Serious Incident

Aircraft Type and Registration:	Airbus Helicopters EC175 B, G-MCSH
No & Type of Engines:	2 Pratt & Whitney Canada PT6C-67E turboshaft engines
Year of Manufacture:	2018 (Serial no: 5034)
Date & Time (UTC):	17 February 2023 at 0900 hrs
Location:	Elgin Oil Platform, North Sea
Type of Flight:	Commercial
Persons on Board[1]:	Crew - None Passengers - None
Injuries:	Crew - N/A Passengers - N/A
Nature of Damage:	Four rotor blades detached. Damage to helicopter fuselage
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	38 years
Commander's Flying Experience:	4,703 hours (of which 2,159 hours were on type) Last 90 days - 91 hours Last 28 days - 30 hours
Information Source:	AAIB Field Investigation

Synopsis

The helicopter was operating to the Elgin PUQ[2] offshore platform ahead of an approaching storm. A tail rotor gearbox chip warning led to the helicopter being shutdown on the offshore helideck and experiencing strong winds as the storm passed through.

A failure of the rotor brake meant it was not possible to stop the rotors fully to apply the main rotor blade tie down straps. There was also difficulty mooring the helicopter to the helideck. It is considered vertical air flow caused by the 'cliff edge' effect of an accommodation block on the platform exacerbated the rotor blade sailing, causing four blades to break and detach from the helicopter. One blade nearly struck a person trying to strap the helicopter to the helideck. The subsequent investigation identified several operational shortcomings, a failure of the rotor brake and faults with the model of flight recorder fitted to the helicopter. A number of safety actions have been taken, and six Safety Recommendations are made in this report.

Footnote

1 There was no one onboard the helicopter at the time the rotor blades broke, however, there had been two pilots and one passenger onboard at the time of the tail rotor gearbox chip warning which initiated the subsequent events.

2 Production, Utilities, Quarters.

History of the flight

The pilots reported for duty at 0615 hrs for a return flight to the Elgin PUQ offshore oil platform, situated in the North Sea about 135 nm east of Aberdeen. As part of their pre-departure preparations they checked the weather, paying particular attention to the actual and forecast wind speeds, as 'Storm Otto' was due to pass through the area in which they would be operating. They reported that all the relevant winds were forecast to be within limits for the planned duration of their flights.

At approximately 0645 hrs on the morning of the incident, the helicopter was towed out of its hangar at Aberdeen Airport to a parking position on the apron. The ground handling team reported that during this move the rotor head slowly rotated, despite the rotor brake being applied. This placed the blades in danger of coming into contact with the cab of the tug, requiring one of the team to climb up onto the tug to stop them doing so.

When the helicopter had been parked, the ground handling team returned to the hangar. One of the team stated that the issue with the blades turning had been reported to the line maintenance engineers although, when later questioned, none of the maintenance engineers could recall this and no checks were carried out on the rotor brake. The crew's pre-flight checks of the helicopter went without issue and the helicopter departed at 0725 hrs, with six passengers on board for the 37-minute flight to the Elgin platform.

When the helicopter was about 60 nm from the platform, at 0746 hrs, the crew received updated weather information over the radio from the platform[3]. This reported a south-westerly wind of 36 kt, gusting to 46 kt. This was within the operator's 60 kt[4] wind limit for landing offshore and the crew continued, approaching the platform from the north-east. During the approach the crew monitored the wind speed calculated by the helicopter's flight management system (FMS), which indicated a maximum wind speed of 60 kt. The crew proceeded with the approach, landing at 0808 hrs without incident.

The helicopter remained on the helideck, with the rotors running, whilst the passengers disembarked and a single passenger boarded for the return flight to Aberdeen. The crew then conducted their pre-departure checks, during which a Tail Gear Box (TGB) XMSN CHIP (tail rotor transmission chip detection) appeared on the cockpit Flight and Navigation Display (FND) Master List. After reviewing the Vehicle Monitoring System (VMS), the commander decided to discuss the problem further by telephone with engineering staff based at Aberdeen. He left the helicopter to make the call, at the same time escorting the sole remaining passenger off the helicopter and back to the platform accommodation.

The commander spoke with the operator's engineering team in Aberdeen by telephone and was advised to shut the helicopter down. He returned to the helicopter and informed the co-pilot of the decision and, at 0841 hrs, the engines were shutdown with the wind on the Elgin PUQ reported as 36 kt gusting 46 kt. In accordance with standard operating procedures (SOPs), as the rotor speed dropped below 50% N_R, the rotor brake was applied.

