



**Accident** to the De Havilland DHC-6 400 “Twin Otter”  
registered **F-OMYS**  
operated by CAIRE  
on Thursday 24 August 2023  
at Saint-Barthélemy airport

<b>Time</b>	15:40 <sup>1</sup>
<b>Type of flight</b>	Passenger commercial air transport
<b>Persons on board</b>	Captain (PF <sup>2</sup> ), co-pilot (PM), 6 passengers
<b>Consequences and damage</b>	Two persons slightly injured, aeroplane substantially damaged

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.

**Runway veer-off on landing, collision with a parked helicopter**

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<sup>1</sup> Except where otherwise indicated, the times in this report are in Coordinated Universal Time (UTC). Four hours should be subtracted to obtain the local time on the day of the event.

<sup>2</sup> The glossary of abbreviations and acronyms frequently used by the BEA can be found on its [web site](#).

## 1 HISTORY OF THE FLIGHT

*Note: the following information is principally based on the CVR and FDR, security camera footage and statements.*

After carrying out a first rotation between Pointe-à-Pitre - Le Raizet (Guadeloupe) and Saint-Barthélemy airports, the crew took off at 14:47 bound for Saint-Barthélemy for the second rotation.

The cruise level FL080 was reached after a flight time of seven minutes. During the cruise, after updating and analysing the weather information for the destination airport, the crew chose runway 28 for landing.

At 15:26, the crew started the descent.

At 15:37, realising that the aeroplane was too high on approaching point "COCO"<sup>3</sup>, the captain decided to carry out a three sixty to lose altitude. The crew selected flaps 10° and positioned the propeller pitch lever to MAX. During the turn, the captain felt a pain in his left ear and informed the co-pilot of this. The crew selected flaps 37°.

At 15:40:21, at the end of the turn, at around 1,000 ft<sup>4</sup>, the captain still had ear pains. Unable to clear his eardrum, the captain transferred the controls to the co-pilot so that he could blow his nose and perform the Valsalva manoeuvre. During this phase, the captain asked for the before landing checklist. The checklist was read out by the co-pilot and the captain replied to him. A few seconds after the end of the checklist, the captain's eardrum suddenly cleared and he took back the controls.

At 15:41:18, a "CAUTION TERRAIN" alert was transmitted by the TAWS, immediately followed by a "TERRAIN PULL UP" warning. As they had sight of the ground and realising that they had forgotten to inhibit the TERRAIN alerts<sup>5</sup>, the captain called out to disregard the warnings and asked the co-pilot to activate their inhibition.

During the last turn, at around 190 ft, while the captain was reducing the pitch attitude to adjust the interception of the slope, the "SINK RATE" alert was activated.

At 15:42:22, when the wheels touched down on the runway, the crew heard a squeal of tyres and observed that the aeroplane was veering to the left. Thinking that he may have incorrectly positioned his feet, the captain adjusted their position to ensure that they were not on the brakes and then made an input on the right-hand pedal. The aeroplane continued to veer to the left. The captain then suspected that the left-hand wheel had locked and applied pressure to the brakes in the hope that this would release the left-hand brake. He also tried to correct the path by maintaining pressure on the right-hand pedal and turning the control wheel to the right. Observing that they were reaching the edge of the runway, he decided to use the reverse thrust. It seemed to him that this attenuated the aeroplane's tendency to veer to the left, but that it was not sufficient

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<sup>3</sup> "COCO" is a position reporting point which geographically corresponds to the island of Coco, and to the start of the base leg to land on runway 28. The altitude for passing this point for the arrival is 1,000 ft.

<sup>4</sup> Unless otherwise stated, the altitudes indicated in this report are the altitudes with the QNH setting.

<sup>5</sup> In part C of the operator's manual, it is indicated to activate the "TERRAIN INHIB" mode for the arrival on runway 28 at SBH.

to correct the phenomenon. The aeroplane then ran over the runway's grass shoulder. It struck the sign indicating the junction with taxiway C. The captain then decided to use the nose wheel lever by pushing it with all his force to turn right.



Figure 1: path

The left-hand wing of the aeroplane struck an AS350 helicopter parked on stand H1. The aeroplane pivoted violently and then came to a halt.



Figure 2: position of aircraft after accident (source: Gendarmerie)

After taking a moment to collect his thoughts, and noticing that the passengers were getting up, the captain ordered them to remain seated using the public address (PA) system. As the passengers did not appear to obey his first announcement, he raised his voice to ensure that they complied with his instructions. Seeing no warning, the captain visually checked outside by opening his door and observed no fire. However, seeing smoke, which he attributed to oil leaking onto hot parts of the engine, he decided to evacuate the aircraft and asked the co-pilot to carry out the evacuation procedure.

The AFIS officer informed the crew by radio that the fire fighting service (ARFF) had been alerted.

When the co-pilot had shut down the engines and reached the stage of the evacuation procedure where the actual evacuation of the aircraft's occupants was to begin, the captain instructed him to proceed with the evacuation via the rear right-hand door only.

The captain informed the ARFF officer approaching the aircraft that the evacuation would take place via the rear right-hand door of the aircraft.

## **2 ADDITIONAL INFORMATION**

### **2.1 Aircraft information**

#### **2.1.1 General information**

The DHC-6 400 is the latest version of the Twin Otter. It is equipped with a Honeywell avionics suite which includes the main instruments and part of the secondary instruments. The type certificate holder is De Havilland Aircraft of Canada Limited.

F-OMYS was added to the CAIRE fleet in 2019, after being manufactured.

The Twin Otter is certified for single-pilot operations.

CAIRE operated its DHC-6 fleet with multi-crews. The CAIRE DHC-6 two-pilot operating procedures were adapted from the De Havilland Pilot Operating Handbook (POH).

#### **2.1.2 Nose Wheel Steering (NWS) system**

##### **2.1.2.1 Description**

The DHC-6 landing gear is a fixed landing gear.

The nose wheel is steered from the cockpit using a steering lever<sup>6</sup> that turns around the left-hand control wheel hub and is marked NW STEER, with R (right) and L (left) direction arrows.

There are two marks on the steering lever, one on the part which moves and the other on the fixed part. The alignment of the marks indicates the alignment of the wheel with the aeroplane's axis.

This lever is only on the left-hand side; there is no NWS lever on the right-hand side.

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<sup>6</sup> The nose wheel is not steered using the rudder pedals.



Figure 3: NWS lever (source: De Havilland / BEA)<sup>7</sup>

The nose wheel is pivoted by a hydraulic actuator installed on the nose shock strut.

The steering control lever is connected via a system of cables and pulleys to a drum on the actuator steering valve which controls the direction and amplitude of the rotation in response to the steering lever being pivoted up or down.

<sup>7</sup> The BEA photo in this figure shows the steering lever in F-OMYS. The De Havilland cockpit photo shows the overall view of the cockpit of another aeroplane.

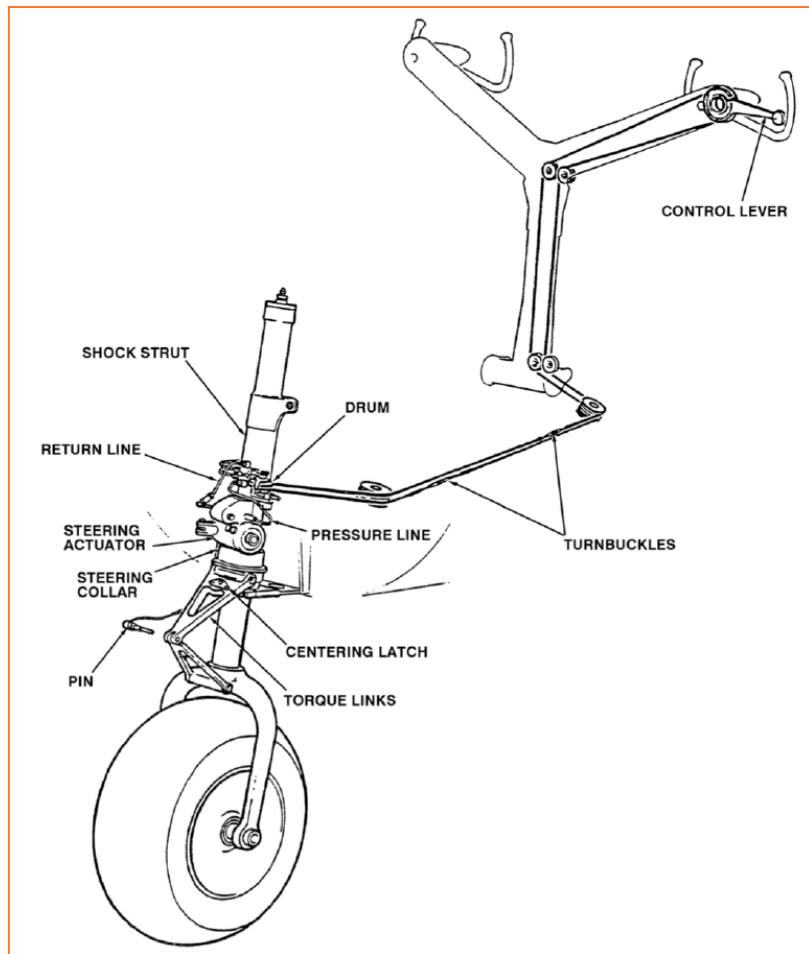


Figure 4: diagram of NWS (source: De Havilland)

A spring latch locks the nose wheel in the centred position in flight when the shock absorber is decompressed provided that the wheel is aligned before the decompression of the shock absorber.

