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INVESTIGATION REPORT

Accident to the Schweizer 269C-1 registered F-HAGO

on 12 January 2021
at Bastelica (Corse-du-Sud)

Time	Around 14:20[1]
Operator	Private
Type of flight	Local
Persons on board	Pilot and passenger
Consequences and damage	Aircraft destroyed

This is a courtesy translation by the BEA of the Final Report on the Safety Investigation published in March 2022. As accurate as the translation may be, the original text in French is the work of reference.

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

Decrease in main rotor speed, loss of altitude while crossing a mountain pass, forced landing on a snow-covered surface, helicopter tips forward

1 - HISTORY OF THE FLIGHT

Note: the following information is principally based on statements, on radio communication recordings and on the video from the passenger's mobile phone

The pilot, accompanied by a friend, took off without a flight plan from the helipad where the helicopter was based (see Figure 1, point ❶) for a VFR flight in the mountainous area of Val d'Ese. The pilot, in radio contact with the flight information service of Ajaccio, headed in the direction of Tolla (see Figure 1, point ❷). At 13:54, he announced that he was three minutes away from Ese and that he was flying at an altitude of 3,400 ft (1,035 m). He then left the frequency. He crossed the Bocca della Calle pass (at an altitude of 1,950 m), heading towards Lake Vitalaca (see Figure 1, point ❸) which was located further north, then he turned around.

The pilot stated that on the return leg, while flying at an altitude of 7,200 ft (2,200 m), the main rotor speed decreased and the helicopter lost altitude. The pilot was unable to counter this trend. He crossed the Bocca della Calle pass in descent and had no choice but to make a forced landing on the slope, behind the pass. When the helicopter landed on the snow-covered ground, it tipped forward and the main rotor made contact with the snow.

At 14:18, the Aeronautical Rescue Coordination Centre (ARCC Lyon) received a message from the Cospas-Sarsat French Mission Control Centre (FMCC) concerning the activation of the emergency locator transmitter associated with F-HAGO in the Monte Renoso area.

The wreckage was found at around 15:30, followed by the occupants at 15:49 on the Scaldasole ridge, approximately two kilometres from the accident site, from where they were airlifted out by helicopter.

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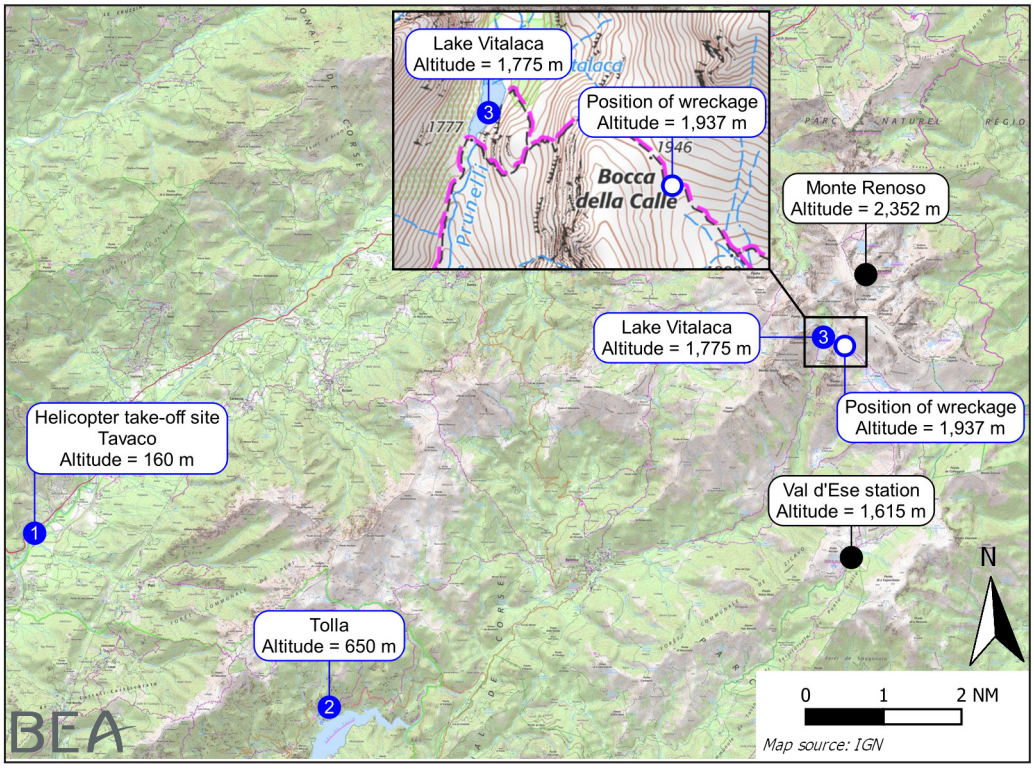