Footnote

3 A radio operator provides a radio watch for inbound and outbound helicopters when the helicopter is within approximately 20 minutes flying time of the platform.

4 The limit is a general regulatory limit (SPA.HOFO.135) imposed to protect passengers disembarking the helicopter and walking across the exposed helideck.

Despite this, the rotor blades did not fully stop and continued to slowly turn. The crew left the helicopter, clearing under the rotor disc on the rear right side of the helicopter, where they assessed they had the biggest clearance from the still turning blades above.

At about 0920 hrs the commander returned to the helicopter with two members of the platform's helideck team to secure it using tie down straps. The crew were unable to fit the rotor tie down straps with the rotors still turning. Although there were tie down straps reported to be kept on the helideck, they did not fit the helideck tie down points and time was spent finding other ratchet straps elsewhere on the platform. These were then used to tie the helicopter down, although the three people doing so still struggled to secure the straps to the helideck tie down points. All the time this was being done, the wind was changing direction so that the helicopter was no longer facing into wind, but was increasingly being subjected to wind from its right side. The team had managed to secure both the front left and front right of the helicopter, as well as the rear left and, at about 0931 hrs, were about to attach a fourth strap to the rear right side. With the blades still turning above, one of the blades suddenly lifted near vertical, partially breaking off near the root with the broken portion hanging down and continuing to turn. As it did so, it narrowly missed the single deck crew member positioned at the rear of the helicopter, who was trying to attach the final strap to the helicopter (Figure 1). The blade then separated and fell into the sea. As a result, those working on the helicopter considered it too dangerous to remain and retreated back to the accommodation block next to the helideck.

Figure 1

CCTV image of G-MCSH blade fracturing and striking fuselage close to helideck crew member trying to secure the rear of the helicopter
(courtesy Total Energies E&P UK Limited)

The four remaining blades continued to rotate, with increasingly strong wind conditions causing them to sail. Over the next 1 hour 40 minutes three of the remaining blades lifted at different times to the point where they also failed. The broken blades remained on the helideck and were later recovered.

By 1600 hrs, the wind had abated sufficiently to allow the fourth strap to finally be attached to the helicopter. The following morning it was manually manoeuvred off the helideck onto an adjacent parking area to allow other helicopters to land. It was subsequently recovered by sea back to Aberdeen.

Recorded information

Introduction

The helicopter was fitted with a crash protected Cockpit Voice and Flight Data Recorder (CVFDR), model FA5000 manufactured by L3 Harris Aviation Products (as of 31 March 2025, L3 Harris Aviation Products was renamed Acron Aviation), and a non-crash protected cockpit image recorder, model Vision 1000 manufactured by Appareo. These were removed from the helicopter after the incident and sent to the AAIB flight recorder laboratory for readout. The FA5000 contained recorded flight data and cockpit audio for the incident flight. However, anomalies were found with the recordings of flight data from previous flights. The Vision 1000 cockpit image recorder did not contain a recording of the incident flight but did contain partial images from a previous flight and several images recorded the day after the incident.

Flight data was also available from the helicopter's Flight Data Continuous Recording (FDCR) system which stores data to non-crash protected memory. The FDCR data is used by the operator's Flight Data Monitoring (FDM) program and the Health Usage Monitoring System (HUMS), which included HUMS monitoring of the main rotor brake performance. The FDCR operation is independent of the CVFDR system and records different parameters.

A CCTV recording of G-MCSH whilst on the helideck was available. This footage included the period staff were tying down the helicopter and the four rotor blades subsequently failed.

Details of the operation and testing of the FA5000 CVFDR and Vision 1000 cockpit image recorder are provided in Appendix 1. The salient findings are:

- A loss of chronological flight data recording by the FA5000 CVFDR caused by rapid cycling of input power at initial startup.
- The loss of chronological recording of flight data has occurred on EC175, UH-72 (EC145) and EC155 helicopters fitted with FA5000 CVFDRs.
- When a loss of chronological recording occurred, only the most recent 15 hours of flight data was not affected.
- The loss of chronological recording is resolved by Service Bulletin (SB) SB001- FA5000 that installs software 840-E5498-12 to the FA5000 series of CVFDRs.

