



Accident to the DIAMOND - DA40 - NG
registered **F-HRPM**
on 5 March 2021
en route over the Mediterranean Sea (Haute-Corse)

Time	Around 18:10 ¹
Operator	Cannes Aviation Academy
Type of flight	Instruction
Persons on board	Instructor and two pilots in training
Consequences and damage	Instructor injured, aircraft 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.	

Total decrease in power en route, emergency landing on water, in instruction

1 HISTORY OF THE FLIGHT

Note: the following information is principally based on statements, radio-communication recordings, video recordings, radar data and the Search And Rescue (SAR) reports.

The instructor and the two pilots in instruction had programmed training flights with a view to obtaining the commercial pilot licence and the multi-engine instrument rating (CPL(A) IR/ME). They took off at the beginning of the afternoon from Cannes Mandelieu airport (Alpes-Maritimes) bound for Ajaccio Napoléon Bonaparte airport (Haute-Corse). On arrival, they replenished the aircraft with fuel. The pilot flying changed places with the pilot sat in the rear. The before take-off ground engine tests did not reveal anything abnormal. After a touch-and-go at Calvi Saint-Catherine airport (Haute-Corse), they started the return flight to Cannes.

At 18:02, when the aeroplane was stable en route at FL 060, at an approximate distance of 40 NM from the Corsican coast, the engine power suddenly decreased without any forewarning. The instructor complied with the checklists for an in-flight loss of engine power and an in-flight engine restart with propeller windmilling. Her actions had no effect. She sent a Mayday message to the Nice approach controller with whom she was in contact and made a U-turn to head back to Corsica. At 18:11, the instructor ditched the aircraft at around 30 NM north-west of the coast.

The three persons on board managed to evacuate the aeroplane and get into a life-raft while waiting for the rescue services. The aeroplane rapidly sank. The pilot of an APM 30 registered F-HNIZ located them at 18:17 and communicated their position to the controller. The rescue services located them at 18:55. They were hoisted into a helicopter from the life-raft at night, a little more than two hours after the accident.

