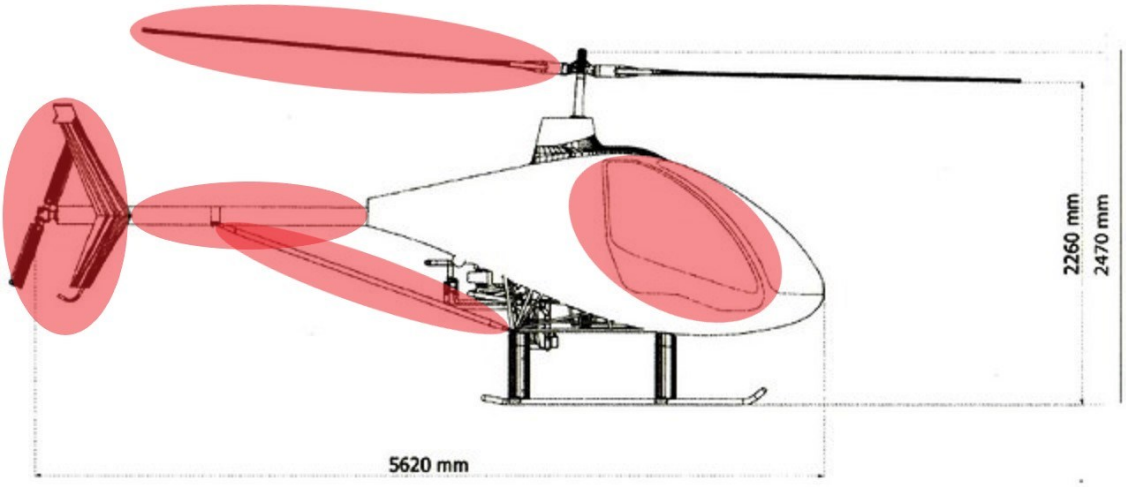

Figure 3: components found separated from the main wreckage (source: User Manual).

A detailed examination of the wreckage was carried out after it was moved to a hangar. Given the damage caused by the fire, it was not possible to check the continuity of the flight control linkages. All of the damage observed resulted from the accident.

The two main rotor blades showed similar damage. The trailing edges were open and the leading edge reinforcements were torn off. All of this damage indicated that both blades made contact with a component while the main rotor was rotating. The tail boom showed two signs of impact. The blade found separated from the rotor showed traces of paint that could correspond to a strike with the tail boom at the “Danger” sign.

Figure 4: marks resulting from contact of the rotor blades with the tail boom (source: BEA)

The failures observed between the airframe and the tail boom, between the tail boom and the tailplane, as well as at the ends of each brace, were of a sudden nature. The blades' flapping stops were slightly damaged, indicating important blade flapping.

All these observations showed that the rotor blades came into contact with the tail boom, causing the components found near the main wreckage to separate.

Due to the occurrence of two previous accidents[5] during which a door opened in flight, particular attention was paid to examining the doors. The doors showed little damage. The three locking bolts were found extended and showed no visible distortions. The door surrounds on the airframe were completely burnt. It was therefore not possible to make any observations on the bores into which the bolts slide. The opening/closing mechanisms were operational. Two internal latches were present on each of the doors, confirming the implementation of a modification[6] introduced following the two accidents mentioned above. Examinations were unable to confirm or invalidate the fact that the doors were correctly locked. It should be noted that the microlight was not equipped with a warning to indicate that the doors were not correctly closed.

2.2 Read-out of the video taken by the paraglider pilot

A paraglider pilot was flying close to the accident area and was recording his flight using a camera and the Syride application.

Note: the video resolution did not allow the microlight attitudes to be determined with accuracy, nor did it allow the debris detaching from the airframe during the loss of control to be identified accurately.

[5] Accident to the Heli-Sport CH77 identified 86QF on 19 June 2018 at Châtellerault (Vienne).
Accident to the Hélisport - SRL - CH 77 Ranabot identified 83ARU on 30 November 2019 at Gréoux-les-Bains (Alpes-de-Haute-Provence).

