BEA
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SAFETY INVESTIGATION REPORT

Serious incident to the Airbus A330-941N registered F-HHUG on 17 January 2022 in transoceanic cruise between Fort-de-France (Martinique) and Paris-Orly (Val-de-Marne)

Time	Around 23:50[1]
Operator	Corsair International
Type of flight	Passenger commercial air transport
Persons on board	Captain, co-pilot[2], 8 cabin crew members, 284 passengers
Consequences and damage	None
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.	

Incapacitation of the captain in climb phase during a transatlantic flight, continuation of flight, second incapacitation en route, diversion

1 HISTORY OF THE FLIGHT

Note: the following information is principally based on the FDR[3], statements, pilot flight files, radio communication recordings, as well as radar data. The data from the cockpit voice recorder (CVR) was not preserved.

The crew were performing flight CRL925 between Fort-de-France – Le Lamentin and Paris-Orly. They knew that Fort-de-France airport would be closing shortly after their take-off due to work. On this ETOPS[4] flight, the planned alternate airports were Antigua airport (Antigua and Barbuda) in the Caribbean, Lajes airport in the Azores (Portugal) and Santiago airport (Spain). Take-off occurred at night, at 23:19. The captain was PF and the co-pilot was PM.

At 23:27, at flight level FL130, in climb to FL380, the PF engaged AP1[5]. The crew then obtained oceanic clearance and contacted the airline's Operations (OPS) service to update the meteorological information. The crew explained to the BEA that, due to a failure of the ACARS on-board printer, they could not obtain weather data updates directly (see para. 2.2) and had to contact the OPS service to do so.

[1] The times in this report are in Coordinated Universal Time (UTC). Four hours should be deducted to obtain the legal time applicable in Fort-de-France, one hour should be deducted to obtain the legal time applicable in Lajes and one hour should be added to obtain the legal time applicable in Metropolitan France on the day of the event.
[2] Or First Officer (FO).
[3] The glossary of acronyms frequently used by the BEA is available on its website.
[4] Extended-range Twin-engine Operations Performance Standards.
[5] The A330 is equipped with two autopilots, AP1 controlled from the left seat and AP2 from the right seat.

The PF explained that he felt tired at this point and wanted to rest for a while. The co-pilot explained that the captain did not inform her of this need for rest and that, as a result, the distribution of PF/PM duties remained unchanged. It was then approximately 23:45 and the aeroplane was close to FL300 at the end of the climb.

At around 23:50, shortly before reaching the cruise altitude, the co-pilot noticed that the captain appeared to be asleep and did not respond when she spoke to him or shook him. After two attempts to wake him up, she used the emergency phraseology to be employed in the event of incapacitation of a flight crew member to summon the chief purser. When the latter entered the cockpit, the captain was coming around; he explained that he was a little tired but fine. The aeroplane was then approximately 200 NM from Fort-de-France.

The chief purser asked questions which the captain answered as expected. She applied moist compresses to his neck and forehead and measured his temperature, blood pressure, blood oxygen level and blood sugar: the results were normal, apart from a low oxygen level (90%)[6].

At 23:55, the co-pilot asked the captain what his intentions were, and he replied that he wished to continue the flight. The chief purser gave oxygen to the captain, who did not understand the commotion around him. The aeroplane reached cruising level FL380. The co-pilot took over the PF duties and engaged AP2.

At 00:10, after a call was made over the PA, one of the cabin crew members informed the chief purser that a passenger was a doctor. The latter, a gastroenterologist, was invited to join the cockpit: after being briefed on the situation, she checked the captain's vital signs, which were normal. She diagnosed a vasovagal episode that required simple monitoring and added that the captain should consult a doctor on arrival. The crew placed the doctor in business class, close to the cockpit, and decided to continue the flight. A cabin crew member remained in the cockpit.

The captain said he wanted to rest in his seat again for a while and asked the co-pilot to wake him up half an hour later.

The co-pilot prepared for a possible diversion. She established radio contact with the OPS service to obtain weather information in Guadeloupe, Martinique and Antigua and Barbuda. She received help from the crew of Corsair flight CRL927 flying from Pointe-à-Pitre (Guadeloupe) to Paris-Orly, which was behind them, to obtain updated weather information for Lajes. The investigation was not able to determine whether the co-pilot mentioned the captain's fainting episode during these initial exchanges with the OPS service and the crew of flight CRL927.

When the co-pilot woke up the captain, he responded normally and then announced that he was going to rest for another 45 minutes. Shortly before 02:00, the co-pilot woke him up again and asked the chief purser and the doctor to come back and examine him: his blood pressure had dropped to 10/6 and his oxygen level to 85%.

The chief purser removed the stripes from the captain's epaulettes. After administering him oxygen, the doctor asked for the captain to be placed in a lying position in the galley, but the latter refused so as not to worry any passengers who might see him; he got up and laid down by himself

[6] If in good health and physical condition, a person will maintain an oxygen level of over 93% up to a cabin altitude of around 10,000 ft. The cabin altitude was 5,000 ft at FL280 and 6,500 ft at FL380.

on the floor at the back of the cockpit. The aeroplane was now roughly equidistant from Fort-de-France and Lajes, around 1,200 NM from both airports.

At around 02:15, the captain's vital signs deteriorated further. The doctor carried out neurological tests and found that the captain was searching for words and showing signs of aphasia[7]. The co-pilot contacted the crew of flight CRL927 to inform them of the situation and ask them for updated weather data for Lajes. In order to release the co-pilot from part of her workload, the crew of flight CRL927 offered to ensure coordination with the OPS service. The co-pilot then calculated the landing performance.