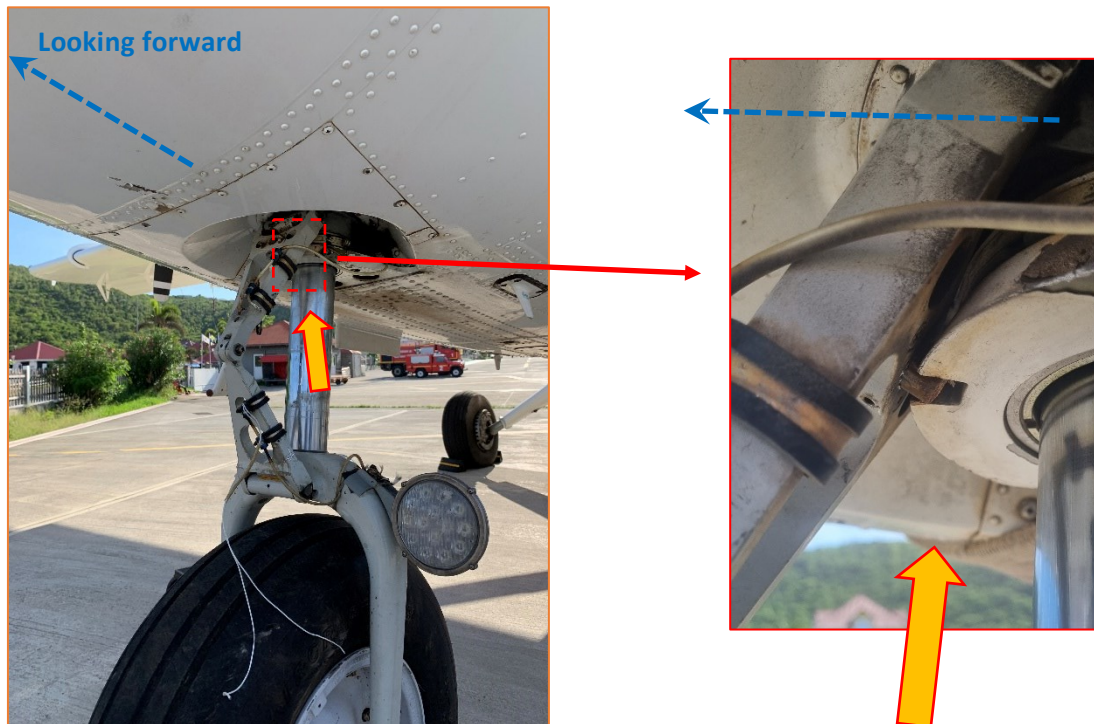


Figure 5: nose gear locking mechanism - spring latch in position, gear locked <sup>8</sup> (source: BEA)

#### 2.1.2.2 Operating procedures - general

According to the POH, in the “Safety and Operational Tips” section, the NWS is to be used primarily when manoeuvring on the ramp or parking areas, as well as for tight turns between runways and taxiways.

The use of the NWS is not recommended during take-off or landing. Steering is controlled by the rudder.

#### 2.1.2.3 Take-off procedures

The “Safety and Operational Tips” section of the POH states that it must be confirmed that the nose wheel is centred in the straight-ahead position before beginning the take-off run. To do this, it is recommended, after manoeuvring to the take-off position on the runway, to centre the nose wheel using the NWS lever, and then allow the aeroplane to move forward approximately three metres to confirm that the nose wheel is correctly centred.

According to the “Normal Procedures” section of the POH, after take-off, the pilot must ensure that the nose wheel is centred and locked. To do this, he must, if necessary, align the marks on the NWS lever and then apply slight upward and downward pressure to the lever to confirm that the nose gear is locked in the centre position.

This action ensures that the spring latch (see paragraph 2.1.2.1) is actually in the locked position.

<sup>8</sup> To take this photo with the aeroplane on the ground, the nose of the aeroplane was raised so that the nose gear shock absorber was decompressed.

This procedure is described in a temporary amendment (referenced TA-31), dated 2 October 2017<sup>9</sup>. The previous procedure consisted solely of checking that the NWS lever was centred by aligning the marks if necessary.

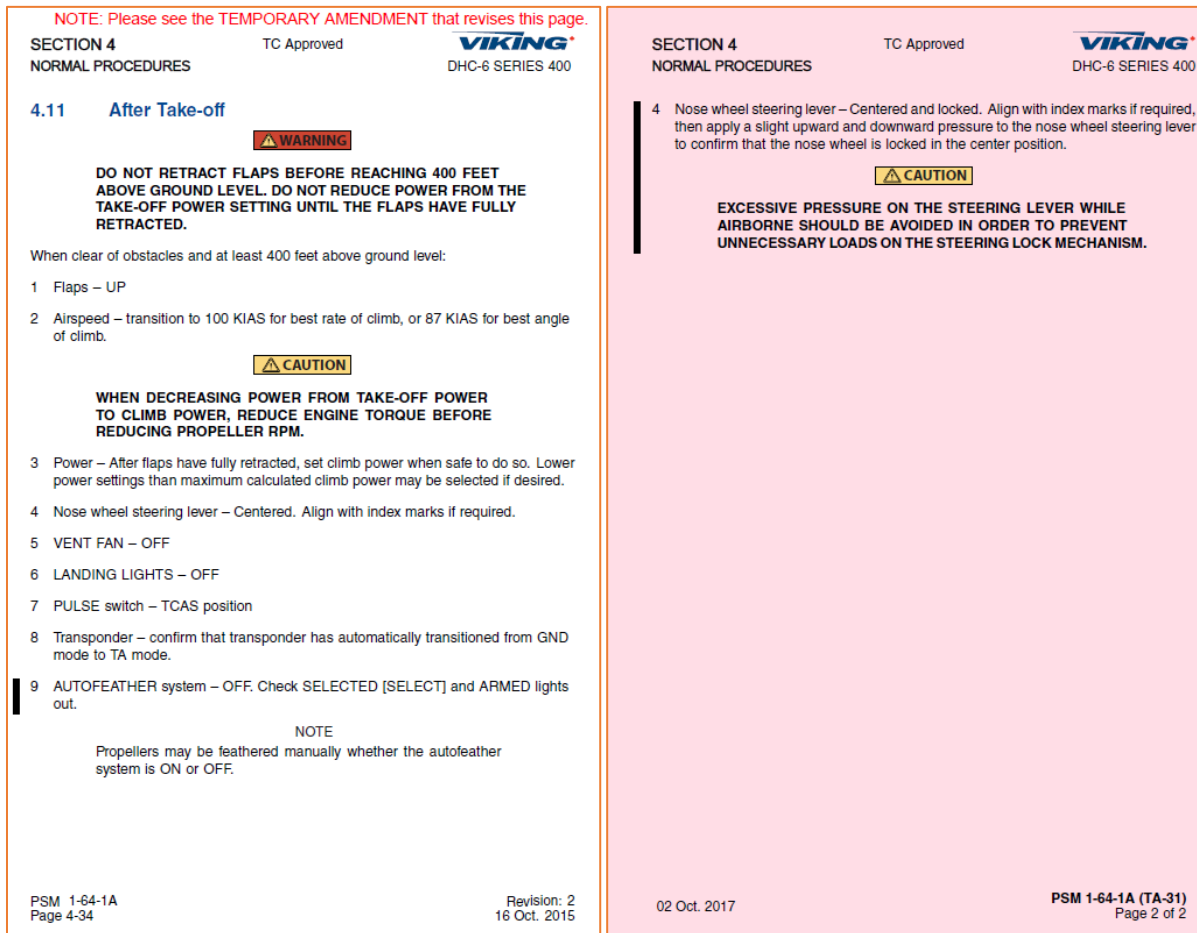


Figure 6: after-take-off procedure taken from the POH and its amendment (source: De Havilland)

This amendment had not been incorporated into the normal procedures of the CAIRE operating manual for the DHC-6. In this manual, the after take-off procedure only states that the pilot in the left-hand seat must ensure that the NWS is centred and locked by checking that the NWS marks are aligned.