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

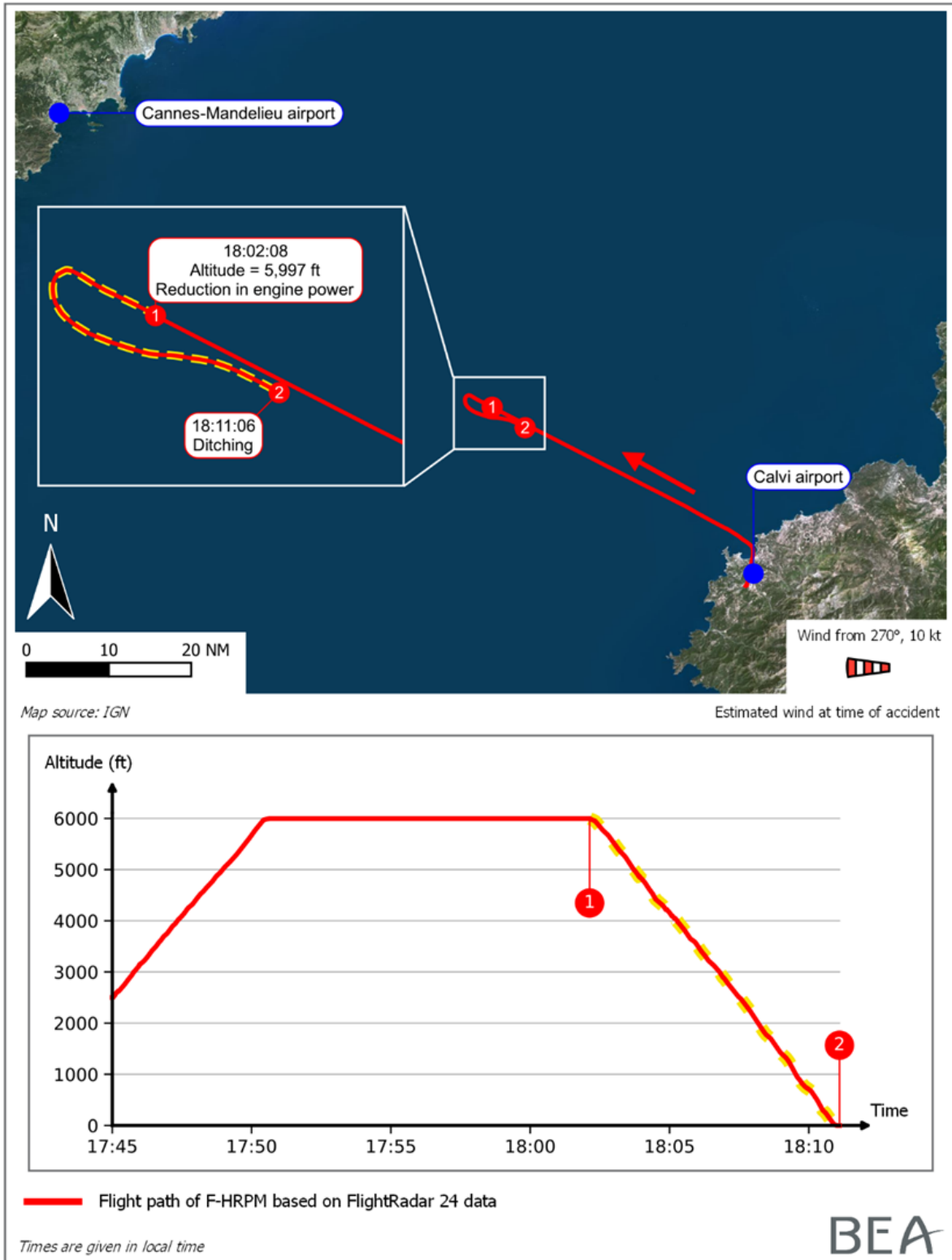


Figure 1: flight path of aeroplane

2 ADDITIONAL INFORMATION

2.1 Persons on board information

2.1.1 Instructor

The 35-year-old instructor held a Commercial Pilot Licence (Aeroplane) (CPL(A)) with the following ratings: Class Rating Instructor Aeroplane (CRI(A)), Instrument Rating Multi-Engine (IR/ME), Cessna Citation C525 type rating and aerobatic flight rating. She had logged around 3,000 flight hours. She was also a captain for a business jet operator on the Cessna Citation C525.

She had worked previously as a cabin crew member for Air France where she had followed safety training in relation with this job, and notably training in the preparation for an imminent accident and in survival.

2.1.2 Pilot in training and flying

The 24-year-old pilot held a Private Pilot Licence - Aeroplanes (PPL(A)). He had logged 141 flight hours including 39 hours as pilot-in-command. He held the theoretical part of the Airline Transport Pilot Licence (ATPL). He started his practical and simulator training in August 2020 in order to obtain the Instrument Rating (IR(A)).

2.1.3 Pilot in training in rear seat

The 29-year-old pilot² held a PPL(A). He held the theoretical part of the ATPL. He had started his practical and simulator training 12 months previously and was at the end of the training for the IR(A).

He obtained the safety training certificate³ in June 2011.

2.2 Meteorological information

The meteorological conditions estimated by the French met office, Météo-France, were the following: wind from 270° of 10 kt, visibility greater than 10 km, occasional showers to the north of the ditching zone, sky clear to few clouds, temperature 13 °C, dewpoint temperature 9 °C, QNH 1017.

At the site of the ditching, the sea was smooth with a 265°-swell of less than 0.6 m, a slight current of 0.01 m/s from 225° (in these conditions, floating objects would drift in a north-easterly direction). The temperature of the water observed at 16:00 was 13.8°C. The sun was situated at an azimuth of 240° with an elevation of 21°. The aeronautical night started at 18:51, i.e. around 40 min after ditching. The moon had set and was not visible.

² He is designated passenger in the rest of the report.

³ This state diploma is required to work as a member of the cabin crew on board aircraft operated by French flight operators. It shows that the holder has acquired specific knowledge and skills regarding safety and first aid on board aircraft.

2.3 Statements

Note: this chapter contains a synthesis of the statements made by the occupants of the aeroplane concerning the loss of power. The statements concerning the preparation for ditching and survival are summarized in the [Survival Aspects](#) chapter.

The pilot remembered that when carrying out the after take-off checklist after the touch-and-go at Calvi, the engine indications were all in the green. The aeroplane was flying outside the cloud layer.