- A loss of flight data recording for 5 seconds at 10-minute intervals occurred after about three hours and fifteen minutes of helicopter operation. This was a result of the FA5000 CVFDR ARINC[5] 717 loopback signal being out of specification. This affects EC175, UH-72, and EC145 helicopters that are installed with Helionix Version 8 software.
- Neither the loss of chronological recording nor data for periods of 5 seconds will result in a CVFDR Built In Test (BIT) fault message. It is necessary to readout all recorded flight data to confirm the presence of the anomalies.
- The cause of the anomalous operation of the Vision 1000 was not identified. Other State accident investigation authorities have experienced similar recording issues with Vision 1000s.

Four Safety Recommendations are made concerning the correct operation of flight data recording systems and FA5000 CVFDR (refer to the analysis section on Loss of chronological flight data recording).

Data interpretation

The helicopter departed Aberdeen at 0724 hrs. Whilst in the cruise, which was flown at 3,000 ft amsl, the helicopter's FMS had calculated that the wind was from 278° at 67 kt. On approach to land, at a height of 440 ft agl, the FMS calculated that the wind was from 250° and the maximum recorded wind speed reached 60 kt. The helicopter landed on the Elgin at 0808 hrs where it was positioned into wind, on a heading of 248°. At touchdown, the FMS calculated windspeed was 56 kt. As the FMS does not calculate windspeed with the helicopter on the ground, no further measurements were available.

At 0816 hrs, as the pilots were conducting their pre-departure checks, the TGB XMSN CHIP caution activated; 25 minutes later the engines were shutdown. As the N_R (main rotor speed) reduced to 48% (134 rpm) the rotor brake was applied and the N_R reduced at an average rate of 1.5 rpm/sec (90 rpm/min). At 70 seconds after the rotor brake was applied, the N_R was at 9% (25 rpm), after which the CVFDR data ended. CCTV footage shows that the rotor head continued to rotate.

Aircraft information

The Airbus Helicopters EC175 B, also known commercially as the H175, is a five-bladed twin engine 'super-medium' sized utility helicopter. The main rotor has five Spheriflex blades and the tail rotor has three blades. The fuselage is of aluminium construction with a composite tail rear of the passenger compartment. In the UK, in oil and gas configuration, the helicopter can carry 16 passengers.

Footnote

5 Aeronautical Radio, Incorporated (ARINC) characteristic 717 defines the form, fit, function, and interfaces of flight data acquisition and recording system. Attachment 9-2 provides the specification for the rise/fall times of the waveform signal.

Two Pratt and Whitney PT6C-67E turboshaft engines drive the main gearbox which in turn directly drives the main rotor. The tail rotor is driven via a drive shaft which exits the main gearbox to the rear.

To allow the rotor system to be slowed when the engines are shutdown, and to prevent the rotors from turning when parked, a rotor brake is used. This rotor brake acts on the tail rotor output shaft to the rear of the main gearbox. It is activated by a lever located centrally on the cockpit roof, which is connected to the rotor brake via a flexible cable and spring box (Figure 2).

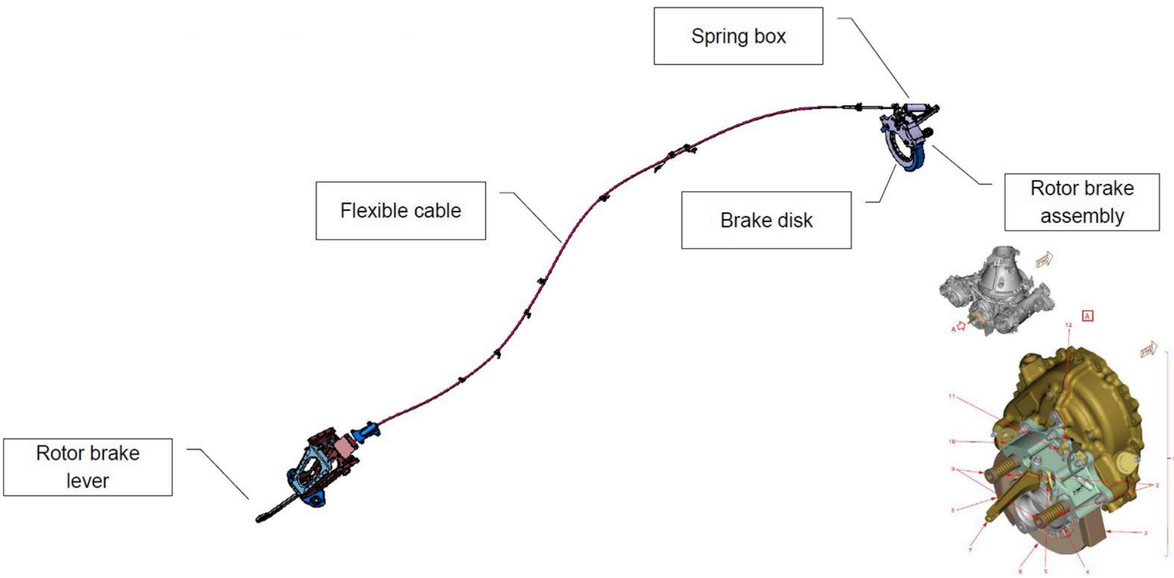


Figure 2

Rotor brake system from EC175
(courtesy of Airbus Helicopters)