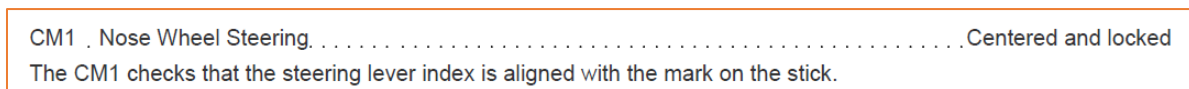


Figure 7: after take-off procedure taken from the CAIRE operating manual

The after take-off checklist includes the corresponding verification item:  
 “STEERING .....CENTERED”.

<sup>9</sup> According to DHC, this procedure remains a temporary amendment pending the publication of a full revision of the POH.

### 2.1.2.4 Arrival procedures

During the approach, according to the “Normal Procedures” section of the POH, the pilot must ensure that the nose wheel is centred and locked using a method similar to that used after take-off. This procedure is also described in a temporary amendment (referenced TA-32), dated 2 October 2017.

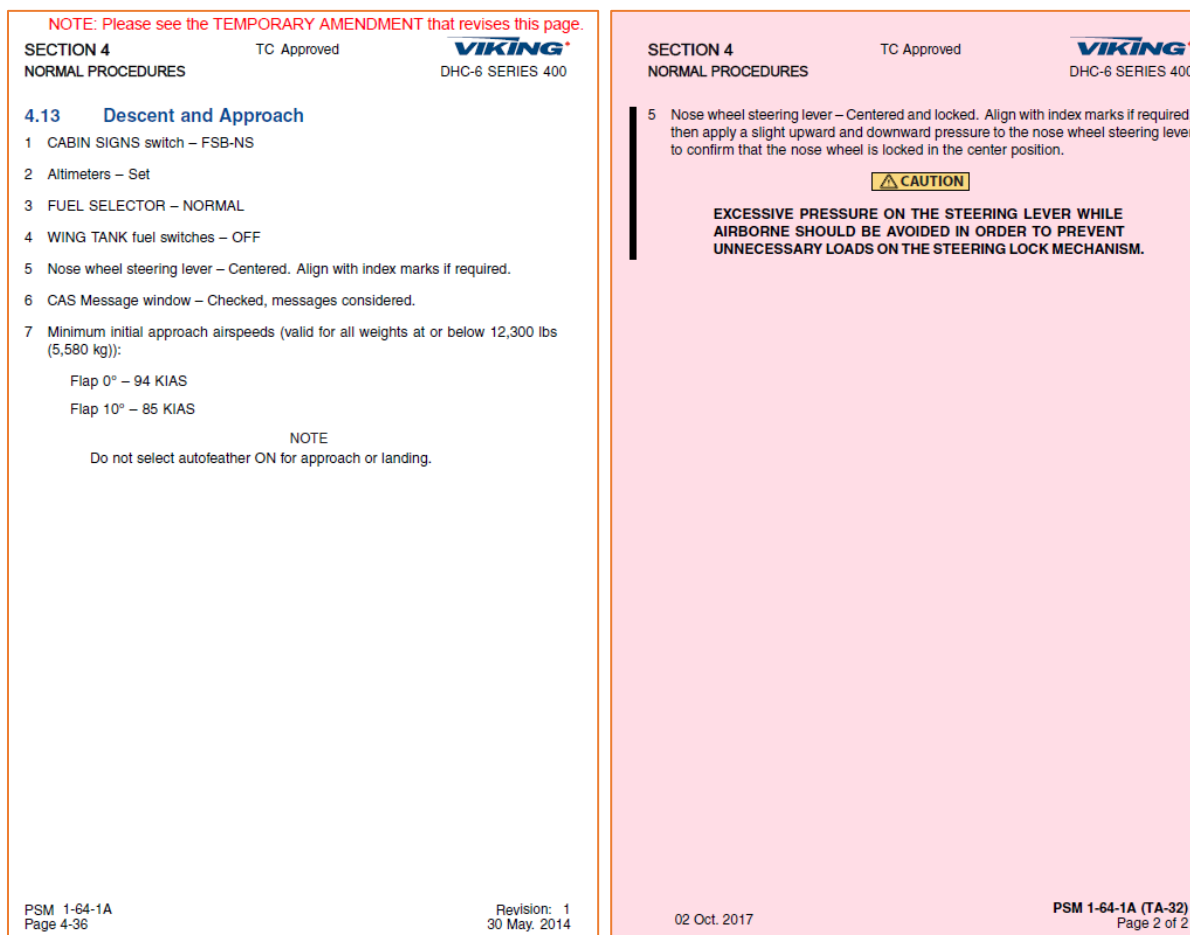


Figure 8: Descent/Approach procedure taken from the POH and its amendment (source: De Havilland)

The normal procedures in the CAIRE operating manual for the DHC-6 do not contain any actions relating to the NWS during the descent or approach. The before landing checklist includes the verification item, “STEERING...CENTERED”.

### 2.1.2.5 Maintenance history

The last major scheduled inspection<sup>10</sup> was EMMA inspection No 35<sup>11</sup>, carried out from 8 to 11 August 2023. This inspection included checks on the nose gear and the nose wheel control system, which revealed nothing unusual.

<sup>10</sup> Excluding daily and weekly inspections.

<sup>11</sup> The EMMA inspection system (Equal Maintenance for Maximum Availability) is a maintenance programme developed by the manufacturer, De Havilland and approved by the certification authority, Transport Canada. In this system, a certain number of individual job cards are specified for each 125 h inspection, each one covering a separate area of inspection of the aeroplane. The programme consists of forty-eight 125 h inspections, the complete overhaul cycle thus being 6,000 h.

The examination of the aeroplane's TLB (Technical Log Book) found the following items in connection with the NWS:

Date	Comments	Maintenance operation
14 August 2023	Loss of steering during alignment for take-off - NWS cable found broken.	Replacement of NWS cable.
21 August 2023 (14 flights before the accident flight)	Play on steering, vibrations during take-off - <i>Bearing nyliner of arm to steering actuator</i> found in poor condition.	Replacement of bearing.
22 August 2023 (4 flights before the accident flight)	Suspicion of bird strike level with nose gear on taking off.	Inspection, no damage detected, cleaned.

The tool used to check the tension of the NWS cable after its replacement was referenced on the TLB page at the date of the replacement operation, but no tension value was indicated.

### 2.1.2.6 Manipulations and tests carried out after accident

After the accident, a technician present at Saint-Barthélemy and approved for simple maintenance services for Air Antilles, intervened to help move the aeroplane. He carried out checks on the NWS under the supervision of the gendarmes who were present during these operations. He removed the safety pin in order to tow the aeroplane and accessed the compartment of the nose gear steering control mechanism in order to check the continuity and tension of the NWS cable<sup>12</sup>.

When the BEA investigators arrived on site, 48 h after the accident, the NWS and landing gear locking in centre position system were tested based on the functional tests described in the aeroplane's maintenance manual. These tests did not reveal any particular malfunction.

The position of the NWS lever was consistent with the orientation of the nose wheel. However, it was observed that:

- the alignment marks could be offset to varying degrees although the gear was locked in the centred position by the spring latch (Figure 9);
- the marks could be aligned although the nose gear was not locked in the centred position by the spring latch (Figure 10).



Figure 9: photos of NWS lever when the gear is locked in the centred position (source: BEA)

<sup>12</sup> This tension check was carried out without a specific tool. It was filmed and the recording of this action was given to the BEA.



Figure 10: photo of NWS lever aligned although the gear is not locked in the centred position  
(source: BEA)

When resources were used in November 2023 to disassemble the aeroplane for its transport, additional tests were carried out by De Havilland technicians, in the presence of gendarmes, and based on a protocol validated by the BEA.

During these tests, it was observed that the tension of the connecting cable between the NWS lever and the actuator was insufficient<sup>13</sup>. It was not possible to determine the cause of this insufficient tension level.

According to De Havilland, an insufficient NWS cable tension can lead to the offset described above, with the marks aligned although the gear is not centred. In this case, if locking is not checked in accordance with the amended procedures, the orientation of the wheel can change during the flight.