When the aeroplane was en route, the instructor started a knowledge exercise which consisted in asking questions about the engine parameters while concealing part of the Multi-Function Display (MFD). The pilot remembered that the instructor asked him questions about the number of engine rpms, the oil temperature, the oil pressure and the coolant. The purpose of this exercise was to train the pilots in training in detecting an abnormal deviation early, and in anticipating a potential problem. The instructor specified that at the start of this exercise, the engine parameters were normal.

After changing frequency on the Bastia controller's request, the instructor and pilot heard an aural alert and saw the "caution" visual alert. The double alert message, "ECU A fail" and "ECU B fail" was displayed in the inset on the bottom right side of the Primary Flight Display (PFD) and a cross was displayed next to the "Load" value on the MFD. The pilot had the impression that the engine stopped in one second and that the aeroplane veered left. The instructor added that all the engine parameters stayed in the green, that no other alert was displayed and that the propeller continued windmilling until they ditched. She felt a deceleration and the speed of the aeroplane drop sharply. It seemed to her that the aircraft took an attitude corresponding to flight exercises with zero engine power.

Initially, she asked herself if this really was an engine failure. The pilot indicated that he understood that it was not an exercise when the instructor expressed her surprise and took back the controls. She disconnected the autopilot and then asked the pilot to manage the checklists. He carried out the following abnormal checklists; each point of the checklists was checked by the instructor: ECU A FAIL, ECU B FAIL, re-starting engine. As specified in the checklists when the ECU A FAIL and ECU B FAIL messages are still displayed or cannot be reinitialized, they decided to fly to the closest aerodrome. The MFD map indicated that the aeroplane was 41 NM from Calvi compared to 50 NM from Nice. Given the wind direction, the instructor decided to return to Corsica. She squawked 7700 on the transponder, sent a Mayday message and started the turn around.

While the instructor piloted the aeroplane towards Calvi, the pilot carried out the engine re-start checklist three times without obtaining a positive result or an evolution in the engine parameters.

2.4 Examination information

2.4.1 Wreckage

Based on the available information, the zone in which the aircraft ditched was probably 34 NM north-west of Calvi airport and 67 NM south-east of Cannes airport. Given the average sea depth in this zone (between 2,500 and 3,000 m), no plans were made to use underwater means to find and raise the wreckage. Note: light aircraft are not equipped with a transmitter giving their position under water, this is not a regulatory requirement.

2.4.2 Cause of sudden reduction in engine power

A fault tree of the possible causes of a loss of engine power was produced with the technical assistance of the engine manufacturer and aircraft manufacturer, using the chronology of the events reported by the three persons on board the aircraft. It was not possible to determine the cause of the sudden loss of engine power. However, it is probable that only a malfunction in the high-pressure fuel system could have led to the sudden reduction in engine power. The various components which when faulty, could lead to this malfunction are listed below:

- high-pressure fuel pump;
- high-pressure fuel pump driving gear;
- pressure control valve of the “common rail” injection system;
- electrical wiring of the pressure control valve of the “common rail”;
- fuel flow metering unit;
- electrical wiring of the fuel flow metering unit;
- supply system.

A leaktightness fault in the high-pressure fuel system could also lead to a loss of engine power and is not to be excluded.

2.5 Engine information

On 21 January 2021, a new engine model - Austro Engine E4-A S/N 323 - was installed on the aeroplane.

Note: Austro Engine started manufacturing the E4 engine using a basic Mercedes engine already equipping aircraft. As the production of this engine has stopped, new or overhauled engines delivered by Austro Engine from around mid-2020 come from a new production calling upon new suppliers with certain parts manufactured differently.

Since being installed, no abnormal operation had been reported by the pilots of F-HRPM. Between the engine being installed and the time of the accident, the aeroplane had logged 42 flight hours.

Safety measures taken by the manufacturer

On 11 August 2021, i.e. around five months after the accident, Austro Engine published MSB⁴-E4-034/3 requiring the replacement of the driving gear of the high-pressure fuel pump equipping the E4 model engines. The E4-A engine of F-HRPM was equipped with this type of pump. The MSB refers to the possible damage to the driving gear on being assembled by an assembly tool which could result in its premature failure, followed by a loss of pressure in the “common rail” and an engine shutdown.