[6] https://www.ecologie.gouv.fr/sites/default/files/BI_2019-ULM-03%20R1_portes_CH77.pdf

The microlight, approaching the paraglider, appeared on the video. The microlight was in descent. In less than three seconds, it tilted forward and components detached from the airframe. The tail boom broke during the tilt. The microlight then fell vertically for approximately 6 s. A fire broke out after the collision with the ground.

The distance between the paraglider pilot and the microlight at the time of the loss of control was around 700 m.

Shortly afterwards, the paraglider pilot called the emergency services to inform them of the accident.

2.3 Pilot information

2.3.1 Experience and ratings

The 62-year-old pilot held a microlight pilot licence issued in 2000, along with a fixed-wing class rating. He held an ultralight helicopter class rating issued in November 2019.

He also held a Private Pilot Licence - Aeroplanes (PPL(A)) issued in 1985[7] and a Private Pilot Licence - Helicopters (PPL(H)) issued in 1999. His R22 and R44 type ratings expired in 2007. In December 2005, the pilot reported to the DGAC that he had logged a total of 248 flight hours on helicopters.

2.3.2 Statements

The manager of La Saline-Les-Bains strip, where 974PT was based, indicated that he knew the pilot. He specified that, according to him, the pilot had logged approximately 250 flight hours on the CH77. He added that the pilot maintained his microlight and was meticulous during the pre-flight inspection.

The instructor that the pilot was to join during the accident flight reported that the pilot had contacted him for advanced flying courses in mountainous region. They had already logged approximately 20 flight hours in this context. Their generally flew for 45 min, always on 974PT. He specified that the pilot was calm and meticulous and had no particular learning or piloting difficulties. He added that the pilot was particularly careful to close the doors correctly.

2.3.3 Medical information

The autopsy on the pilot's body did not reveal any element likely to explain the accident.

Several witnesses reported that the pilot completely lost the use of his right eye in 2007. They added that he underwent rehabilitation to compensate for this loss. The instructor who was providing him advanced mountain flying courses reported that he had not noticed it until the pilot told him.

In a static situation, monocular vision does not affect the detection of fixed or moving objects in space, the estimation of distances or the appreciation of terrains. However, monocular vision causes a visual field reduction. In dynamic situations, monocular vision may therefore require more active space-scanning strategies to compensate for this reduction.

[7] His Single-Engine Piston (SEP) class rating expired in 2007. The pilot reported that he had logged a total of 604 flight hours on aeroplanes in December 2005.

2.4 Microlight information

The Ranabot CH77 is an ultralight helicopter equipped with a composite twin-blade teetering rotor, sold as a kit by the Italian company Heli-Sport SRL, then assembled and distributed in France by the limited liability company Helisport. In normal flight configuration, the pilot-in-command sits in the right seat[8]. Normal cruising speed is around 160 km/h. At this speed, a distance of 700 m is covered in approximately 16 s.

974PT entered into service in May 2019. The Head of Helisport stated that he knew this microlight well and had carried out maintenance operations on it. He specified that the microlight had logged around 300 flight hours and was well maintained.

Section 8 of the Flight Manual contains safety notices published following various accidents involving light helicopters. It specifies that nose-down inputs producing a low load factor condition are extremely dangerous. Section 8.21[9] indicates in particular that a rapid forward movement of the cyclic pitch stick - to avoid a bird or another aircraft, for example - may result in a low load factor condition, which may cause rotor mast bumping and separation of the main rotor or one blade striking the fuselage.

2.5 Excessive flapping of the blades on a teetering rotor head

The flapping movement of a blade is intended to limit lift asymmetry on the rotor disc. The blades of a helicopter are thus flapping constantly to find a balance position.

In the case of a teetering rotor head, the mechanical connection between the rotor head (with its blades) and the mast is a pin joint, which allows the rotor head to tilt as the blades flap to find a balance position.

On a twin-blade helicopter equipped with a teetering rotor head, excessive blade flapping can have the following consequences:

- mast bumping;
- contact of the rotor blades with the airframe.