The rotor brake consists of a calliper assembly attached to the rear of the main rotor gearbox, which acts on a floating brake disc splined onto the tail rotor output shaft (Figures 3 and 4). When the cockpit rotor brake lever is moved to ON, it pulls on a spring box attached to the brake calliper lever. The spring box is used to apply a progressive force to the brake calliper lever as the cockpit lever is moved, it also allows compensation for brake pad wear. The movement of the calliper lever acts on the back of the rear brake pad, referred to as the mobile pad, moving it forward and clamping the brake disc between it and the forward brake pad, known as the fixed pad. The mobile pad moves along two sprung guides. The springs move the mobile pad backwards, releasing the brake, when the rotor brake lever is moved to the OFF position. To allow for in-service wear, the spring box can be adjusted during maintenance.

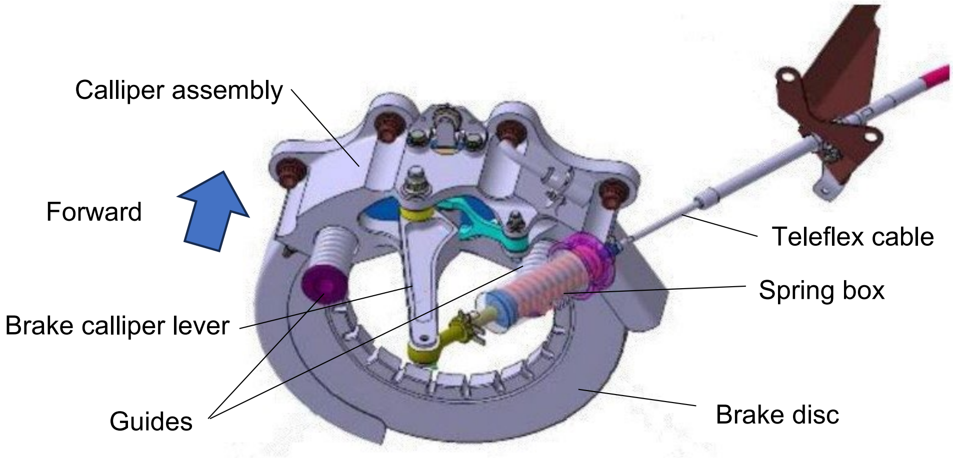
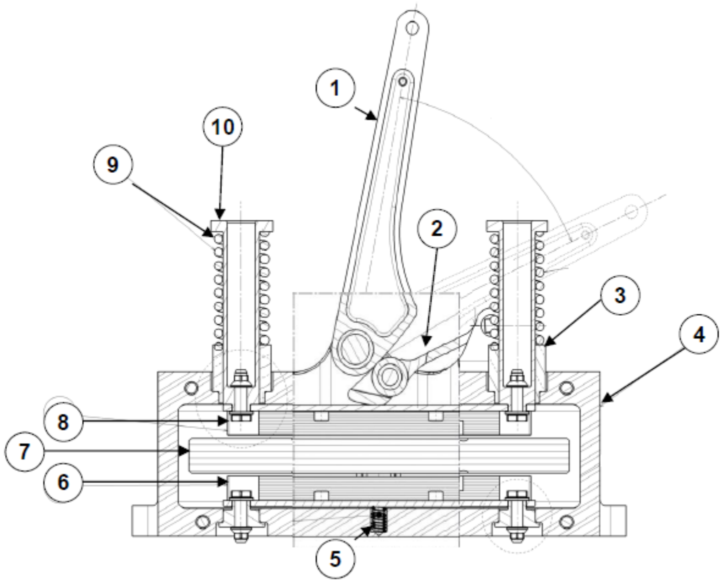


Figure 3

EC175 rotor brake assembly
(courtesy of Airbus Helicopters)



Lever	1
Balancer	2
Ring	3
Stirrup	4
Spring fix pad	5
Fixed pad	6
Disk	7
Mobile pad	8
Pad spring	9
Pad guide	10

Figure 4

Cross section of EC175 rotor brake assembly viewed from below
(courtesy of Airbus Helicopters)

The rotor brake should only be activated with the engines shut down and the rotor rpm less than 50% N_R. However, in an emergency the rotor brake can be used from 100% N_R but would require assessment by maintenance if it were applied at an N_R greater than 50%.