On 10 September 2021, Austro Engine published MSB-E4-035/1 requiring the inspection of the driving gear of the high-pressure fuel pump equipping the E4 model engines equipped with cylinder heads bearing P/N E4A-12-500-000. The engine of F-HRPM would have been concerned by this MSB which refers to a stack up of tolerances between the cylinder head, camshaft gear and high-pressure fuel pump driving gear which could result in premature failure, followed by a loss of pressure in the “common rail” and an engine shutdown.

⁴ Mandatory Service Bulletin.

An emergency Airworthiness Directive AD 2021-0203-E published by the European Aviation Safety Agency (EASA), applicable on 14 September 2021, adopted MSB-E4-034 and 035.

On 30 November 2021, Austro Engine published MSB-E4-036/1 requiring the inspection and replacement of the driving gear of the high-pressure fuel pump equipping the E4 model engines. It incorporated the requirements of MSB-E4-034 and MSB-E4-035, and prohibited the installation of a certain cylinder head and high-pressure fuel pump driving gear combination.

An emergency Airworthiness Directive AD 2021-0274-E published by EASA, applicable on 13 December 2021, adopted MSB-E4-036.

2.6 Survival aspects

2.6.1 Regulations regarding onboard survival equipment when flying over a stretch of water

Section NCO.IDE.A.175 Flight over water of the European Regulation “Air-Ops”⁵ describes the mandatory onboard equipment when flying over a stretch of water. The Acceptable Means of Compliance AMC1 NCO.IDE.A.180 and AMC25 NCO.IDE.A.180 and the Guidance Material GM2 NCO.IDE.A.180 also give additional details about the emergency locator transmitters, the additional survival equipment and what constitutes a zone in which search and rescue operations would be difficult.

To carry out the Calvi to Cannes flight, the regulations only required that the aircraft be equipped with a sufficient number of life jackets for all the persons on board. This equipment was to be worn or stowed in a position that was readily accessible from the seat of the person for whose use it was provided

Given the coast-to-coast distances and the flight time to reach them, the regulations did not require the presence of equipment for making distress signals, life-saving equipment or life-rafts.

The survival equipment on board F-HRPM on the day of the accident was the following:

- a life jacket for each person on board;
- a knife to cut the seat belts if necessary;
- a life-raft and its bag containing a mirror, a paddle, ropes, an inflator, a hand pump, a small buoy, two Bengal lights with pull cord and a bailer for bailing out water.

2.6.2 Ditching

The recommendations relating to the management of a ditching due to an engine shutdown are specific to each type of aircraft and may be described in certain flight manuals (CIRRUS SR22, SOCATA TB20, CESSNA F 172N, etc.). This is not the case for the DA40 whose flight manual does not contain a ditching procedure.

The Australian Civil Aviation Safety Authority (CASA) issued a [publication](#) about ditching in order to help pilots and light aircraft operators plan and perform this manoeuvre.

⁵ Commission Regulation 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](#)).

It specifies that the chances of surviving a ditching are high and that 88 % of controlled ditchings result in few injuries. There is a greater risk of drowning due to hypothermia and exhaustion. Wearing a life jacket in the aeroplane greatly improves survival prospects.

The French civil aviation safety directorate (DSAC) has also published an article in its magazine, [Objectif SECURITE](#) about ditching in a light aeroplane.

These two documents also provide some advice about survival after ditching, while waiting for the rescue services. In particular, the article by the DSAC indicates that in most cases the aircraft will float long enough for all the occupants to evacuate calmly and that the life-raft should be attached to the aeroplane or a person's wrist, before throwing it into the water otherwise it will quickly be blown away with no hope of getting it back. The experience of F-HRPM shows that an aircraft can sink quickly and that in these conditions, it could drag the life-raft down. In this case, attaching the life-raft to a person's wrist is the best compromise.

2.6.3 Chronology of survival aspects

At 18:05, the instructor sent a Mayday message to the Nice approach controller indicating that they had an engine failure. She heard the controller propose a heading towards Calvi. At 18:06, the controller asked her if the engine was still operating but did not get a reply. The controller then activated a distress phase (DETRESFA⁶). No other radio message from F-HRPM was recorded on the Nice approach frequency. The pilot of the APM 30 registered F-HNIZ, also heading towards Corsica, was about 12 NM ahead of F-HRPM. The pilot proposed to the controller to search for the aeroplane in distress and the controller guided him.