### 2.1.3 Evacuation

The DHC-6 has six doors for boarding and disembarking:

- two doors to access the flight compartment, one on each side;
- two doors to access the passenger cabin, one on each side: the left door is a double door and is normally used for passenger boarding or disembarking. The right door is a single door;
- two emergency evacuation doors, one on each side, in the forward section of the passenger cabin.

<sup>13</sup> The tension values measured were of the order of 10 lb for a nominal value of 40 lb in the conditions of the day.

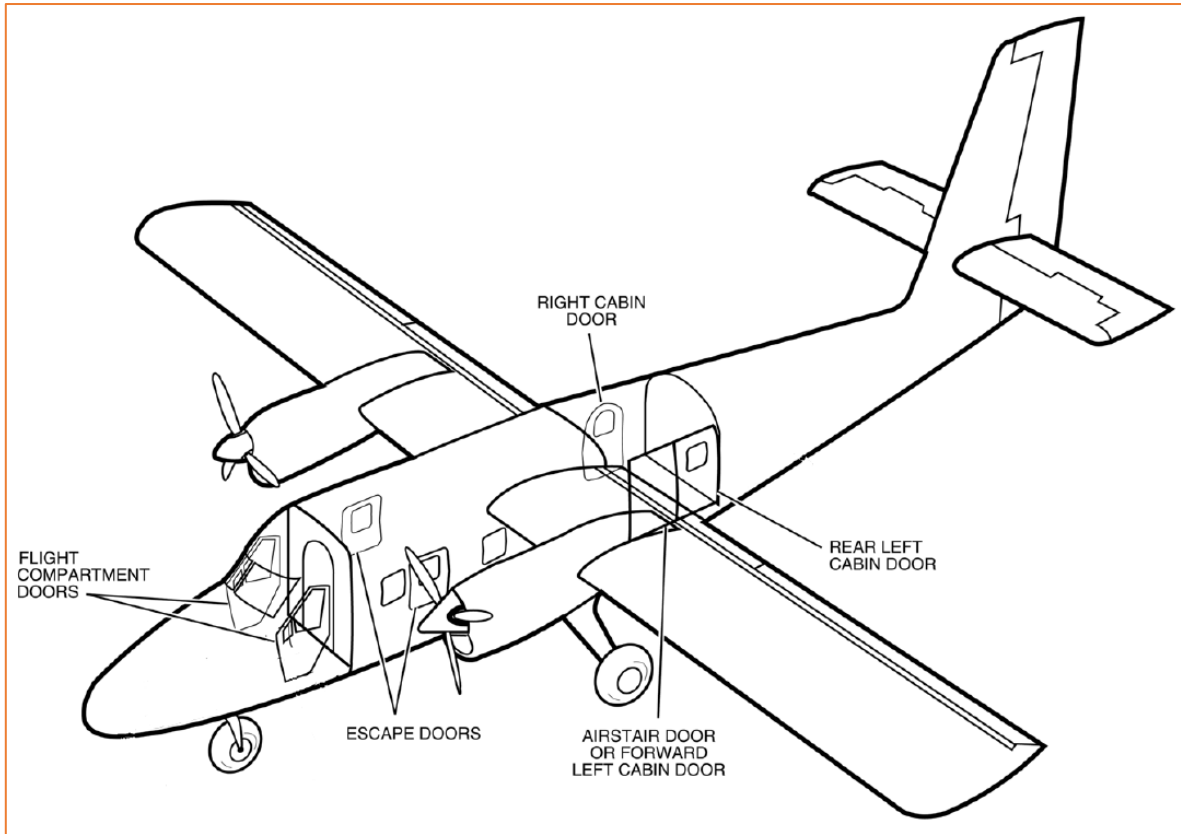


Figure 11: doors of DHC-6 (source: De Havilland, modified by the BEA)

## 2.2 Site and wreckage information

The marks left by the aeroplane's wheels on the ground, as soon as the aeroplane touched down, included a pronounced nose wheel mark. This is consistent with the nose wheel being out of line with the path and skidding. No similar particularity was observed on the marks left by the wheels of the main landing gear.



Figure 12: mark left by nose wheel (source: BEA)

The left wing of the DHC-6 was torn off and held by the strut, control rods and other connecting hoses. Damage was visible on the leading edge corresponding to the point of contact with the helicopter. The left propeller had deformations linked to contact with the ground.

The helicopter was considered as economically unreparable.

## 2.3 Airport information

Saint-Barthélemy airport is a restricted-use airport reserved for aircraft with appropriate characteristics and performance and for authorized pilots. It has a paved runway 28-10, measuring 646 m long and 18 m wide.

A helicopter stand area is situated at the eastern end of the ramp (indicated by “P HEL” on Figure 13).

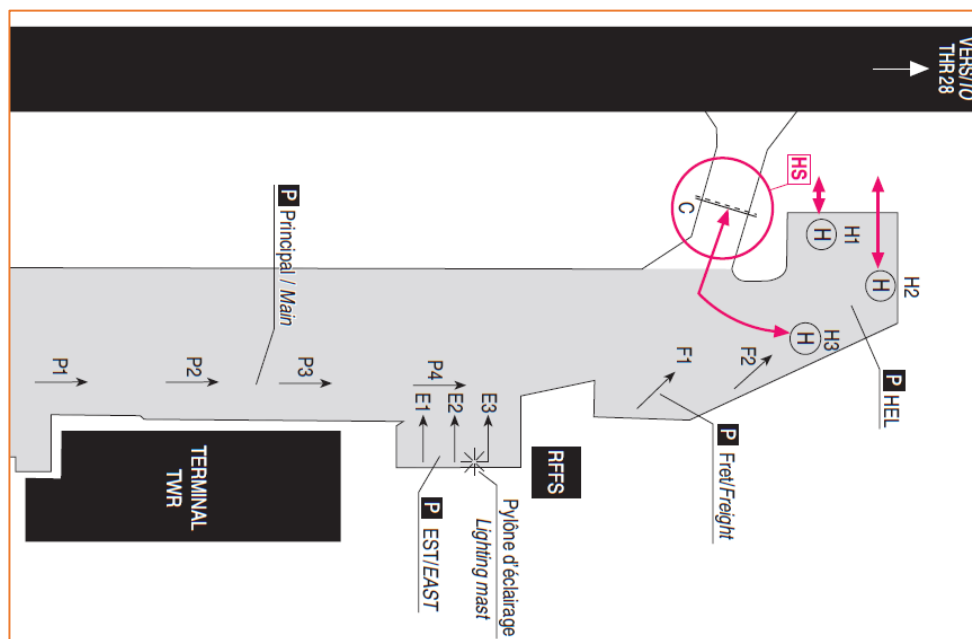


Figure 13: excerpt from ramp drawing (source: AIP)

Being 30 m from the runway axis, the position of this stand complies with the aerodrome certification standards applicable<sup>14</sup> to Saint-Barthélemy airport, as it does not encroach on the runway safety area<sup>15</sup> which has a minimum width of 60 m. The position of the direction sign indicating the junction with the taxiway was also compatible with the standards relating to the presence of objects in this safety area.

<sup>14</sup>“CHEA” modified order of 28 August 2003 concerning the Conditions of Approval and Operating Procedures for Aerodromes (<https://www.legifrance.gouv.fr/loda/id/LEGITEXT000005657923>).

<sup>15</sup> For an aerodrome such as Saint-Barthélemy, as the runway is not used in instrument flight conditions, there is no minimum width for the runway strip but solely a minimum width for the runway safety area. The result of this is that from a lateral point of view, the runway strip merges with the runway safety area.

## 2.4 Meteorological information

The Saint-Barthélemy airport 15:30 automatic weather report contained the following information:

- wind from 020°, 8 kt;
- temperature 34°C, dew point 27°C;
- QNH 1013.

Before landing, at 15:40, the AFIS officer informed the crew that the wind was from 030° of 7 kt.

The examination of the aerodrome's security camera footage in which the windsock situated close to threshold 28 could be seen, confirmed that the wind was light at the time of landing.



*Figure 14: position of windsock at time of landing of F-OMYS  
(source: Collectivité de Saint-Barthélemy)*

## 2.5 Crew information

### 2.5.1 Captain

#### 2.5.1.1 Qualification and experience

The 33-year-old captain held a CPL(A) licence obtained in December 2013 along with an instructor licence FI(A).

The day of the accident, he had logged 4,538 flight hours including 3,208 hours on the DHC-6, of which 1,109 as captain on type. In the previous 30 days, he had carried out 58 flight hours all in the scope of operations for CAIRE.