Excessive flapping can occur when a first input is followed shortly afterwards by an opposite input on the cyclic pitch stick. With the first input on the cyclic pitch stick, the rotor tilts and drives the airframe. If an opposite input is made rapidly, the airframe continues to be driven by the first input while the rotor tilts in the opposite direction, following the second input. This can result in the tail boom being cut by the main rotor blades. As a general rule, low load factor conditions (also known as low “G” conditions) are conducive to excessive flapping.

2.6 Meteorological information

The analysis of the weather conditions by Météo-France showed that on the day of the event, the Reunion island was subject to fairly strong trade winds in a relatively moist air mass. In the morning, the windward slopes were cloaked in cloud, while elsewhere sunny spells prevailed.

[8] The pilot was ejected at the time of the impact and his position on board the microlight could not be confirmed.

[9] Entitled “Aeroplane pilots flying helicopters”.

In the area of the accident, the sky became increasingly cloudy on the slopes between 09:30 and 10:30. There was no precipitation and the wind was light. However, between the low-level breezes and the easterly upper flow, light turbulence was possible.

The video of the paraglider pilot's flight did not reveal any particular aerological phenomena or turbulence at the time of the accident. Visibility was good and the microlight was flying below the cloud layer.

At the time of the accident, the solar altitude (angle above the horizon) was 36.5° and azimuth angle was 47.7° (see **Figure 2**). The sun, the paraglider and the microlight were more or less along the same axis.

2.7 Electronic conspicuity

In light aviation, in uncontrolled airspace, collision avoidance relies essentially on the "see and avoid" rule. This requires constant monitoring of the sky and, to be effective, a sky-scanning strategy. This "see and avoid" principle showed many limitations and proved to be deficient in a number of accidents.

To improve pilots' situational awareness and facilitate visual acquisition of surrounding traffic, a number of uncertified traffic detection systems were developed for light aviation[10]. Some of these systems are interoperable, which substantially improves visibility of surrounding traffic. These systems may require the installation of ground receivers to substantially increase the amount of visible traffic, in particular aircraft equipped with a Mode-S transponder and the ADS-B Out function.

Since the end of 2023, the French civil aviation safety directorate for the Indian Ocean (DSAC-OI), in cooperation with the French Microlight Federation (FFPLUM), SafeSky[11] and various electronic conspicuity equipment designers, has been conducting an experiment to reduce the risk of collision on the Reunion Island. Alongside with actions to support the development and promote the safe use of electronic conspicuity devices, the DSAC-OI plans to set up a network of approximately ten ground receivers to increase the amount of traffic visible through these devices and thus reduce the risk of midair collision.

[10] See para. 1.18.3 of the report on the accident to the Robin DR400 registered F-BXEU and to the Alpi Aviation Pioneer300 identified 37AHH on 10 October 2020 at Loches (Indre-et-Loire).

[11] Since December 2023, the SafeSky application has incorporated the user location from the Syride application, that the paraglider pilot was using in flight during the accident of 974PT.

3 CONCLUSIONS

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

Scenario

While the pilot headed towards the Mafate cirque, the rotor blades struck the tail boom of the microlight. The radio message transmitted by the pilot a few seconds before seems to indicate that he had not noticed any particular emergency or problem and that the event was sudden and abrupt.

A few seconds later, the microlight was in descent, whereas the pilot had just announced on the radio that he was climbing. A possible forward input of too high amplitude on the cyclic pitch stick may have created a low load factor condition conducive to excessive blade flapping on the microlight. The blades then severed the tail boom, causing the microlight to fall.

The separation of the two doors during the fall was probably due to a distortion of the airframe.

The investigation was unable to determine the reasons that might have led the pilot to make a high-amplitude input on the cyclic pitch stick. Although the distance separating him from the paraglider pilot was important, it is possible that when the pilot saw the paraglider wing, he considered that immediate action was required and made an excessive input on the controls. However, the investigation was unable to rule out a potential mechanical malfunction of the microlight, leading to the loss of control.

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