Figure 1: General location map

2 - ADDITIONAL INFORMATION

2.1 Examination of site and wreckage

The wreckage was located at an altitude of 1,937 m, in the centre of the valley, which is roughly oriented along a northwest/southeast axis (see Figure 2). Marks were visible in the snow over a distance of around 10 metres before the airframe. The airframe was oriented south-southwest and its front section was sunk into the snow. The tail boom was broken, the rear stabiliser and the tail rotor had been torn off and were located several metres away in front of the airframe. The main rotor blades were bent and evidence of power was observed on one of the blades. The flight control linkages were continuous. No technical element was found that could explain the decrease in the main rotor speed.

Source: High Mountain Gendarmerie Platoon (PGHM) of Corsica

Figure 2: Photograph of accident site and wreckage

2.2 Meteorological information

According to the valid WINTEM chart at 12:00 UTC for FL 100, a north wind of 15 to 20 kt was forecast at altitude over the Corsican mountains.

The meteorological conditions estimated by Météo-France at the accident site at 14:00, at an altitude of between 1,950 m and 2,190 m, were as follows: wind from 340° to 360° of 4 to 16 kt, low turbulence, visibility 10 km, clear sky, temperature - 4°C, horizontal and vertical wind shear[(2)] at the Bocca della Calle pass.

[(2)] Significant variation in speed and/or wind direction over short vertical or horizontal distances.

2.3 Helicopter information

2.3.1 General

The helicopter was powered by a Lycoming HIO-360-G1A fuel-injected engine (180 hp at 2,700 rpm). The instrument panel had various warning and caution indicator lights, including a red "Rotor - Low RPM" warning indicator light, coupled with an aural alarm. According to the manufacturer's flight manual, this indicator light comes on and the aural warning sounds when the following conditions are met:

- engine speed below 2,530 rpm: visual and aural warnings activated intermittently;
- rotor speed below 390 rpm: visual and aural warnings activated continuously.

The manual indicates that to counter a decrease in rotor speed and bring it back within the normal operating range, the pilot must immediately increase power and/or lower the collective pitch lever.

The helicopter was equipped with conventional skids without skis for landing on snow.

2.3.2 Performance

At the time of the accident, the weight of the helicopter was approximately 745 kg. With this weight and at a temperature of -4°C, the F-HAGO flight manual indicates that at the maximum power of 2,700 rpm, the helicopter's hover ceiling In Ground Effect (IGE) is approximately 7,000 ft (2,135 m).

2.4 Pilot experience

The pilot, who owned the helicopter, held a Private Pilot Licence - Helicopters (PPL(H)) issued in February 2017 and a HU269 type rating revalidated on 22 December 2020. He stated that, on the day of the accident, he had logged more than 200 flight hours, approximately 12 hours of which in the last 12 months and approximately 9 hours of which in the last 3 months, all in F-HAGO.

He was qualified to use helicopter landing sites since August 2017. He stated that he had not followed any training in mountain flying.

Note: there is no mountain rating for helicopter pilots. The mountain rating is only required to fly aeroplanes or motor-powered gliders to and from areas where the authorities deem such a rating to be necessary.

Nevertheless, the pilot explained that he regularly performed mountain flights, often alone, and that this was the first time he had landed on snow-covered ground. The pilot had envisaged performing a mountain flight with an instructor.

2.5 Statements

The pilot reported feeling vibrations from the main rotor blades as he crossed the pass perpendicularly, with a tailwind. After the main rotor speed decreased, the helicopter lost approximately 300 ft of altitude, with a rate of climb of approximately -500 ft/min. Thinking that he had encountered a downdraft, the pilot pulled on the collective pitch lever to try to regain altitude, without success, then he lowered the lever to regain rotor speed. He stated that during the descent (performed at an airspeed of 50 kt, according to him), no warning indicator lights came on, but he could not remember if the aural warning had sounded. After initially considering diving into the valley to accelerate, he instead opted to land after the pass, nose towards the valley, in an area with a slight descent covered with snow. He added that he had had no choice but to make a run on landing over several metres because he had no more power available to hover, and that when he sustained the manoeuvre with the collective pitch lever, the helicopter had sunk. The "Rotor - Low RPM" aural warning had sounded just before landing. After landing, due to the snow that was not packed, the skids had sunk and the helicopter had tipped forward.