When the DA40 was in descent at an altitude of around 2,000 ft, the instructor decided to prepare for ditching. She did not manually activate the ELT⁷ which was in ARM mode. She asked the passenger to take out the life jackets which were in the back pocket of the pilot's seat, two per bag. After moving the objects taking up space in the cabin, the three persons on board donned the life jackets. The instructor also asked the passenger to open the bag holding the life-raft which was located under the seat, without attaching it to the aeroplane or deploying it. The passenger made room in the rear of the cabin, took the life-raft out of its bag and kept it under his arm. It was the first time that he had opened a life-raft bag.

The instructor searched to no avail, for a ship that she had seen when they were flying to Corsica in order to get close to it. She asked the controller for the position of this vessel but the controller did not receive her message. She tried several other radio frequencies but without success.

Before ditching, the instructor asked the passenger to open his gullwing door. It was immediately torn off by the relative wind. The instructor asked the pilots to get ready to disconnect their headsets just before the impact. At her request, the pilot unlocked the front canopy⁸. At this point,

⁶ On the activation of the DETRESFA phase, the personnel in the Lyon Aeronautical Rescue Coordination Centre (ARCC-Lyon) located the aircraft and initiated a Search And Rescue (SAR) operation. This enabled CROSSMED, in agreement with the Toulon PREMAR, to divert a merchant navy ship and to activate the civil defence and air force helicopters based on Corsica.

⁷ A KANNAD ME406 not associated with a GNSS receiver (SARSAT accuracy of four kilometres indicated in its manual).

⁸ Only the front left seat is equipped with the opening mechanism to lock and unlock the front canopy. The canopy was then opened by tipping it forward.

the altitude was 500 ft. The instructor, although she knew of the existence of a knife under her seat to cut the safety belts if necessary, decided, unlike the pilots, to release her belt as she was afraid of being blocked in the aeroplane after ditching. There was little swell. The aeroplane was in the clean configuration. The speed was around 67 kt and the approaching stall warning sounded.

The contact with the water was described as rough by the persons on board. The aeroplane bounced and then instantly stopped with the wings level. The instructor's head violently struck the instrument panel. She remained conscious but experienced difficulties in breathing normally. The water immediately entered the cockpit up to the waist of the occupants. The two pilots evacuated the aeroplane via the left wing and the instructor via the right wing. The instructor showed the pilots how to inflate their life jackets as they did not know how to do it. The life-raft was inflated. The three occupants jumped into the water and got into the life-raft. A very short time later, the aeroplane tipped forward and rapidly sunk.

None of the three occupants knew that the life-raft was equipped with a tent. They sat on the inflatable frame of the tent preventing it from being deployed. The instructor suffered an injury to her eyebrow bone and had neck pains. The pilots were not injured.

They took stock of the available equipment: the backpack belonging to a pilot with a bottle of water inside, and the contents of the life-raft's survival pack, namely a mirror (not usable at night), a paddle, ropes, an inflator, a hand pump, a small buoy, two Bengal lights with pull cord and a bailer. The latter can be used to bail out a large quantity of water from the life-raft. They started to suffer from the cold. They heard the sound of a leak and realised that air was escaping from a valve on the life-raft. Uncertain about the consequences of this, the pilots decided to take turns putting their hand over the hole to limit the leak, which stopped by itself after about 45 min. In retrospect, they said that this tired them out.

The survivors heard the noise of an engine and saw a small plane. The instructor set off the first Bengal light. At 18:17, i.e. seven minutes after ditching, the pilot of F-HNIZ saw the Bengal light and located the life-raft and its occupants. He informed the Nice controller, confirmed the presence of three people in the life-raft and gave him their GPS position. At 18:23, the pilot set course for Calvi. The survivors were unable to dry off and were getting colder and colder.