At around 02:30, two neurologists who had not previously been identified among the passengers arrived in the forward galley, where they spoke with the gastroenterologist. At 02:50, the co-pilot asked for a medical report: the gastroenterologist explained that she suspected a stroke[8] and recommended landing as soon as possible. The co-pilot decided to divert the flight to the Azores (Santa Maria or Lajes).

As no pilot of the airline was listed among the passengers, the cabin crew member who had remained in the cockpit volunteered to assist the co-pilot and sat on the left seat. The co-pilot explained to her the approach procedure and her role in reading the checklists.

At 02:52, the co-pilot asked the crew of flight CRL927 for updated weather data for Lajes. She also informed them of her intention to divert there.

At approximately 02:58, the crew of flight CRL927 informed the OPS service that flight CRL925 was diverting to Lajes due to incapacitation of the captain, specifying that, according to the Emergency Medical Services based at Necker hospital[9], it was quite serious ("*d'après Necker c'est assez sérieux*"). The crew of flight CRL927 told the OPS team that there was no point in calling her as they would be acting as a relay ("*c'est pas la peine de l'appeler puisqu'on va servir de relais*"). They then repeated that the Emergency Medical Services based at Necker hospital were probably aware of the situation ("*Necker doit être au courant*").

At 02:59, the co-pilot sent a PAN urgency message via the ACARS system to the Santa Maria controller, informing him of her decision to divert. She applied the Special procedure for in-flight contingencies in oceanic airspace, shifting her flight path 5 NM to the right and descending 500 ft. At the same time, the chief purser informed each cabin crew member individually of the situation.

[7] Language disorder caused by a pathology of the central nervous system.

[8] Also known as CVA (Cerebrovascular accident).

[9] The crew of flight CRL927 were convinced that the diagnosis was made in consultation with the Paris emergency medical services.

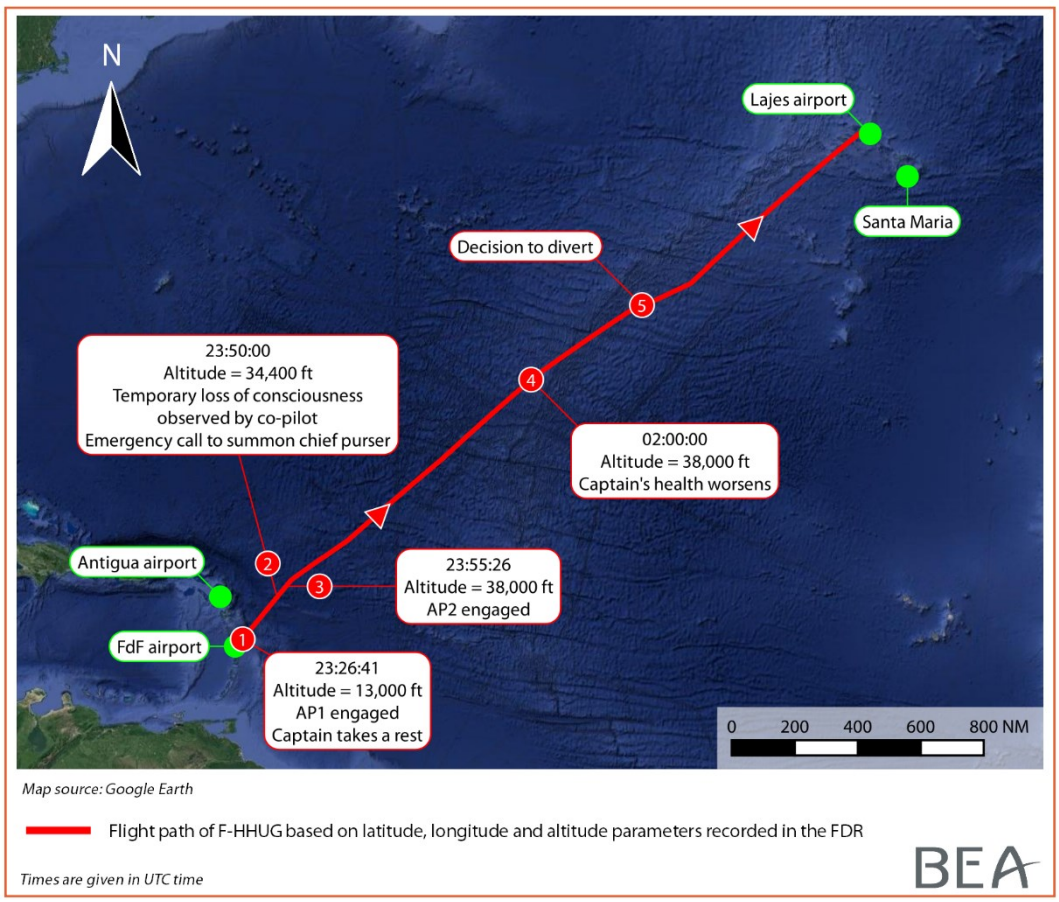

Figure 1: flight path of the flight

At 03:10, the control centre at Santa Maria (Azores) contacted the co-pilot by satellite to ask her to specify her intentions. The latter, unable to remember the English word “stroke”, announced a “*brain bleed*” and declared a MAYDAY emergency situation.

At 03:40, the chief purser made an announcement in the cabin to inform passengers that, following a medical problem on board, the captain had decided to land in the Azores so that the patient could be taken care of by a medical team.