He obtained his DHC-6 type rating in June 2018. The ATO, Aéropyrénées, provided the training for this rating on behalf of CAIRE. The flights to obtain this rating were carried out in single-pilot operation, with the pilot in the left seat and the instructor in the right seat.

He became captain on the DHC-6 in January 2022, in CAIRE, and had been flying as captain since this date.

### 2.5.1.2 Activity in the previous days

In the occurrence report completed by the captain for this accident, he checked the “tired” box. In this report, he expressed being “slightly tired”<sup>16</sup>, indicating the reason for this tiredness as a lack of sleep and as factors for this state of tiredness, concern about the company’s situation, the impact of this situation on the payment of salaries, his domestic responsibilities and feeling obliged to fly due to the company’s situation.

The following information comes from his statement.

After a four-day rest period, there was a “*jour blanc*” (a sort of blank day<sup>17</sup>) on 22 August during which he was not engaged. He went to bed at around 22:00 that day but was woken at around midnight. He returned to bed at around 00:30 and then woke up at 05:00 to carry out a day of flights, composed of three return flights between PTP and SBH. He came on duty at 06:30, the first flight being scheduled for 07:15. The last flight ended at 17:00 and he went to bed at around 22:00. He thought that he had taken some time to fall asleep, perhaps at 00:30.

The day of the accident, he woke up at 05:00. His duty period started at 06:30, the first flight being scheduled for 07:15.

### 2.5.1.3 Statement

The captain explained that the first flights of the day proceeded normally without any particular incident. He remembered that during the flights, he had had discussions with the co-pilot about the company’s situation, the impact for the strikers on their salaries (see paragraph 2.7.3) and his personal fatigue related to his disrupted sleep of the last few nights. They also had “sound discussions” about social issues.

He indicated that for the approach of the occurrence flight, the conditions did not pose any particular difficulty.

Concerning the pain in his ear during the three sixty on approach to the base leg, he explained that occasionally he had some discomfort during the descent. This time it had been a sharper pain. He managed to compensate but continued to have a feeling of a slight discomfort. He considered, however, that this had not hampered him subsequently.

He added that after the accident, he could no longer remember if they had carried out the before landing checklist.

Concerning the NWS check procedure, he explained that he visually checked that the marks were aligned on the NWS lever. He indicated that there was play in the lever and that sometimes the marks were slightly offset to each other. He added that the NWS marks were in his field of vision when he looked at the PFD and he thought that he would have noticed if these marks were not aligned during the flight.

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<sup>16</sup> Choice of “slightly tired” in a drop-down option menu.

<sup>17</sup> This day is shown as a “*journée de dispersion*” on the captain’s roster which CAIRE provided to the BEA. These terms are not described in the CAIRE operating manual. The captain explained to the investigators, that a “*jour blanc*” was a day during which a crew member could be called up with a 12 h notice.

When turning onto final, he considered that he was a little high and made a small nose-down input to intercept the slope and give himself some time to stabilize his speed. He thought that this was why the “SINK RATE” warning was activated. He considered that after this correction, he was on the approach slope, correctly centred and with the approach speed. He indicated that they were stabilized.

He mentioned having made asymmetric use of the reverse thrust during the ground run but could not remember in what direction he had applied it.

He explained that he knew that the NWS must not be used during take-off and landing. He knew of the incident that had occurred in the company in 2022 in relation to its use during the take-off run. For this reason, during the landing run, he started to use the NWS lever in a moderate manner. But he had the impression that the control was very stiff. He ended up having to grab it to raise it using all his strength.

With respect to the decision to evacuate the aeroplane solely by the rear right door, he considered that it was not useful to use the secondary evacuation doors, which are smaller, due to the small number of passengers and that some of them were of a certain age. He also favoured the evacuation from the right side due to the damage on the left side of the aeroplane and the associated risk of an incipient fire.

With respect to the documentation<sup>18</sup>, the captain explained that he used the operator’s manual to revise the operational procedures. He used the De Havilland POH to revise the chapters on the systems and performance.

He thought that the subject of a double check of the NWS (visual and tactile) had not been mentioned during his last recurrent training. He added that he may have been given information about this when he passed the type rating for the DHC-6 in 2018, but he could not remember it. He could not remember an instructor commenting on his compliance with the procedure during his flights or simulator sessions, in training, in LIFUS or in tests.

## **2.5.2 Co-pilot**

### **2.5.2.1 Qualification and experience**

The 23-year-old co-pilot held a CPL(A) obtained in May 2020.

On the day of the accident, he had flown nearly 1,150 flight hours, including 950 hours on the DHC-6. In the previous 30 days, he had carried out 67 flight hours.

He obtained his DHC-6 type rating in February 2022 in the scope of his recruitment by CAIRE. The ATO, EPAG NG, provided the training for this rating on behalf of CAIRE.

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<sup>18</sup> The document versions used by the captain for his personal revision were checked and were consistent with the procedures described in paragraph 2.1.2: there were the same differences between the operator’s manual and the POH indicated in this chapter.

## 2.5.2.2 Activity in the previous days

On 21 August, the co-pilot had carried out two rotations between PTP and SBH. The 22 and 23 August, according to his roster, were “*dispersion*” days but he had not been called on.

## 2.5.2.3 Statement

The co-pilot indicated that he was not physically tired on the day of the accident. However, he felt morally tired with respect to the situation in the company.

The co-pilot’s statement about how the flight proceeded was consistent with that of the captain’s.

He specified that during the landing run, he did not touch the controls but when they approached the helicopter, he put his feet on the brakes.

He expressed experiencing difficulties in managing the passengers during the evacuation, explaining that they did not follow his instructions.

He added that after the accident, he could no longer remember if they had carried out the before landing checklist.

With respect to the NWS check procedure, he explained that it was a visual check. He had observed that some captains touched the NWS lever for this check. When he was PM and he read out the checklist, he also visually checked for the alignment of the marks from his seat.

## 2.5.3 Fatigue

The examination of the duty, flight and rest times of each crew member, which the operator provided to the investigators after the accident, did not show any exceedance of the regulatory limitations.

However, certain terms used in the crew rosters were not defined in the operating manual (“*journée de dispersion*”) and the interviews with the crew brought to light other terms which appear neither in the operating manual nor in the roster.

Parts of the statement concerning the captain’s activity, his sleep time and that he was disturbed during his sleep time in the previous days (see paragraph 0) reveal a sleep deficit.

The co-pilot did not express a feeling of physical fatigue. He did however express a moral fatigue linked to the company’s situation.

## 2.6 Analysis of recordings

### 2.6.1 Flight recorders

The aeroplane was equipped with two flight recorders (FDR and CVR) in accordance with the regulations in force, and an IONode flight data recorder whose recording is used by the operator for flight data monitoring.

### 2.6.1.1 Read-out of flight data recording (FDR)

The position of the nose wheel and that of the NWS lever are not recorded.

Due to the low sampling rate recording of the engine parameters (one value per second) and certain data not being recorded<sup>19</sup> (propeller pitch, position of engine and propeller control levers), it was not possible to determine on what side the reverse thrust had been applied.

Difficulties were encountered when converting the FDR parameters. These difficulties and the assessment of the regulatory references associated with this problem are described in paragraph 2.6.3.

### 2.6.1.2 Read-out of voice recording

On the CVR recording, it is possible to hear brief tyre squeals followed by a continuous squeal of 3.5 s which suddenly stops. This interval is consistent with the time that the nose wheel was running on the runway before passing onto the grass.

The examination of the conversations recorded on the CVR also revealed discussions unrelated to the flight during the sterile cockpit phase, below 5,000 ft (see paragraph 2.7.5), as illustrated in Figure 15. Out of the 8 min 46 s spent below this altitude, less than 42% of the time was used for technical discussions/call outs in relation with the flight or was marked by no conversation, and 58% of the time was devoted to conversation unrelated to the flight. Moments of silence were nearly non-existent.