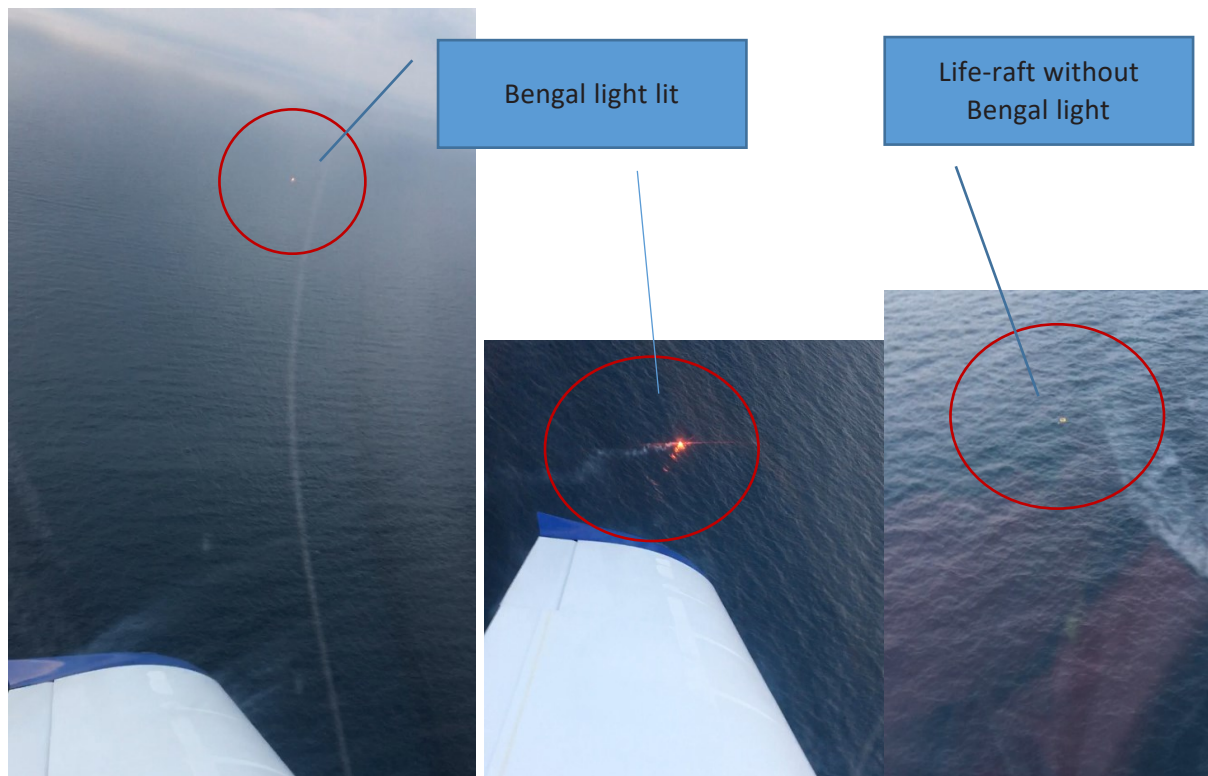


Figure 2: photos from video taken from inside cockpit of F-HNIZ

At around 18:30, a nearby merchant navy ship was diverted by the emergency services and headed to the last reported position of the life-raft.

At around 18:55, at the beginning of the aeronautical night, a Mirage 2000C on operational standby at the Orange airbase arrived at the accident site. The mobile phone of one of the pilots was still operative. It could not pick up a network, making emergency calls impossible. However, the pilot used his telephone to regularly send flashes to the Mirage 2000C. The pilot of this aeroplane who was not equipped with Night Vision Goggles (NVG), spotted the telephone light signals coming from the life-raft when he started a turn. The pilot of the Mirage 2000C believed that without this light signal, it would have been impossible for him to detect the life-raft in the moonless night. The survivors saw the aeroplane which flew low passes and made roll movements to confirm that he had located them. The instructor decided not to use the second Bengal light.

The air leak in the life-raft stopped. The three of them managed to take shelter under the tent without overturning the life-raft. They were then protected from the wind and a little drier after bailing out water. At around 19:15, the Mirage 2000C, at the end of its fuel endurance, left the zone. At the same time, a civil defence helicopter and an air force helicopter took off from Bastia and Solenzara respectively.

The survivors saw a weak light in the distance. The instructor decided to row towards this light both to get closer to it and to warm up. They were suffering from the cold and shivering more and more. For around twenty minutes, the brightness of the light progressively increased before they saw the red and green lights of an aircraft. One of the two pilots in training used the flashlight of his telephone directed towards the lights.

At around 19:40, the civil defence helicopter arrived in the zone of the life-raft. The moonless night and a few mist banks made finding it difficult. The pilot was using NVG and saw the flashes from the telephone. He estimated that the life-raft was at this point around 20 NM from his position. The coordinates of the impact point supplied by the rescue services were confirmed. The instructor ignited the second and last Bengal light when she considered that the helicopter was sufficiently close. The adverse conditions meant that the civil defence helicopter could not safely hoist up the survivors. The helicopter stayed in the zone waiting for the air force helicopter to arrive, the latter being more stable for hoist operations. The occupants of the life-raft saw the helicopter flying around their position but were not certain that they had been located.