At the same time, the captain got up and settled into the observer’s seat at the rear of the cockpit.

At 04:00, the co-pilot spoke to the passengers to remind them of the decision to divert and announced the start of the descent. She then carried out the approach briefing with the cabin crew member.

After being cleared by the controller for an ILS 15 approach, the co-pilot configured the aeroplane for landing and then went through the landing checklist with the cabin crew member. She landed on runway 15 at Lajes at 04:35 and followed an apron vehicle towards a parking point in a military zone that she reached at 04:42. After the doors opened, the emergency services attended the captain and then took him to hospital, where he remained for several days.

2 ADDITIONAL INFORMATION

2.1 Meteorological conditions

2.1.1 Meteorological information noted before take-off

The last meteorological information at Fort-de-France noted by the crew was the ATIS "L" information, recorded at 22:00, which mentioned wind from 080° of 6 kt, visibility of 10 km, scattered clouds at 2,800 ft and 3,300 ft, a temperature of 25 °C and a QNH of 1014 HPa.

In addition to destination information, the Terminal Area Forecasts (TAF) for Lajes and Santiago were also noted on the flight file.

2.1.2 Meteorological information noted during the flight

The notes in the co-pilot's flight file showed that she obtained the ATIS information for Antigua at midnight, which indicated good weather conditions, and for Lajes at 01:00, where the conditions were more difficult (rain, scattered clouds at 500 ft, broken clouds at 1,400 ft). She also noted the ATIS information for Santa Maria where the conditions were even worse, close to the minima.

Later, after the decision to divert was taken, she noted several times the updated information for Lajes and Santa Maria, where the conditions had not noticeably changed.

2.2 A330 F-HHUG ACARS printer information

The A330 F-HHUG is equipped with an ACARS printer for printing updates of the different flight conditions, including meteorological information.

During the previous flight, the ACARS printer broke down and was listed under the MEL[10]. The pilots explained to the BEA that this failure meant that they had to contact the OPS service by satellite telephone to obtain updated weather information.

When contacted, Airbus explained that it was still possible to read D-ATIS[11] data on the MCDU. For other airports that do not have a D-ATIS, it is also possible to make a request via the ACARS and to receive back, on the MCDU, a text message from the OPS service containing the updated information. This functionality also enables free-text operational information to be shared with the OPS service.

Following the event, Corsair issued a memo to its crews detailing this procedure.

2.3 Crew information

2.3.1 Captain

The 58-year-old captain first had a military career in the naval air force from 1987 to 1997. He held an Airline Transport Pilot Licence (ATPL) issued in 2001, along with A320 and A330 type ratings issued in 2001 as well as an A320 simulator instructor rating issued in 2004 and an A330 simulator instructor rating issued in 2010.

[10] Minimum Equipment List.

[11] Digital Automatic Terminal Information Service.

He then became a co-pilot for several air operators, including Corsair International on the Boeing 747 and then the A330. He became captain on the A330 in June 2020. At the time of the incident, he had logged approximately 16,000 flight hours.

2.3.2 Co-pilot

The 40-year-old co-pilot held an Airline Transport Pilot Licence (ATPL) issued in 2008, along with an A320 type rating issued in 2006 and an A330 type rating issued in 2019, as well as an A320 simulator instructor rating issued in 2012. She flew as a co-pilot for several air operators on the A320 from 2006 to 2012, then on the A330 from 2012 to 2019.

After the lockdown period due to the COVID-19 health crisis, she joined Corsair in May 2021. At the time of the incident, she had logged 9,300 flight hours.

2.3.3 Chief purser

The chief purser had been a cabin crew member at Corsair since 1996. She became chief purser on 01 January 2022 and was carrying out her second rotation in this position at the time of the incident flight.

2.3.4 Cabin crew member in the cockpit

The cabin crew member who assisted the co-pilot had been a Corsair cabin crew member since 2001. She had no pilot experience.

2.4 Statements

2.4.1 Captain

The captain explained that the weeks leading up to the incident were difficult, with a busy schedule since the resumption of flights following the COVID-19 health crisis. He had been feeling unusually tired for several days.

Living in Toulouse, he was in the habit of travelling to Paris the day before his flights. On the outbound flight from Paris-Orly to Fort-de-France, the co-pilot was PF and the flight took place without any particular difficulty. In Fort-de-France, the crew had a 48-hour rest period, longer than usual and giving them enough time to recover from the fatigue of the outbound flight. The captain explained that during this period, he was unable to sleep properly and rarely left his room. He felt tired and had a bit of a headache. However, at no time did he consider that his state of health might not be compatible with the flight.

He explained that the take-off on the return flight was normal and that he flew manually up to around 10,000/12,000 ft, as he usually did. He knew that Fort-de-France airport would be closed after their take-off due to work.

He indicated that he told the co-pilot he felt tired and was going to rest for a while, but he did not remember falling asleep or being woken up. He was very surprised to see the chief purser beside him, asking if everything was all right. At this point, he was completely unaware that he had lost consciousness.

When the doctor examined him, the co-pilot asked him how they should proceed ("*on fait quoi ?*") to which he answered without hesitation that they should go on ("*on continue*").

He had no memory of what happened next until he left his seat to lie down at the back of the cockpit. He then took the observer's seat. He was reassured to see this cabin crew member, whom he knew well, sit in his seat to help the co-pilot, because he knew he could count on her. He then had an intermittent situational awareness and did not understand that the flight was diverted. He remembered being taken care of by the medical services after the landing, but had no memory between his transfer to hospital and the following day.