He had not had time to transmit an emergency message over the radio. He explained that after the accident, he and his friend had tried to dial 112 to reach the emergency services, but there had been no phone signal.

Due to a fuel leak, they did not switch the battery back on to use the helicopter's radio. They decided not to wait for help on site and left the wreckage to walk towards the Val d'Ese ski resort, as they knew they would get a phone signal once on the ridge. After walking for just under two hours, they managed to reach the Ajaccio air traffic controller by phone and informed him of their position.

He added that they had not triggered the personal locator beacon (PLB) or taken it with them so as not to interfere with the search operations and their location. They had no food or water. They left the first aid kit in the helicopter. They had not worn warm clothes suitable for the mountain environment at this time of the year. He explained that the clothes they were both wearing (jeans, trainers and sweatshirt) got soaked quickly upon contact with the snow. He explained that they had suffered from cold at the extremities of their lower and upper limbs. When they managed to contact the control tower in Ajaccio, the pilot was beginning to have difficulty speaking due to jaw numbness.

Note: the passenger's statement is similar to that of the pilot.

2.6 Survival aspects

2.6.1 Emergency locator transmitter registration and information update

The order of 21 December 2018[3] establishes the obligation to code the emergency transmitters carried on board aircraft and to register them on the French register of emergency locator transmitters (RFBD[4]). Each 406 MHz emergency locator transmitter is assigned a unique code that identifies the transmitter and may include the aircraft registration. The transmitter must then be registered by its owner on the RFBD. Each change of ownership requires a new registration.

[3] Order pertaining to coding and registering to assist with aircraft search and rescue, emergency locator transmitters operating on the 406 MHz frequency

[4] https://registre406.cnes.fr/sarsatweb/do/

The FMCC specifies that registering an emergency locator transmitter makes the Search And Rescue (SAR) operations easier to process. According to the FMCC, the two transmitters on board F-HAGO were not registered on the RFBD[5].

The investigation conducted by the BEA on the accident to PH-EIL[6] showed that the late activation of the emergency services had resulted from the fact that the coding had not been changed after a change in registration and from the fact that the emergency locator transmitter had not been registered after the change of ownership. This situation could have worsened the consequences for the surviving passenger, who was seriously injured in the accident.

Based on the risks associated with uncoded or unregistered emergency locator transmitters, as stated in the investigation report mentioned above, the Prevention, Safety and Training commissions of the French Aeronautical Federation (FFA) drafted a specific ELT practical sheet, in collaboration with the SAR department of the French Air Navigation Services Provider (DSNA), the FMCC and the ARCC Lyon, to remind people of the regulatory requirements and associated procedures to be applied[7].

2.6.2 Emergency locator transmitter on board F-HAGO

The helicopter was equipped with a fixed KANNAD 406 AF-Compact Emergency Locator Transmitter (ELT) without a GNSS receiver, which had been coded in the workshop during its installation on F-HAGO. This transmitter was automatically activated during the landing. The passenger and the pilot had wondered if the transmitted signal had been received by the Cospas-Sarsat system.

The occupants had also carried a KANNAD 406 XS-3 GPS portable PLB (with a GNSS receiver). Thinking that it would interfere with SAR operations and their location, they had not activated it or taken it with them when they had left the wreckage.

Note: there is no risk of interference between two emergency locator transmitters transmitting in close proximity to each other.

2.6.3 Accuracy when locating a signal transmitted by an emergency locator transmitter

When an emergency locator transmitter is activated, it transmits a distress signal on the 406 MHz frequency containing the locator transmitter's unique coded identification number. Some locator transmitters, associated with a GNSS receiver, also transmit their position coded in the signal. The Cospas-Sarsat system detects the distress signal and calculates the location of the locator transmitter within minutes. Moreover, when the GNSS position is coded in the signal, this accuracy can reach 100 m. The data is then sent, after processing by the FMCC, to the ARCC Lyon in order to organise the rescue operations.