Rotor brake performance and monitoring

The Aircraft Maintenance Manual (AMM) states the acceptable rundown time range to the rotors being stationary is between 20 to 40 seconds. To stop the main rotors 40 seconds after having applied the rotor brake at an N_R of 50% (139 rpm) required that the N_R reduced at an average rate of 1.25 %/sec (3.5 rpm/sec).

A review of the CVFDR flight data showed the following for G-MCSH:

Date	Average reduction speed %/sec (rpm/sec)
13 March 2022	0.61 (1.7)
25 June 2022 to 4 July 2022	1 (2.8)
11 January 2023 to 16 January 2023	1.4 (3.9)
30 January 2023 to 31 January 2023	1 (2.8)
7 February 2023 to 16 February 2023	0.7 (1.9)

Table 1

Rotor brake average stop rate for G-MCSH

The operator advised that the performance of the rotor brake was monitored by the helicopter manufacturer as part of the HUMS. Once a week the helicopter manufacturer provided a report to the operator detailing findings and actions required. On 13 April 2022 the performance of the rotor brake fitted to G-MCSH was identified as having an adverse trend and this led to its subsequent replacement on 17 April 2022. No further notifications of findings or maintenance actions were raised by the helicopter manufacturer. However, on 8 February 2023, the manufacturer enquired if any maintenance had been performed on G-MCSH's rotor brake. The operator confirmed that on that morning a scheduled 100 flight hour general visual inspection had been carried out with *'no defect reported'*. The manufacturer responded by advising that it would *'provide a rotor brake adjustment ifs [sic] the data starts a new trend'*.

The operator had noted, across its EC175 fleet, that FDCR data for the period when the rotor brake was applied was not always available. It considered that this had reduced the effectiveness of the HUMS to monitor brake performance. Following the incident the operator implemented additional monitoring, requiring pilots to record the brake stop time following each shutdown. If the stop time was subsequently found to exceed 40 seconds a check of the brake and its adjustment was made.

Chip detection

Debris monitoring within the helicopter gearboxes is achieved by an array of magnetic plugs within the various oil wetted areas. These magnetic plugs are designed to detect and retain any chips of magnetic material that are liberated into the oil system from, for example, the gears or bearings in their associated gearbox. The chip detector in the TGB provides an amber 'XMSN CHIP' caution to the flight crew when debris of sufficient size, or accumulation, is detected.

A 'XMSN CHIP' caution is annunciated on the FND Master List along with an audio tone, indicating that one or more metal particles are present on any of the detectors in the Intermediate Gearbox (IGB) or TGB. Section 3.7 of the flight manual (FM) describes actions on transmission system failures. Upon the XMSN CHIP caution illuminating it instructs pilots to avoid extended hover flight and to limit the duration of the flight, being prepared for the TGB temperature to increase. It separately instructs that if the temperature exceeds 120°C to land as soon as possible and within a maximum flight time of two hours. The estimated return flight time to Aberdeen was one hour forty-four minutes.

Wind strength limits and tie downs

Section 2.4 of the FM identifies the rotor starting and stopping limitations (Figure 5). This states that the maximum wind strength for starting or stopping is 35 kt unless the wind direction is within a 60° arc centred on the nose of the helicopter, in which case the rotor can be started or stopped in wind up to 60 kt. The operator imposed a limit of 25 kt and 50 kt respectively to add an additional safety margin.

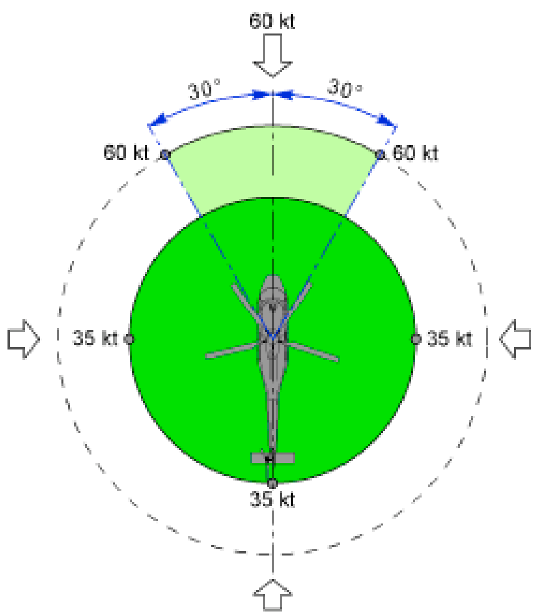


Figure 5

EC175 rotor starting and stopping wind limitations.