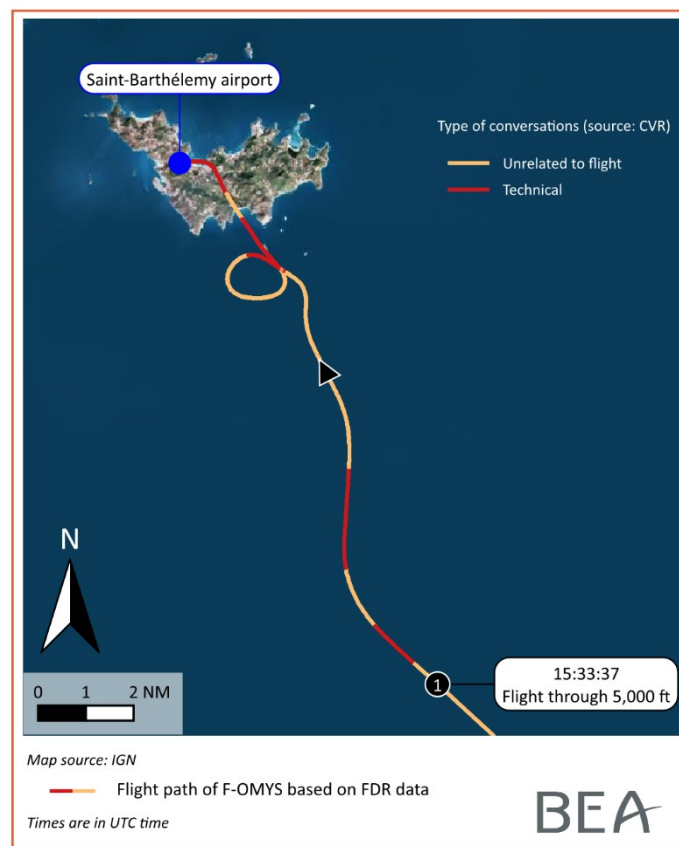


Figure 15: flight path of F-OMYS, type of conversations during the flight

<sup>19</sup> The recording of these parameters is not a regulatory requirement for this type of aeroplane.

### 2.6.2 Video recordings

The security camera files were retrieved from the airport operator. The examination of the videos supplemented the understanding of the occurrence and confirmed certain elements including:

- the position of the aeroplane at the touchdown point on the runway and its path on the runway which meant that the path calculations based on the recorded data could be refined;
- the orientation of the nose wheel to the left during the short final and on landing (data not recorded on the FDR);
- the position of the windsock on touchdown (see paragraph 0).

Figure 14 illustrates these aspects.

With respect to the orientation of the wheel observed in the images, tests carried out on the NWS (see paragraph 2.1.2.6) showed that the position of the NWS lever and the orientation of the wheel were consistent despite the insufficient tension in the NWS cable and the play observed during the ground tests. Thus, the substantial out-of-line observed on the images implies that the NWS lever marks were significantly offset at this point of the flight.

### 2.6.3 Flight data recorder conversion documentation

In Europe, EASA requires aircraft types such as the DHC-6 400, whose first individual certificate of airworthiness was issued after 1 April 1998, to carry an FDR. To meet this requirement, De Havilland chose an integrated solution, Honeywell's Primus Apex avionics suite.

#### 2.6.3.1 Difficulties encountered

After the accident, De Havilland provided the BEA with generic conversion documentation for the Honeywell Primus Apex avionics suite. This documentation was not specific to the installation on the aeroplane: it included a much larger number of parameters than those actually recorded, and essential information was missing (such as sign conventions and the definition of discrete parameters). An additional document, prepared as part of the certification process for the installation of this avionics suite on the DHC-6 400, presenting correlation data for certain parameters, was also provided by De Havilland. These two documents were insufficient to effectively convert and analyse the FDR data as part of the safety investigation.

During the investigation, the BEA contacted its counterparts in Canada, Taiwan, and another third country<sup>20</sup>, who confirmed that they had experienced similar difficulties converting the data of FDR equipping the DHC-6 400 during investigations.

At the end of the F-OMYS investigation, the exact list of recorded parameters had not been determined or confirmed by the aeroplane manufacturer. De Havilland confirmed that the necessary documentation had not been produced for the DHC-6 400 series.

De Havilland informed the BEA that it was currently treating this problem through a review of the FDR installations on the DHC-6 400. This review should lead, in 2026, to the publication of a document containing the necessary and sufficient information to convert the FDR recordings on this type of aeroplane.

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<sup>20</sup> In order to comply with the confidentiality rules required by this country, the nationality is not indicated.

### 2.6.3.2 Regulatory requirements

Part 1 of ICAO Annex 6, "Operation of Aircraft" applicable to international commercial air transport, establishes requirements for the FDR conversion documentation in Appendix 8, "Flight Recorders".

These requirements indicate that the recorder manufacturer must provide the appropriate certification authority with parameter conversion information, that the operator must keep the FDR conversion documentation up to date and that this documentation must be sufficient to ensure that accident investigation authorities have the necessary information to convert the data.

Regulation (EU) No 965/2012, known as "AIR-OPS,"<sup>21</sup> incorporates the ICAO standard concerning the development of documentation by the operator in Annex IV (Part-CAT), CAT.GEN.MPA.195 (Handling of flight recorder recordings: preservation, production, protection and use).

Regarding the design of this documentation, EASA issued a Safety Information Bulletin (SIB 2009-28R1) in January 2015 containing a recommendation on this subject. The latter, applicable to all aircraft in service equipped with a flight recorder, recommends that type certificate holders provide European operators with the information necessary to convert data recordings. The reasons for this recommendation include:

- the problem of incomplete or inaccurate documentation identified by the safety investigation authorities;
- in this case, the inability of the aircraft operators concerned to comply with the European regulation requiring them to develop this documentation.

Compliance with this recommendation is not mandatory.

In 2020, amendment 26 to the Certification Specifications CS-25<sup>22</sup> introduced as an Acceptable Means of Compliance (AMC<sup>23</sup> 25-1459), the indication that the Instructions for Continued Airworthiness (ICA)<sup>24</sup> must include:

- calibration checks of the parameters of the sensors dedicated to the flight data recorder to check the accuracy of these parameters; and
- FDR conversion documentation.

This indication is accompanied by a description of the expected documentation (format and content).

These amendments are not retroactive, and there is no equivalent provision to AMC 25-1459 for aeroplanes subject to CS-23<sup>25</sup>, as is the case for aeroplanes certified in Europe of an equivalent category to the DHC-6. This issue was only taken into account for aeroplanes covered by CS-25, as these were the ones where the main difficulties were encountered and reported by investigation authorities and operators<sup>26</sup>.

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<sup>21</sup> Commission Regulation of 5 October 2012 laying down technical requirements and administrative procedures related to air operations ([Version in force on the day of the accident](#)).

<sup>22</sup> Requirements applicable to aeroplanes with a maximum take-off weight of more than 5,670 kg.

<sup>23</sup> Means of Compliance.

<sup>24</sup> Instructions for Continued Airworthiness.

<sup>25</sup> Certification specifications applicable to "Normal, Utility, Aerobatic and Commuter Aeroplanes".

<sup>26</sup> An equivalent amendment concerned the CS-29 certification specifications applicable to large helicopters.

Thus, to date, European regulations do not specify that documentation relating to the conversion of FDR data must be produced for normal category aeroplanes (nor for CS-25 category aircraft certified before December 2020).

The DHC-6 400 was certified by the Canadian civil aviation authority (TCCA<sup>27</sup>) in 2010, based on the certification specifications in force in 2007<sup>28</sup>.

The TCCA advised that the Canadian Aviation Regulations (CAR) require the installer to provide a report containing information to convert recorded data into usable values in order to obtain approval for the installation (AWM<sup>29</sup> 551.100(d)(4)(i)(A)). This requirement applies to the initial installation of the FDR. It came into force in 2009 and the installations prior to this date, such as the one on the DHC-6 400 were not subject to this requirement.

## 2.7 Operator information

### 2.7.1 General information

CAIRE (Compagnie Aérienne Inter Régionale Express) was a company made up of two business entities, Air Antilles and Air Guyane Express.

The fleet was composed of the ATR 42, ATR 72, DHC-6 300 and 400, Cessna Caravan and Let 410.

The passenger transport operations to Saint-Barthélemy were carried out solely with the DHC-6 400<sup>30</sup>.

### 2.7.2 Oversight of operator by authority

An audit of the organization and flight safety at CAIRE, conducted by the DSAC in April 2016, had revealed non-conformities with respect to AIR-OPS regulatory requirements. Certain malfunctions were considered significant. They concerned:

- the management system, in areas such as risk management, personnel training, and monitoring compliance;
- the time dedicated by nominated managers to their management tasks;
- flight crew repeatedly exceeding their duty time.

Since several of the findings made during this audit had already been notified during previous oversight actions, it was considered that the actions implemented by the operator since these notifications had proved to be ineffective. For these reasons, CAIRE was placed under reinforced oversight in May 2016. This reinforced oversight consisted of a reduction in the oversight cycle time and an increase in the number of in-flight and ground checks during stopovers.