According to the ARCC Lyon, the ELT on board F-HAGO was located on the eastern slope of Monte Renoso. The SAR operations took place within a 5 km-radius circle, centred on Monte Renoso. The wreckage was found to the south-southwest, less than 2 km from Monte Renoso.

[5] The percentage of registered aeronautical emergency locator transmitters that emitted a signal is estimated at 63% in 2019 and and 55.5% in 2020.

[6] Accident to the Vans RV-4 registered PH-EIL on 1 June 2016 at Coëx (Vendée)

[7] This sheet was uploaded to the FFA website on 17/12/2021, in the space dedicated to flying club managers.

2.6.4 Aeronautical emergency phone number

Launched on 20 April 2017, the aeronautical emergency phone number 191 provides direct access to the ARCC Lyon. This freephone service is dedicated to aeronautical emergency call handling and is available 24/7. It can be used by any user in a state of emergency, by any direct witness of an aircraft accident, or by any person concerned about the disappearance of an aircraft and its occupants.

The pilot and the passenger did not know that this emergency number existed. The checklist used by the pilot only indicated the numbers to call for emergency services (112, 18).

2.6.5 Carrying survival equipment

Annex VII Part-NCO[8] of the consolidated Regulation (EU) No. 965/2012 (known as "AIR OPS"[9]) states in paragraph NCO.IDE.H.180 that "*Helicopters, operated over areas in which search and rescue would be especially difficult, shall be equipped with such signalling devices and life-saving equipment, including means of sustaining life, as may be appropriate to the area overflown.*"

The French civil aviation authority (DGAC) specifies that there are no such areas in metropolitan France. The decision to carry survival equipment[10] is at the discretion of the pilot-in-command.

The pilot of the helicopter had not deemed the carrying of such equipment, with the exception of the PLB, useful for this flight. A first aid kit was present in the helicopter.

On 8 December 2021, the French civil aviation safety authority (DSAC) published a guide for operators of aircraft other than complex motor-powered aircraft for non-commercial purposes[11]. This guide deals in particular with the carrying of survival and life-sustaining equipment. It specifies that operators must assess the access difficulties of SAR operations for each area in which they operate their aircraft, and that the appropriate equipment should be carried according to the risks inherent to the regions overflown.

2.6.6 History of SAR operations

As the ELT had not been registered by the pilot when he had purchased it, no information, and in particular no telephone number, was associated with it. The telephone number of the pilot was retrieved by the ARCC Lyon from Ajaccio aerodrome. The lack of telephone coverage in the area of the accident had not allowed the ARCC Lyon to contact the pilot by telephone or to locate him by SMS using the Gendloc[12] application.

As the two occupants of the helicopter managed to reach an area with telephone coverage, they telephoned the Ajaccio air traffic controller and informed him of their position. The controller then retransmitted this position by radio to the Corsica PGHM crew.

The helicopter arrived on site at 15:24 (i.e. approximately an hour after the ARCC Lyon had been informed). The helicopter's crew located the wreckage, then the occupants at 15:49 on the Scaldasole ridge, approximately two kilometres from the accident site. They were still approximately one hour's walk from the Val d'Ese resort. When they were hoisted by helicopter, they were not suffering from hypothermia.

[8] Non-commercial Operations.

[9] Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations (Version in force on the day of the accident).

[10] Document AMC2 NCO.IDE.H.180 lists the following equipment: 500 ml of water for each four persons on board, one knife, first-aid equipment, one set of air/ground codes.

[11] https://www.ecologie.gouv.fr/sites/default/files/guide_pour_exploitations_aeronefs_fins_non_commerciales.pdf

[12] Application used by the PGHM in the mountains to geolocate people experiencing difficulties who are equipped with a mobile phone, by sending them a text message.

2.7 Mountain flying

The book "*Technique d'utilisation de l'hélicoptère*[13]" states that prior to a mountain flight, the pilot must prepare for the flight in order to obtain the information that is critical to safety:

- ❒ Weather information.
- ❒ Weight and balance sheet.
- ❒ Study of the helicopter's performance IGE, Out-of-Ground Effect (OGE) and according to the planned flight (weight, altitude, temperature). This study implies having a good knowledge of the "performance" charts in the Flight Manual.