At around 20:00, the merchant navy ship and the air force helicopter arrived in the zone. Two divers quickly jumped into the water and swam towards the life-raft. The three occupants of the life-raft were suffering from hypothermia. Given the instructor's injuries, it was decided to rescue the two pilots first and then use a stretcher to hoist up the instructor.

At around 20:45, the three survivors were all on board the helicopter which directly flew to Ajaccio hospital where it landed at 21:30. In the meantime, the merchant navy ship recovered the life-raft.

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

A sudden malfunction, probably in the fuel system, with no prior warning, occurred en route between Corsica and the continent, beyond the gliding distance to reach the coast.

The investigation was not able to determine the cause of the failure of the high-pressure fuel system.

Despite carrying out the checklists for the alert messages displayed and the checklist for restarting the engine, the engine did not restart. The instructor sent a distress message and carried out an emergency landing on water. The three occupants evacuated the aeroplane and took shelter in the life-raft which was on board the aircraft. The aeroplane rapidly sank.

Despite not manually activating the emergency locator transmitter in flight, locating the occupants was facilitated by:

- the controller immediately activating the DETRESFA phase which enabled ARCC-Lyon to locate the aeroplane and quickly engage search and rescue resources;
- the coordination between the air traffic controller on the frequency and the pilot of another aeroplane situated close to the ditching zone;
- the use of the onboard life-raft which can be detected more easily than one or more persons in the water;
- the use of the Bengal light which proved to be a very effective means for the pilot of F-HNIZ to locate the life-raft by day;
- the use, at night, of the mobile phone flashlight and the second Bengal light which enabled the rescue service pilots to detect the survivors in poor search conditions.

The specific first aid and survival training which two of the three occupants had had probably facilitated making decisions and the management of actions in an unknown and particularly stressful situation.

Furthermore, the passenger did not attach the life-raft to the aeroplane and given that the latter rapidly sank, this action did not hinder its use, and slowed the progression of hypothermia experienced by the three occupants.

The three occupants, suffering from hypothermia, were then hoisted on board a helicopter at night, around two hours after ditching.

Safety lessons

Preparation for flight over sea

Carrying survival equipment whether in anticipation of flight over a stretch of water, a desert region or mountainous region for example, is necessary without being sufficient to guarantee the safety of those on board and facilitate their localisation. During flight preparation, several actions will considerably increase the chances of survival on ditching:

- the pilot-in-command holding a before flight briefing with the other aircraft occupants, explaining the procedure to be followed in the event of ditching and how to use each piece of survival equipment. Observing at least once, how the different survival equipment is used will ensure that it is used correctly in a stressful situation;
- each piece of survival equipment being placed in the aircraft so that it is easily accessible and can be used quickly.

Survival equipment

The manual activation of the emergency locator transmitter in the event of a forced landing or ditching, as well as the occupants taking it with them on evacuating, when possible, will facilitate and considerably reduce the search time for the rescue organisations.

In the conditions of the accident flight, the regulations did not require the carriage of a life-raft (see paragraph 2.6.2). Nevertheless, the onboard presence and use of the life-raft was vital for the three occupants. Generally speaking, a person in the water has very little chance of being located by the rescue services and, even if he or she can be located, the risk of hypothermia is high before the rescue services arrive.

A waterproof Personal Locator Beacon associated with a waterproof (PLB) GNSS receiver are also not compulsory equipment items to be carried when flying over bodies of water or regions where search and rescue operations would be particularly difficult. However, they are the only means of locating the occupants in a zone not covered by a mobile phone network⁹.

Locating survivors in a moonless night is very difficult even when using NVG. The presence of a flashlight system incorporated in the life-raft and a sufficiently large number of systems such as Bengal lights or LED flashlights are a key element in the rapid location of survivors.

⁹ [Accident to the Schweizer 269C-1 registered F-HAGO on 12 January 2021 at Bastelica \(Corse-du-Sud\).](#)

Weather and sea conditions can also cause delays in recovering survivors. The possibility of dropping an adapted rescue kit (Lindholme gear) could also considerably increase their chances of survival.

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