The BEA requested an analysis from the DSAC, of non-compliances related to the documentary aspects covered by AIR-OPS requirements (control, updating and monitoring of documentary consistency). This analysis showed that the documentary aspect was an identified weakness

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<sup>27</sup> Transport Canada Civil Aviation.

<sup>28</sup> Date of submission of certification file.

<sup>29</sup> Airworthiness Manual.

<sup>30</sup> CAIRE did not hold the approval for steep-slope operations (AIR OPS requirement CAT.POL.A.245) for the DHC-6 300.

at CAIRE. However, since the reinforced monitoring, continuous improvement had been observed, illustrated by a relatively constant decrease in the number of non-compliance findings on this subject since 2017.

### **2.7.3 Situation of the company at the time of the accident**

Pilots of the CAIRE group had been on strike since 14 July 2023. A cabin crew union served a strike notice on 25 July 2023. The following day, CAIRE declared itself bankrupt. On 2 August 2023, CAIRE was placed in compulsory liquidation with operations being continued by the Pointe-à-Pitre Commercial Court. The strike action was suspended following this liquidation.

The court gave CAIRE two months to find a buyer, with a deadline of 1 October 2023.

### **2.7.4 Interviews with certain nominated managers**

Interviews were conducted with the nominated person for crew training (NPCT) and the DHC-6 sector head, who was also an instructor and examiner.

Regarding crew training, the NWS was addressed in the 2022-2023 theoretical knowledge cycle, with a particular focus on an occurrence<sup>31</sup> in December 2022. This point highlighted the risks associated with using the NWS during take-off or landing.

The sector head explained that the specificity of checking the NWS on the DHC-6, both visually and by an input on the lever, is part of the familiarity of the system. It seemed obvious to him that crews were familiar with this aspect. He did not consider it a point requiring particular attention during flight or simulator training sessions. He added that he was surprised when, after the accident, another captain in the DHC-6 fleet told him that he also only performed the visual check, without operating the lever.

The sector head added that he had occasionally noticed that the nose wheel was not centred in flight. He had associated this with improper locking of the NWS.

No explanation was provided for the failure to incorporate temporary amendments TA-31 and TA-32 into the operator's manual. Factors such as personnel changes in the years following the publication of these amendments, as well as changes in the regulatory watch processes in response to these personnel changes, were mentioned.

### **2.7.5 Sterile cockpit rule**

According to the section of the operating manual relating to the DHC-6, the sterile cockpit rule for CAIRE operations on this type of aircraft applies between the ground and 5,000 ft<sup>32</sup>, and during critical phases of flight (take-off, approach, landing, go-around). During these periods when the rule applies, conversations and callouts must be limited to the minimum necessary for the proper execution of the manoeuvre in progress (checklists and briefings).

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<sup>31</sup> Runway excursion during take-off due, notably, to the use of the NWS during the take-off run.

<sup>32</sup> The sterile cockpit rule used by the operator in general, listed in Part A of the operating manual, is the 10,000 ft rule.

## 2.8 Similar occurrences

The BEA reviewed cases of runway veer-offs by the DHC-6 over a period extending from ten years before the change in procedure in 2017 to the date of the accident<sup>33</sup>. The occurrences where a proven cause was established, not similar to the F-OMYS accident, were excluded.

Fifty-four occurrences were listed. Not all the occurrences were the subject of a safety investigation. Only nine investigation reports, three preliminary reports, and one internal report from the operator were obtained.

Twenty-one runway veer-offs occurred after the publication of the POH amendment.

Out of the twenty-five cases where information was available, there were two cases with no damage to the aircraft, six with minor damage, and eighteen with substantial damage.

From the point of view of human consequences, out of the twenty-five cases where information was available:

- only one case of a fatal consequence affecting a third party was reported (the person was outside the aircraft, near the runway);
- in three cases, there were minor injuries for persons on board.

Among the available reports, the following occurrences are noteworthy:

Date	Registration		Link to report
26 Aug 2015	9M-SSB	The interview with the crew determined that the captain realised that the nose gear was oriented to the left-hand side at the end of the occurrence.	Operator's report not public
28 Aug 2015	JA201D	Probably only visual check for alignment of NWS after take-off carried out. Highly probable the crew forgot the before landing checklist, did not carry out the NWS check, and touched down with the nose wheel out of alignment.	<a href="#">Final report</a>
07 Jan 2020	9M-SSE	Amendments TA-31 and TA-32 of the POH not incorporated in the operator's manual, incomplete application of after take-off and before landing checklists, landing with nose wheel probably not centred. The fact that amendments TA-31 and TA-32 of the POH had not been incorporated in the operator's manual was identified as a contributing factor to the accident.	<a href="#">Final report</a>
23 Dec 2022	PK-OTY	Amendments TA-31 and TA-32 of the POH not incorporated in the operator's QRH, approach checklist not carried out.	<a href="#">Preliminary report</a>

<sup>33</sup> This review is based on the list of occurrences provided by De Havilland, based on notifications received from investigation authorities or operators, and supplemented with information available elsewhere.

In the absence of a recording of the nose gear angular position or the NWS lever position, it is difficult to establish with certainty that a non-alignment of the nose gear is a contributing factor in a runway excursion, except when an external recording allows the gear position to be verified, as was the case in the F-OMYS accident, or when a crew member realizes their error (9M-SSB on 26 August 2015).

De Havilland informed the BEA that it had not communicated to operators regarding temporary amendments TA-31 and TA-32 following the F-OMYS accident.

## 2.9 Check of alignment of NWS marks

It has been determined that when the crew carried out the after take-off and before landing checklist, they did not carry out the manual check for NWS locking in the centred position.

The video recordings showed a substantial out-of-line of the nose wheel on landing. The tests carried out on the aeroplane after the accident found that despite the play observed in the mechanisms, the position of the lever in the cockpit remained consistent with that of the wheel.

It is possible that the visual check for the alignment of the NWS marks in the before landing checklist was performed and that the marks were actually aligned, and that the nose gear rotated after this checklist was carried out under the effect of manoeuvres during the approach.

It is also possible that there was no actual visual check of the alignment of the NWS marks when carrying out the before landing checklist. This type of human error has been shown in several studies, including the study by R. Key Dismukes & Ben Berman "*Checklists and monitoring in the cockpit: Why crucial defenses sometimes fail*" (NASA Technical Memorandum Report No. 2010-216396).

This study, based on observation flights in the cockpit, showed a certain number of cases<sup>34</sup> where "*a pilot either responded verbally to a challenge item [of a checklist] without visually inspecting the item, responded verbally before inspecting the item or responded that the item was correctly set when in fact it was not.*"

*In some cases what we recorded as responding without looking may actually have been instances of "looking without seeing". Expectation that an item is correctly set arises from memory of having just set or checked an item and from the vast number of previous instances in which that item has been correctly set. Thus, even though the pilot may direct gaze toward the item to be checked, he or she may perceive it to be in the correct position even when it is not, especially if gaze fixation on the item is brief due to rushing. Also, it is possible that pilots' response to the checklist challenge may become so automatic that pilots sometimes utter the response automatically, perhaps not even realizing that they have not visually confirmed the challenged item."*

Several factors conducive to this type of error are listed in the study. Some of these factors are observed in the accident, which supports the hypothesis of the lack of effective verification of the alignment of the NWS marks during the before landing checklist:

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<sup>34</sup> In the ranking of observed deviations, this type of case is in second position in relation to the number of observed deviations, representing 22% of these deviations in total.

- a distraction effect linked to the occurrence of the compensation problem in the captain's ear, concomitant with carrying out the checklist;
- a task saturation effect, or even reduced attention on the part of the co-pilot: the checklist was completed at a time when the distribution of tasks was no longer standard—it was read by the co-pilot while he was temporarily the PF, while the captain attempted to resolve his ear problem. Combined with reduced availability linked to the accumulation of tasks, this probably deprived the co-pilot of his ability to visually check the alignment of the NWS marks;
- more generally, a probable lack of concentration, linked to non-compliance with the sterile cockpit rule – forgetting to disable TERRAIN alerts for the approach is an illustration of this insufficient concentration.

The captain's fatigue, linked to sleep deprivation in the days preceding the accident, combined with the stress related to the company's situation, felt by the two crew members, may have made the crew even more vulnerable to this type of error.

### 3 CONCLUSIONS

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

#### Scenario

During the landing, the nose wheel was not centred. This wheel was oriented to the left-hand side. When the nose wheel came into contact with the ground, the aeroplane deviated to the left. The PF was unable to correct this deviation despite his actions (rudder, ailerons and then asymmetric use of reverse thrust).