2.4.2 Co-pilot

The co-pilot had already flown with the captain and got on well with him. On the outbound flight, his behaviour seemed perfectly normal. Nor did she detect anything unusual in their discussions as they left the hotel or during the pre-flight briefing on the shuttle bus to the airport.

During the climb, the captain appeared to be asleep. She specified that he did not tell her that he needed to rest. She shook him and thought he was not reacting as a joke. During the second attempt to make the captain regain consciousness, as he did not react, she immediately used the emergency phraseology: the chief purser arrived very quickly, while the captain was coming around.

She immediately considered turning around and asked about the weather conditions for Fort-de-France and Pointe-à-Pitre. She explained that at this point, the captain had fully regained consciousness and was saying that everything was fine, that he was just a little tired.

The co-pilot specified that when a doctor examined him, she did not seem worried, saying it was simply a vasovagal episode.

The captain's rapid recovery, his confidence and the doctor's reassuring diagnosis reinforced the co-pilot's decision to follow the captain's decision to continue the flight after this initial episode, without calling into question his fitness to carry out his duties as captain.

After waking up again half an hour later, the captain's behaviour seemed normal and consistent.

It was only when he subsequently woke up, following a further rest of around 45 minutes, that his vital signs had deteriorated noticeably. The co-pilot then prepared for a possible diversion and decided to do so when the doctor indicated that it might be a stroke requiring a landing as soon as possible. Lajes airport was the planned alternate airport for the flight; the co-pilot did not choose it based on its medical care resources, as she had no information about these.

The co-pilot explained that she held a briefing with the cabin crew member seated in the left-hand seat to explain to her how to go through the different checklists. According to the co-pilot, this enabled the procedures to be completed as naturally as possible.

The co-pilot added that she knew very quickly that the situation in the cabin was under control, which helped to ease her mind. The presence of a cabin crew member in the cockpit for most of the flight also relieved her, and assured her that she would be able to get help at any time if she needed it.

She knew that she could call the Emergency Medical Services, but did not do so, since a doctor was on board. She specified that in her mind, calling the Emergency Medical Services was only justified when no doctor was identified on board.

She explained that after leaving his seat, the captain took part in the conduct of the flight episodically, with a degraded level of consciousness and elocution. During taxiing after landing at Lajes, he told her not to forget to switch on the APU BLEED, but he also said he was surprised not to recognise the Orly taxiways.

She added that the ACARS printer failure added a substantial workload: she could not obtain any weather data updates other than by radio relay with the OPS service or with flight CRL927 that was flying behind them.

2.4.3 Chief purser

The chief purser explained that she saw the captain on several occasions during the stop at Fort-de-France and that he told her he had slept badly and had not managed to take a nap in the afternoon before the flight.

When she heard the emergency phraseology, she immediately went to the cockpit where she saw the captain in an unusual position: curled up in his seat, with his head bent forward but his eyes open. While she applied moist compresses, she asked him a number of questions to check his state of consciousness and his reactions, and to which he answered correctly.

Later, when the captain's incapacitation became apparent and he left his seat, she acted as the interface between the doctors and the co-pilot. When the doctors considered that it was necessary to land as soon as possible, she passed on the information to the co-pilot. She then went on to inform the different cabin crew members.

She explained that she had already encountered in-flight medical emergencies, but that these had always involved passengers, never crew members.

She added that, in her mind, the procedure was to check whether a doctor was on board and to contact the Emergency Medical Services only if there was no doctor among the passengers.

2.4.4 Cabin crew member in the cockpit

The cabin crew member explained that she knew the captain and had already flown with him, but that she did not know the co-pilot. During the incident flight, she was in the forward galley with the chief purser. When she heard the emergency phraseology, she helped the chief purser, providing her with moist compresses.

After the captain's first loss of consciousness, she did not identify any signs suggestive of a stroke such as those described in the Safety and Rescue Manual (*Manuel Sécurité Sauvetage* section 8.5.7, see para. 2.6.10).

After she took a seat in the cockpit, the co-pilot explained to her how to go through the checklists using a dedicated tablet, something she had never done before. She specified that during the checklists, the co-pilot appeared calm.

2.4.5 Doctor

The gastroenterologist identified herself when the chief purser asked for a doctor over the PA. She specified that she had no knowledge of aeronautics and was unfamiliar with multi-crew cooperation in an aeroplane.

When she entered the cockpit for the first time, the captain seemed to have slow reactions, but was recovering. The signs she observed led her to think of a vasovagal episode.

It was only when she returned a second time that she noticed that his vital signs had deteriorated and that the captain had speech difficulties. It was then that she suspected a stroke or TIA[12] (see para. 2.5.1) and discussed it with other doctors on board. Following these discussions, she considered that the captain needed to receive care as quickly as possible.

She added that she examined the captain in the same way as if he had been a passenger: she focused on providing him with medical assistance without taking into account his position as a pilot and the possible impacts on flight safety, with which she was not familiar.

2.5 Medical information

2.5.1 Cerebrovascular accident (CVA) and transient ischaemic attack (TIA)

CVA (also known as a stroke) is a pathological condition that can lead to death or to serious and often irreversible neurological damage[13]. A stroke must be considered an absolute medical emergency. TIA is just as serious.

There are many signs of a stroke, not all of which are systematically present: fainting episodes, headaches, nausea, hot flushes, vomiting, weakness or numbness, loss of balance, neurological signs, impaired vision, slurred speech, paralysis of limbs or face, unexplained behaviour, often high blood pressure. These symptoms are not specific to a stroke: identifying them can allow a stroke to be suspected, but not diagnosed.