In addition, the FM also provides details of the mooring systems and the wind strengths at which the mooring systems should be used (Table 2). The configuration of the tie downs is shown pictorially in Figure 6.

The operator only carried main blade tie down straps on board each helicopter, but did not carry blade mooring poles. This was normal for flight operations to reduce weight and because helicopters were not expected to shut down offshore. It was not the responsibility of the helideck operator to store blade tie down kits or poles.

Helicopter mooring kits were required to be stored on offshore helidecks, details of which were included in CAP 437. Helideck owners were required to accommodate the types of helicopters operating to a particular platform and to fit the specific attachment points embedded in the helideck (Figure 7).

Wind strength	Securing of main rotor	Securing of airframe
Less than 35 kt	Rotor brake ON	None
35 to 65 kt	Rotor brake ON Main rotor blades mooring on helicopter with dedicated kit and ropes	Helicopter mooring on the ground using four mooring rings and eight mooring ropes
65 to 80 kt	As for 35 to 65 kt with additional blade mooring poles	As for 35 to 65 kt with two extra mooring rings and four extra ropes
Above 80 kt	Hangar the helicopter	

Table 2

EC175 mooring instructions for varying wind strengths

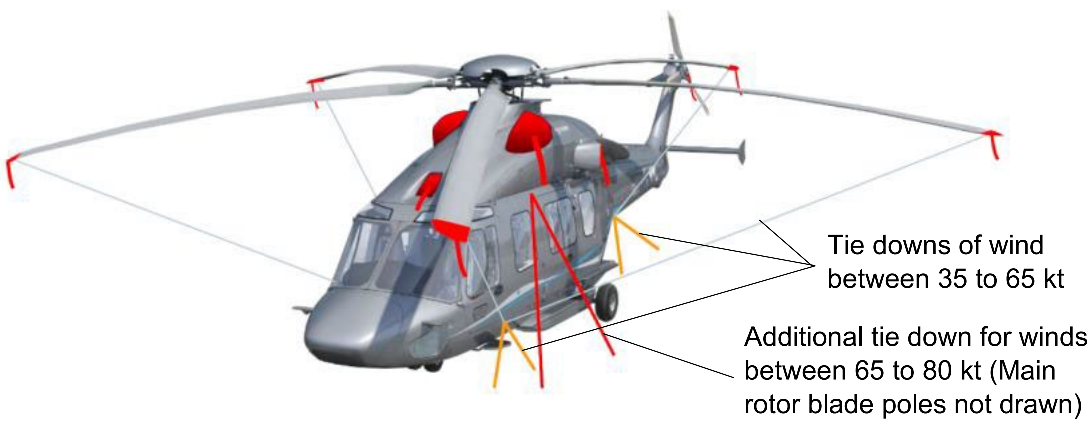


Figure 6

EC175 mooring for varying wind strengths

Figure 7

Attachment Point on Elgin PUQ Helideck

A Helideck Certification Agency (HCA) audit the day before the incident identified four ratchet straps stored on the helideck. They did not check whether the straps would fit either the EC175 helicopter or the helideck attachment points. There were no blade mooring poles stored on the platform.

Helicopter Examination

The four broken main rotor blades had all fractured in the aerofoil section just outboard of where the root transitions to the aerofoil. Each of the fractured blades had failed in bending associated with being forced upward.

The left side of the helicopter fuselage showed multiple impact marks indicating where the failed blades had struck it, including cracks and holes to the left pilot's seat door window and the loss of the external emergency door handle.

Tail rotor chip detection

On removal of the TGB chip detector, it was found that a fragment of a spring reinforced seal was the cause of the TGB XMSN CHIP caution (Figure 8). The sliding collar assembly fitted to the TGB on G-MCSH had previously been replaced due to a similar seal fragment causing a chip caution. This was associated with the failure of a seal, damaged when the sliding collar assembly was fitted.