The aeroplane veered off the side of the runway and collided with a helicopter parked on the dedicated stand.

The crew were not aware of the modifications to the procedures for checking the Nose Wheel Steering (NWS) system after take-off and before landing which consisted of checking that the NWS was locked in the centred position. De Havilland had introduced them in the Pilot Operating Handbook (POH) for the DHC-6 series in 2017. These modifications were not included in the operator's procedures which were an adaptation of the De Havilland procedures for multi-pilot operations.

The NWS check after take-off and before landing was therefore not completely carried out, with the crew not making a manual input on the NWS lever to check that the NWS was locked in the centred position.

The tension in the NWS control cable was insufficient. It was not possible to determine the cause of this incorrect adjustment. The probable consequences of this was a situation where, on take-off, the NWS marks were aligned although the NWS was not locked in the centred position. As it was not locked, the nose wheel probably pivoted during the flight.

## Contributing factors

It was not possible to determine, at the time the before landing checklist was carried out, whether the nose wheel was aligned on the aeroplane's axis. If it was, and became misaligned after the checklist was completed, the only safety barrier would have been the actual verification of NWS locking by the manual verification action on the NWS lever, as provided for by the standard procedure.

The following factors may have contributed to the crew's lack of knowledge of the after take-off and before landing NWS check procedures:

- shortcomings in the operator's development of the documentation which resulted in the amendment of these procedures not being included in the operating manual;
- the instructors paying insufficient attention to the carrying out of the NWS check during initial training and then in the successive training of pilots on the DHC-6.

If the wheel was already misaligned when this checklist was carried out, the visual check of the marks on the NWS lever should have identified this situation. Taking this hypothesis, the following factors may have contributed to the lack of a visual check or to its ineffectiveness:

- a distraction effect linked to the occurrence of the compensation problem in the captain's ear, concomitant with carrying out the checklist;
- a task saturation effect, even reduced attention on the part of the co-pilot, who, when the checklist was carried out, was performing the tasks of PF and PM;
- a probable lack of concentration on the part of the crew;
- the captain's fatigue linked to sleep deprivation in the days preceding the accident.

## Safety lessons

### Risk management

The accident illustrates the importance, at the organisational level, of being proactive in the identification of the risk.

Malfunctions in the operator's development of the documentation had been identified and this was improving. However, the modifications to the DHC-6 operating procedures published in 2017 by De Havilland had not been included in the operational documents used by the CAIRE crews. This created a latent error situation.

Active monitoring of the occurrences experienced by the worldwide DHC-6 fleet could have drawn the operator's attention to the risk linked to the checklist amendment not being taken into account and might have led the operator to check its operational documents with respect to this particular point.

The crews, and more specifically instructors, are also proactive safety actors. It is probable that a crew member's incorrect application of the checklist will be detected, for example during a check or training flight. It seems important that this detection be the subject of in-depth reflection that goes beyond simply noting the error and informing the individual who made it. Training flights must therefore be a space for reflection that leads to an understanding of why the error was made.

### Importance of complying with sterile cockpit rule

The sterile cockpit rule is a requirement that, during critical phases of flight, non-essential activities in the cockpit are strictly prohibited.

This rule was imposed in the United States in 1981 by the FAA following the findings of several accident investigations, which concluded that the distraction of the crews, linked to non-essential conversations or activities during critical portions of the flight, had contributed to the occurrence of the accident.

Conversely, studies have also shown that cockpit discussions, even if it is simply chatting to “get to know each other”, contribute to crew synergy. The sterile cockpit rule has the advantage of clearly defining when it is time to put aside non-essential activities and focus strictly on the task at hand to ensure safe flight operations.

## 4 RECOMMENDATIONS

*Note: in accordance with the provisions of Article 17.3 of Regulation No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation, a safety recommendation in no case creates a presumption of fault or liability in an accident, serious incident or incident. The recipients of safety recommendations shall report to the safety investigation authority which issued them, on the measures taken or being studied for their implementation, as provided for in Article 18 of the aforementioned regulation.*

### 4.1 Reminder to DHC-6 operators of the changes to the NWS check procedures introduced in 2017

Rigorous compliance with a procedure is an essential element of flight safety. A cornerstone of this safety principle is that changes to procedures over time should be made known to crews. In some cases, it may also be useful to integrate elements into theoretical or practical training to promote proper understanding and assimilation of these procedural changes by users.

Searches made for similar occurrences show that the CAIRE case illustrated by this accident is not unique. At least two other DHC-6 operators had not taken Temporary Amendments TA-31 and TA-32 into account. In one of these cases, where the investigation had finished, this aspect was noted as a contributing factor to the accident. In the other case, the investigation is ongoing, but the fact that the operator had not taken into account Temporary Amendments TA-31 and TA-32 was noted in the preliminary investigation report.

Although aircraft manufacturers are not responsible for operators taking into account POH changes, the fact that several DHC-6 operators had not taken the Temporary Amendments into account shows that De Havilland could play a positive role in reminding all DHC-6 operators of the importance of taking Temporary Amendments TA-31 and TA-32 into account, as evidenced by the various cases of runway excursions mentioned in this report.

**Consequently, the BEA recommends that:**

- *whereas the importance of rigorously complying with operational procedures for flight safety;*
- *whereas various cases of runway veer-offs demonstrate that several DHC-6 operators had not sufficiently taken into account Temporary Amendments TA-31 and TA-32 and had not incorporated these amendments into their operational documents;*
- *whereas the assimilation by crews of a procedure change is fostered through training;*

**De Havilland Aircraft of Canada Limited remind DHC-6 operators of the evolution of the Nose Wheel Steering (NWS) check, introduced by Temporary Amendments TA-31 and TA-32 to the DHC-6 POH and of the importance of them taking these into account (notably by updating the operational documents and integrating this update into crew training programs).**

**[Recommendation FRAN-2026-001].**

### 4.2 Conversion document for FDR recordings

The read-out of FDR provides essential information for understanding an accident or incident. To enable this read-out, the provision of a valid and up-to-date conversion document is essential.

During the investigation into this accident, the BEA encountered difficulties in effectively converting and analysing the FDR data. Similar difficulties were encountered by foreign investigation authorities during investigations into accidents or incidents involving the DHC-6 400.

These difficulties are related to the fact that De Havilland did not produce a data conversion document for the FDR equipping the DHC-6 400 during the design of the aeroplane and the integration of the recording system. At the time when the DHC-6 400 was certified, the applicable certification basis did not explicitly require such a document to be produced.

During the investigation, De Havilland informed the BEA that it is currently addressing this issue through a review of the FDR installations on the DHC-6 400. This review should lead, in 2026, to the publication of a document containing the necessary and sufficient information to convert the FDR recordings on this type of aeroplane.

**Consequently, the BEA recommends that:**

- *whereas the difficulties encountered by the BEA during this investigation and by other investigation authorities in the past in reading out the data of FDRs installed on the DHC-6 400;*
- *whereas the need for conversion documentation to be provided by the entity responsible for installing the FDR on the aeroplane;*

**De Havilland Aircraft of Canada Limited complete its efforts to produce the necessary documentation to convert the recordings of the FDR on the DHC-6 400. [Recommendation FRAN-2026-002].**

Pursuant to requirement CAT.GEN.MPA.195 of Regulation (EU) No 965/2012, known as "AIR-OPS", commercial air transport operators operating aircraft required to carry an FDR must retain and keep up to date FDR data conversion documentation.

Following difficulties encountered by investigation authorities and their recommendations to civil aviation authorities, EASA has amended AMC 25.1459 of certification specification CS-25 to improve the availability and quality of data recorded by flight recorders.

A similar amendment was not made to certification specification CS-23 applicable to aeroplanes of an equivalent category to the DHC-6 400.

The investigation revealed that no data conversion documents were available for the DHC-6 400. Consequently, the operator of F-OMYS was not able to meet the requirements of CAT.GEN.MPA.195.

**Consequently, the BEA recommends that:**

- *whereas the problem with FDR data conversion documentation highlighted by the investigation authorities is not specific to CS-25 category aircraft and also affects CS-23 category aircraft equipped with FDRs;*

- *whereas the modification to AMC 25.1459 as part of Amendment 26 to CS-25, the objective of which is to explain the expectations regarding instructions for the continued airworthiness of the FDR installation, could be transposed to CS-23 category aircraft equipped with FDRs;*

**EASA impose that FDR conversion documentation is produced by design organisations of CS-23 category aircraft equipped with FDR recorders, thus enabling operators of these aircraft to comply with requirement CAT.GEN.MPA.195. [Recommendation FRAN-2026-003].**

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