A TIA may present similar symptoms which disappear within a few minutes. The urgency and need for appropriate assistance are the same, because the risk of having a stroke in the short term is high.

In the event of a suspected stroke or TIA, rapid medical assistance considerably improves the chances of survival and recovery.

[12] Transient ischaemic attack.

[13] A stroke can be haemorrhagic (15% of cases), where a bleeding vessel causes compression of the brain in the skull) or ischaemic (cerebral infarction, 85% of cases, where a blocked vessel causes a lack of oxygen to part of the brain).

2.5.2 Pilot fainting episode information

The investigation did not identify any medical history or current treatment for the captain.

Before the flight and for several days, the captain suffered a marked state of fatigue. He spent most of the stopover at Fort-de-France resting in his hotel room, where he suffered from headaches. It was not possible to determine whether there were any fainting episodes of which he was unaware during this rest period or prior to the rotation.

The first signs of fainting were formally identified by the co-pilot at approximately 23:50, about half an hour after take-off from Fort-de-France, when the captain lost consciousness and did not respond to the co-pilot's calls. After this initial loss of consciousness, the cabin crew members and the doctor did not identify any symptoms of a stroke. The return to an apparently normal state of consciousness did not make them consider any life-threatening situation, and the low level of oxygen in the blood did not constitute a warning. This return to an apparently normal state, together with the doctor's reassuring diagnosis, did not make the co-pilot question the captain's fitness to carry out his duties.

After two further rests, his vital signs continued to deteriorate and speech difficulties developed, forcing the captain to lay down on the floor behind the cockpit. The suspicion of a stroke was raised at around 02:50, i.e. three hours after the first fainting episode was identified.

Emergency services attended the captain at around 04:45, i.e. almost five hours after the first fainting episode was observed[14].

The tests carried out during the captain's hospitalisation did not reveal any evidence of a stroke. A TIA without after-effects was suspected.

2.6 Operator's procedures

The Corsair Operations Manual comprises various sections, including Part A, which is mainly intended for flight crew, and the Safety and Rescue Manual, which is intended for all crew members.

2.6.1 Part A, section 1.5.1: Responsibilities of each crew member

This section focuses on the self-assessment of crew members' health, without providing any precise criteria for this self-assessment. In particular, it specifies that crew members must not perform duties on an aeroplane if they know that they are tired or consider that they are tired, or if their state of unwellness is such that the flight could be endangered.

2.6.2 Part A, section 8.3.2.1: Standard procedures Division of tasks - General - Safety rules

The standard procedures describe the principles for ensuring flight safety, setting out that pilots must be well enough to carry out their respective duties in order to deal with any abnormal situation.

[14] Particularly in the case of an ischaemic stroke, which accounts for 85% of cases, the injection of a drug to dissolve the clot must be carried out within 4 hours and 30 minutes of the onset of the stroke.

The section relating to coordination and mutual monitoring specifies that, with the exception of periods of flight when a flight crew member takes a short rest, flight crew members must complement and monitor each other to ensure flight safety.

This section also defines a short rest on board with a non-augmented crew operating: If a flight crew member feels the need to take a rest in flight, this will be considered under the following conditions:

- captain's agreement;
- rest is taken at the crew member's station;
- rest can only be considered en route;
- the rest period will not exceed 40 minutes;
- a cabin crew member will enter the cockpit or contact it over the intercom system every 30 minutes on day flights and every 20 minutes on night flights.

2.6.3 Part A, section 4.3.1 and Safety and Rescue Manual, section 4.3.1: Transmission of command rules in the event of physical incapacitation of the flight crew

The wording for this section is identical in the Operations Manual and in the Safety and Rescue Manual. In the event of incapacitation of the captain, it specifies that his duties are transferred to the co-pilot seated on the right when the crew does not comprise two captains.

Part A, section 4.3.1 of the Operations Manual refers to Part A, section 8.3.14 for instructions and procedures in the event of incapacitation of a flight crew member.

2.6.4 Part A, section 8.3.14.1: Physical incapacitation of a flight crew member in flight

The preamble to this section states that the partial or total incapacitation of a flight crew member is an emergency situation.

It describes methods to detect a partial or total incapacitation: apart from obvious cases, the following anomalies must make the observer consider a physical incapacitation:

- after a deviation from normal procedures or from the standard flight profile has been observed, the deviation is called out without any appropriate reaction;
- general behaviour is abnormal;
- no correct answer to two obvious questions.

It provides a procedure to be applied by the able-bodied flight crew member(s): In the event of partial or total incapacitation of flight crew members, the able-bodied crew member(s) will ensure flight safety by reorganising the cockpit as follows:

- first and foremost, control the aeroplane's speed and path (autopilot, autothrottle);
- secure the incapacitated crew members in their seat using the harnesses (no interference with the flight controls) or evacuate them to the cabin with the help of the cabin crew;
- if available, provide in-cabin medical assistance;
- alert the control centre (emergency message and medical assistance);
- contact the Emergency Medical Services based at NECKER hospital via SATCOM;
- land at the most suitable aerodrome.

Unlike the Safety and Rescue Manual, coordination with cabin crew using the emergency phraseology and the possible assistance of a cabin crew member in the cockpit are not addressed in this section.

Also unlike the Safety and Rescue Manual, this section of Part A of the Operations Manual calls for the Emergency Medical Services to be contacted systematically, even in the event of a partial incapacitation, and for the aeroplane to land at the most appropriate aerodrome.