Figure 8
Fragment on tail rotor gearbox chip detector

Rotor brake

The rotor brake was found to be partially seized, such that when the brake was applied only one of the pad springs would compress. This resulted in uneven pressure being applied to the brake disc, thus reducing the braking force that could be applied to slow and stop the rotor system. The spring box setting was measured to be 15 mm in comparison to 18–20 mm when the brake is setup in accordance with the AMM.

The rotor brake was removed from the helicopter and returned to the helicopter manufacturer's facility for testing and further assessment.

Rotor brake testing

The rotor brake assembly and brake disc removed from G-MCSH were fitted to a main gearbox. With the gearbox stationary the brake was activated by applying a load to the spring box. The torque required to overcome the braking force was then measured to determine the static braking performance. This was completed for steadily increasing spring box loads up to and beyond the AMM initial settings and included the spring box setting measured after the incident.

Similar testing was also completed with the following four configurations (results presented in Figure 9):

- Configuration 1 - a new brake and spring box, using a new disc and pads.
- Configuration 2 - the event rotor brake system with its spring box setting identified by a red cross in the Figure.

- Configuration 3 - a new brake and spring box fitted with a used brake disc and pads which had been rejected from service due to excessive rundown times[6].
- Configuration 4 - a new brake and spring box fitted with pads machined to be on the maximum wear limits.

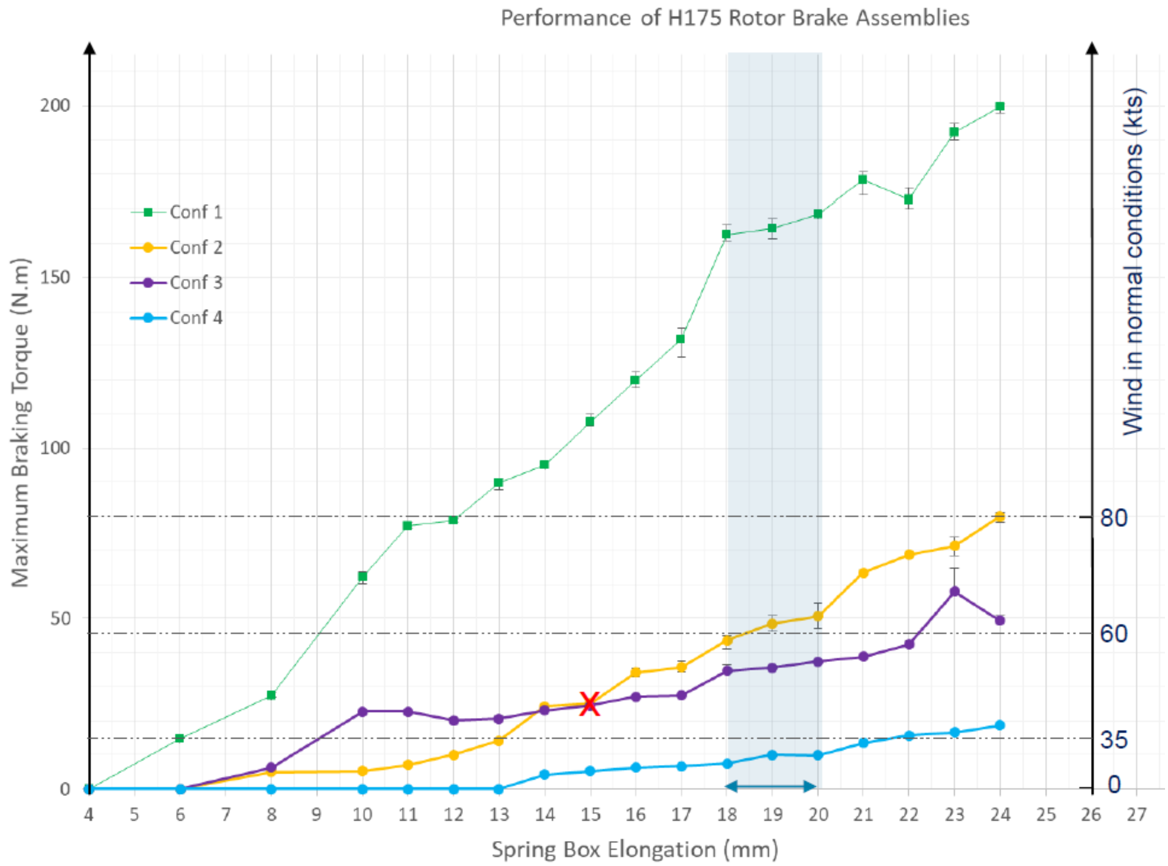


Figure 9

Breakout test results of rotor brake assemblies

The maximum braking torque, which was the torque applied through the gearbox when the brake started to slip, could be directly linked to the torque on the rotor head and equated to the load imparted on the rotor by the wind when acting horizontally within the arc of ±30° from the nose of the helicopter.