It specifies that downwind of the terrain, there is always an area which is very dangerous, as it is subject to turbulence and downdrafts. In a pass, in particular, the wind speed increases due to the Venturi effect. The vertical component of a downdraft can then exceed the vertical speed obtained at maximum power. The pilot must therefore expect to encounter turbulence and downdrafts anywhere and must always fly with great caution.

The document advises pilots to perform training flights with a skilled flight instructor before undertaking a mountain flight.

Moreover, the EHEST[14] group of the European Aviation Safety Agency (EASA) publishes, on its website, brochures on various topics for helicopter pilots and instructors. One of these brochures describes the techniques for helicopter operations in hilly and mountainous terrain[15]. It specifically recommends:

- ❒ Carrying survival equipment when flying over inhospitable terrain in the event of a precautionary or forced landing, and considering a means of communication, water, warm clothes, fire-making, as well as a means of attracting a search aircraft.
- ❒ Not assuming that a stranded aircraft and crew will be quickly or easily located.
- ❒ Filing a flight plan or notifying someone of the intended route.

Before making the decision to leave a wreckage after an accident in the mountains, the French mountain pilots association (AFPM) advises its members: firstly, to evaluate the distance and time they will need to reach a convenient location; to assess the upcoming weather conditions; and to determine how well they know the path to be followed and the dangers they will encounter.

In this event, the two occupants made the decision to leave the accident site based on their knowledge of the environment, the estimated walking time to the Val d'Ese ski resort (approximately three hours), and the time of sunset, at 17:15.

[13] Published by Cépaduès, 3rd edition, May 2011 (The 4th edition was published in April 2021, after the accident).

[14] European Helicopter Safety Team.

[15] Techniques for Helicopter Operations in Hilly and Mountainous Terrain

3 - CONCLUSIONS

The conclusions are solely based on the information which came to the knowledge of the BEA during the investigation. They are not intended to apportion blame or liability.

Scenario

The pilot was heading towards the Bocca della Calle pass, with a tailwind component. As he approached the pass at a low altitude, the aerological conditions may have caused the decrease in main rotor speed that the pilot mentioned, and therefore the loss of altitude. The pilot managed to cross the pass, but found himself downwind of the terrain, which accentuated the loss of altitude due to downdrafts. At that moment, the pilot did not have enough power reserve to counter this effect. As a result, he had no choice but to make a forced landing facing down the slope, managing the helicopter's downward path as best as he could. The lack of skis on the skids, designed for soft ground landings, caused the helicopter to tip on landing on the snow-covered surface.

The ELT activated during the accident. As they had no mobile network coverage and did not know whether the ELT signal had been received or not, the occupants decided to leave the wreckage to reach the nearest ski resort, without activating or carrying their personal locator beacon. After walking approximately two hours in the snow wearing inadequate clothing, they managed to telephone the emergency services at the top of a ridge, and communicated their position. In the meantime, the emergency services had been sent out upon receiving the ELT signal. Nevertheless, the Corsica PGHM helicopter had difficulties locating the wreckage due to positioning uncertainties linked to this type of transmitter, not provided with a GNSS receiver.

Contributing factors

The following factor may have contributed to the loss of altitude while crossing the pass:

- The lack of adequate mountain flying training with a qualified instructor.

The following factor may have contributed to the delay in locating the wreckage and the occupants:

- The lack of knowledge of the functionalities of the PLB, which led the occupants not to activate it and not to carry it with them when they left the accident site and as a consequence, did not give information about their GNSS position.

Safety lessons

Carrying appropriate survival equipment during a mountain flight (See para. 2.6.5)
The importance and usefulness of carrying adequate clothing and survival equipment, especially in mountainous environments, is often underestimated by pilots. However, in the case of a forced landing in the mountains, carrying such equipment allows the occupants to better withstand the cold while waiting to be located and taken care of by the rescue services.

Decision to leave an accident site in a mountainous environment

The decision of occupants to leave an accident site in a mountainous environment should be assessed based not only on changing weather conditions, but also on the risks associated with the environment, according to their own knowledge of the area.

Aeronautical emergency phone number 191[16]

This number can be called to alert and to make direct contact with the ARCC Lyon, which has the specific means to locate a wreckage, independently of conventional emergency organisations. This allows the wreckage and/or occupants to be located more quickly.

[16] Sheet "Call 191 for aeronautical emergencies".