2.6.5 Safety and Rescue Manual, section 15.2.8: Emergency procedures - Flight crew incapacitation

This section describes the emergency procedures in the event of one of the flight crew members becoming incapacitated in flight. The Safety and Rescue Manual specifies that in the event of one of the pilots becoming incapacitated, the able-bodied flight crew member will warn the cabin crew members using the emergency phraseology "*Ici le poste de pilotage, chef de cabine au poste*" (This is the cockpit, chief purser to the cockpit). The chief purser (or purser) must go immediately to the cockpit while the other cabin crew members stow and secure the food service equipment and return to their stations.

Generally speaking, this section is intended for cabin crew members and in particular for chief pursers/pursers. The procedure is different from the one described in Part A, section 8.3.14.1. The chief purser/purser must:

- take charge of the incapacitated flight crew member;
- secure the incapacitated flight crew member in their seat using harnesses;
- tilt the seat of the flight crew member;
- if the incapacitated flight crew member is removed from their seat, open the cockpit door;
- if necessary, evacuate the flight crew member (removed from seat) to the cabin with the help of a cabin crew member;
- remove the stripes;
- provide first aid;
- call for any doctors present to make themselves known.

The wording of this section differs from that of Part A, section 8.3.14.1. For example, it does not describe methods to detect and characterise a partial or total incapacitation.

A note specifies that a cabin crew member may be asked to assist the able-bodied flight crew member in the cockpit at their request (reading out checklist etc.). Although this is not mentioned in the Safety and Rescue Manual, the training provided by the operator to cabin crew members recommends that, in this case, the cabin crew member with the least cabin crew experience should be designated to assist the able-bodied flight crew member.

During annual training sessions for cabin crew members, the case of an incapacitated flight crew member is systematically recalled using an educational video. This old video shows procedures and tools applicable to the Boeing 747, a type of aeroplane that has not been in service with Corsair for several years. It also does not show recent tools that have been made available to cabin crew members in the meantime.

This part of the Safety and Rescue Manual recommends calling upon a doctor on board, but does not mention calling the emergency medical services, in contrast to Part A, section 8.3.14.1.

2.6.6 Safety and Rescue Manual, section 8.2.1: Requesting in-flight medical assistance

This section of the Safety and Rescue Manual deals essentially, and implicitly, with a medical emergency situation affecting a passenger. It reminds the crew that after an initial analysis, they must request the assistance of a doctor who may be on board and, in the event of a life-threatening emergency, also call the emergency medical services.

The crew has an emergency line to contact the Paris emergency medical services, which traditionally handles medical dispatch requests for French aircraft: in the event of a life-threatening problem, the Paris emergency medical services must always be called in addition to the doctor.

This section of the Safety and Rescue Manual also specifies the role of the emergency medical services as being the optimisation of remote medical assistance through the help and advice of experts.

The emergency medical services are able to:

- respond to all requests for advice;
- help organise ground assistance[15];
- the advice given by the Emergency Medical Services is considered to be objective information on which the captain shall base his decision;
- emergency medical services communications are recorded and have a medico-legal value in the event of a problem.

2.6.7 Safety and Rescue Manual, section 8.3.6: First-aid equipment - diagnostic kit

Section 8.3 details the first-aid equipment available to the crew, including a blood pressure meter and a pulse oximeter. It states that the O2 saturation standard values on the ground for a person in good health are between 100% and around 97%. At 2,400 m (7,500 ft, average cabin altitude) the saturation rate may reasonably fall from 96% to 93%. In the event of a fainting episode and low SpO2, oxygen must be provided as a supplement, and any doctors present must be called on.

At FL280, after the captain's first loss of consciousness, when his oxygen level was measured at 90%, the cabin altitude was 5,000 ft. It was 6,500 ft en route at FL380 when the captain's oxygen level was measured at 85%.

2.6.8 Safety and Rescue Manual, section 8.4.3: Loss of consciousness

The Safety and Rescue Manual describes the signs of unconsciousness as being when the victim does not respond or react normally to simple questions and commands, but is still breathing.

It specifies that this is a life-threatening situation and that the Paris Emergency Medical Services must always be alerted in addition to the call for a doctor, to assist and advise the crew during a life-threatening situation. The airline's Operations service should also be informed of any life-threatening situation on board.

[15] In particular, the emergency medical services have up-to-date information regarding medical care resources based on the patient's pathology and possible destinations.

2.6.9 Safety and Rescue Manual, section 8.5.2: Fainting episodes

Fainting episodes are described in this section of the Safety and Rescue Manual as events occurring frequently on board, in particular, vasovagal episodes, which often occur in young, healthy people, for which recovery is almost immediate.

This section of the Safety and Rescue Manual does not associate fainting episodes with an immediate life-threatening situation. In particular, it does not explicitly state how to distinguish between a loss of consciousness (requiring the Emergency Medical Services to be called) and a fainting episode, nor does it make a distinction when the fainting episode affects one of the flight crew members.

2.6.10 Safety and Rescue Manual, section 8.5.7: Cerebrovascular accident

This section of the Safety and Rescue Manual specifies that a stroke may occur at any age, resulting in severe physical and mental disabilities and irreversible neurological after-effects. Mortality after one year is 40%.

The Safety and Rescue Manual uses the FAST[16] method to detect a possible stroke and describes the most frequent symptoms. It specifies that a stroke should be suspected if at least one of these symptoms appears, and that this will be a life-threatening situation requiring a doctor and the Emergency Medical Services to be called. Diversion may be considered after contacting the Emergency Medical Services and obtaining the agreement of the captain.

2.6.11 Part A, section 2.4.1: Irregularities - choice of diversion airport

This section specifies that when it is operationally possible to choose between several airports in the event of a diversion, the captain must take into account the conditions for troubleshooting, re-routing of passengers, accommodation, etc.

Generally speaking, the operator's documentation does not characterise airports based on medical care resources available at the site.

2.7 Manual of Civil Aviation Medicine - Part I, Chapter 3 Flight crew incapacitation

The Manual of Civil Aviation Medicine is published by the International Civil Aviation Organization (ICAO), under reference Doc 8984.

Chapter 3 of Part I sets out the principles of in-flight management of crew incapacitation. Incapacitation is defined operationally as "*any physiological or psychological state or situation that adversely affects performance*".

Representations of incapacitation most often refer to a sudden phenomenon that visibly affects the relevant personnel. However, paragraph 3.1.21 states that they may appear as "*subtle incapacitations [...] frequently partial in nature* [that] *can be insidious because the affected pilot may look well and continue to operate but at a less than optimum level of performance. The pilot may not be aware of the problem or capable of rationally evaluating it.*"

[16] Face (facial paralysis), Arms (limb paralysis), Speech (language impairment), Time (life-threatening situation and time factor, so quick response required).

In concluding the chapter, the document stresses that "*In-flight pilot incapacitation is a safety hazard and is known to have caused accidents. [...] Incapacitation can occur in many forms, ranging from sudden death to a not easily detectable partial loss of function, and has occurred in all pilot age groups and during all phases of flight. [...] Instruction and training of flight crew concerning action in the event of in-flight pilot incapacitation should include early recognition of incapacitation as well as the appropriate action to be taken by other flight crew members.*" [17]

3 CONCLUSIONS

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

3.1 Scenario

During a night transatlantic flight between Fort-de-France and Paris-Orly, the captain felt tired at the end of the climb and lost consciousness shortly afterwards. A few minutes later, the co-pilot noticed that the captain was not responding to her questions. After two attempts to wake him up, she called in the chief purser, using the emergency phraseology to be employed in the event of incapacitation of one of the flight crew members. The chief purser arrived while the captain was gradually coming around.

An initial analysis by the chief purser led the crew to call in a doctor who was among the passengers and who diagnosed a simple vasovagal episode.

After approximately two hours and several successive rests, the captain's state of health deteriorated further while the aeroplane was in the middle of the Atlantic, roughly equidistant from Fort-de-France and the Azores archipelago.

When the doctor suspected a stroke and informed the co-pilot, the latter reassigned roles within the crew and decided on an emergency diversion to Lajes (Azores). Even though the hospitalisation facility at destination proved to be adequate, this criterion was not part of the decision-making process, as the co-pilot did not have this information.
The co-pilot landed at Lajes, where the captain was taken care of and hospitalised for several days.

3.2 Contributing factors

3.2.1 Captain's state of health before the flight and decision to undertake the flight

The captain had been feeling tired for several days. During the rest period in Fort-de-France, he was unable to recuperate and mentioned having headaches. It is likely that his state of health had already deteriorated before the flight, and it is even possible that he had already suffered a fainting episode of which he was not aware.

At no time did he consider that his state of health might not be compatible with the flight.

This illustrates the insidious nature of a subtle incapacitation and the difficulty crew members may have in self-assessing their own state of health when faced with the responsibility of not being able to fulfil their mission.

[17] In February 2011, the BEA published an Incidents in Air Transport bulletin (ITA no. 12) covering flight crew incapacitation.

3.2.2 Decision to continue the flight

When the captain first lost consciousness, the co-pilot questioned whether the flight should continue and asked the captain what his intentions were. The captain's fitness to perform his duties was not called into question, there was no transfer of responsibility and the captain took the decision to continue the flight. The co-pilot did not object on a number of grounds:

- the captain had come around and was behaving normally;
- the captain was adamant that he could continue the flight;
- by referring to the Safety and Rescue Manual, the cabin crew did not associate the symptoms observed with a life-threatening situation;
- the doctor on board associated the symptoms initially observed with a probable vasovagal episode: her diagnosis was reassuring.

The initial lack of reaction from the captain when the co-pilot tried to wake him up was not considered a sufficient warning sign to declare him incapacitated, nor were the two subsequent requests for rest.

This illustrates the difficulty in identifying and confirming a partial or temporary incapacitation and, consequently, in deciding on the transfer of the captain's duties as provided for in the operators' procedures.

3.2.3 Situational awareness of the OPS service

Communications between the co-pilot and the OPS service were handled by the crew of flight CRL927. These communication recordings revealed that the crew of flight CRL927 were convinced that the diagnosis was made in consultation with the Emergency Medical Services and passed on this erroneous information to the OPS service, who no longer had direct contact with the co-pilot.

While this relay relieved the co-pilot of her workload, it reduced the situational awareness of the OPS service, who did not suggest that the co-pilot contact the Emergency Medical Services.

3.2.4 Co-pilot workload management

The cabin crew's cohesion and calm helped the co-pilot in her management of the flight. In particular, the chief purser and the cabin crew member in the cockpit effectively assisted her during the flight, while the rest of the crew was maintaining a calm situation in the cabin.

Conversely, the failure of the ACARS printer overloaded the co-pilot in managing the diversion. She explained that, in particular, she was unable to obtain updated meteorological information directly and had to rely on a relay to obtain it.

3.3 Safety lessons

Crew's use of the Emergency Medical Services' advice

When faced with an in-flight medical problem, crews, particularly on commercial flights, are trained to apply procedures designed to establish first and foremost the severity of the emergency and whether there is a life-threatening risk for the affected person, whether that person is a passenger or a crew member.

In the event of the incapacitation of a flight crew member, in addition to the life-threatening risk to the affected person, there are specific aspects associated with their position as pilot and the possible impacts on flight safety for all those on board. The impacts on the able-bodied flight crew can be significant, particularly when it comes to managing an abnormal situation such as a failure or degraded weather conditions. Doctors on board are unaware of these factors and cannot take them into account when making their diagnosis and deciding what action to take.

Section 8.3.14.1 of Part A of Corsair's operations manual specifies that in the event of physical incapacitation, even partial, of one of the flight crew members, the Emergency Medical Services should be contacted. This requirement does not appear in the Safety and Rescue Manual, which only recommends calling the Emergency Medical Services in the event of a life-threatening emergency, without making a distinction when the patient is a flight crew member.

Identifying and confirming the captain's incapacitation was made difficult due to the non-obvious symptoms and his return to a normal state of consciousness after the first loss of consciousness. The co-pilot knew that she could seek advice from the Emergency Medical Services, but did not consider it, thinking that it was only justified when no doctor was identified on board.

Following the captain's first loss of consciousness, which could be likened to falling asleep, the co-pilot did not consider that the captain was in fact no longer capable of assessing his own fitness and ability to continue the flight. Without calling into question the appropriateness of calling for a doctor on board, contact with the Emergency Medical Services could have optimised remote medical care. These services would have provided the co-pilot with objective assistance to help her make her decision from the first loss of consciousness. Having no contact with the Emergency Medical Services, she could only rely on subjective opinions:

- that of the captain, who was not fully aware of the situation;
- that of the doctor, who was reassuring after the first loss of consciousness, but was not an emergency medicine specialist, had no knowledge of aeronautics and could not take into account the operational consequences of the captain's loss of consciousness;
- those of the chief purser and the cabin crew member, who did not recognise the symptoms of a stroke as described in the Safety and Rescue Manual, the latter initially pointing to a simple fainting episode with no associated life-threatening risk.

Consideration given to medical care resources in the event of a diversion

Lajes airport was one of the planned alternate airports. Although it does have the appropriate medical care resources, the co-pilot did not have this information and the diversion to Lajes was not chosen for these reasons.

Calling the Emergency Medical Services could have given the co-pilot this information to make her decision. This information could also have been included in the operator's documentation.

By way of comparison, Air France has an in-flight medical event management programme running since 2021. One of the stated aims is to provide practical information to help crews make decisions, while avoiding unnecessary medical diversions.

In the event of a medical event on board an Air France flight, the crew contact the Operations Control Centre (CCO), which then contacts the Emergency Medical Services to establish three-way communication. The role of the Emergency Medical Services is then to establish the medical diagnosis and identify situations requiring a diversion.

At the same time, the documentation available to Air France crews ("*Manuel Statut Aérodromes*") includes information about the medical care resources at the reachable sites and the optimum operational strategy identified by the CCO. This common mapping made available to the crew and the CCO means time is saved in developing a shared strategy. The associated operating principles are set out in Parts A and C of the Operations Manual.

The "medical support" airports are validated collectively by the Emergency Medical Services, the Air France medical service and its stop-over stations. The process is updated twice a year.

At the same time, Air France has set up the "Community of Doctors" programme. Doctors are pre-selected according to their medical qualifications (emergency doctor, anaesthetists, etc.) to respond to the most common in-flight emergencies. Their presence on board is indicated to the crew in the passenger list. These doctors have undergone training to define their role:

- the captain is solely responsible for ensuring flight safety and takes all decisions;
- he has higher authority than any medical authority on board;
- in practice, the captain's decision usually takes into account the opinion of the "volunteer" passenger doctor requested by the crew;
- the doctor's legal position is covered by the company's civil liability insurance in the same way as its own employees.

The presence of one of these doctors on board does not dispense with the need to call the Emergency Medical Services.

During the incident flight, having such a map of medical support airports might have helped the co-pilot in her decision to divert, by not basing her decision solely on the initially selected alternate airports.

3.4 Measures taken by Corsair

Corsair has taken a number of measures following this serious incident.

- Parts 8 and 15 of the Safety and Rescue Manual have been amended to specify that in the event of partial or total incapacitation, or if there is any doubt as to the nature of the incapacitation of a crew member on board, the call to the Emergency Medical Services via SATCOM must be made by the flight crew, even if a doctor is on board. This update details the role of the Emergency Medical Services as a complement to the call for a possible doctor on board, while specifying the roles of each of them;
- An emergency medical sheet ("*Fiche Médicale d'Urgence*") has been drawn up and attached to each emergency medical kit and to the Automated External Defibrillators (AED) equipping the aeroplane. It must be used by the cabin crew members or the doctor on board to collect the information before the call, that will enable the Emergency Medical Services to assess the situation;

- An internal communication was also drawn up to raise awareness among Corsair crews regarding the incapacitation of a flight crew member and the mandatory nature of a call to the Emergency Medical Services, even in cases where a doctor has been identified on board;
- Corsair informed the BEA that the subject is now discussed in detail during common Human Factors training courses for flight crew and cabin crew.

Finally, other medical requirements are under discussion within the airline's flight safety committee, particularly with regard to crew training or medical resources at the different destinations.

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