The results from the test showed that the new rotor brake performed well, however the brake fitted to G-MCSH, when set at 15 mm spring elongation and the other ex-service brake components used for the testing, did not fulfil the braking requirements to hold the rotor in winds above 60 kt, even when the spring box elongation was up to 2 mm above AMM settings.

Footnote

6 The wear on the disc was found to be 10% more than limits and the pad thicknesses were within limits.

Rotor Brake assessment

After the testing the brake assembly fitted to G-MCSH was subject to detailed examination at the helicopter manufacturer's facility with AAIB and Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (BEA) personnel present.

The examination identified that the right brake pad guide had seized in its ring and would not allow movement of the brake pad on that side. The left brake guide was free to move and, therefore, when the brake was applied, the mobile pad moved unevenly only contacting the disc over approximately 1/3 of the brake pad area (Figure 10). Similarly, the fixed pad exhibited uneven but opposite wear (Figure 11).

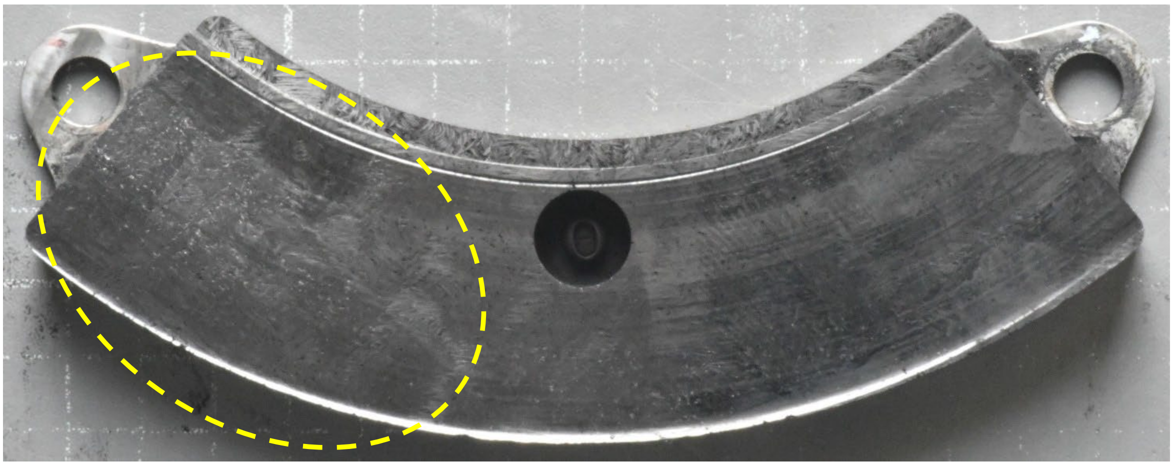


Figure 10
Mobile rotor brake pad showing area of most wear

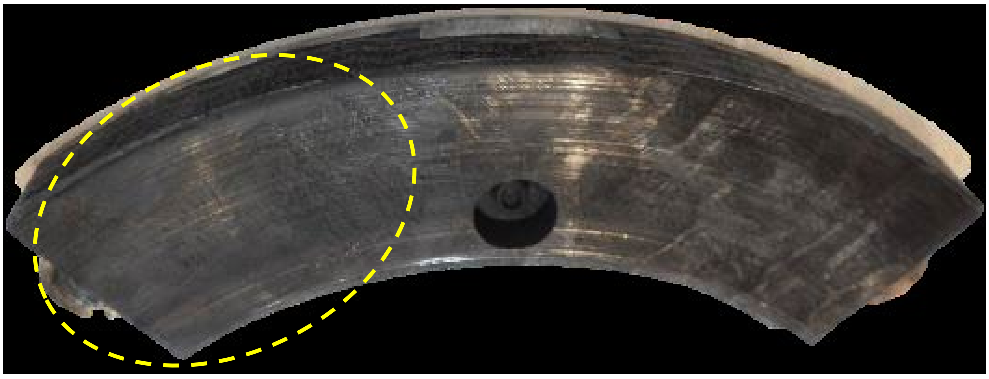


Figure 11
Fixed rotor brake pad showing area of most wear

Removal of the right pad guide from its associated ring required differential heating and considerable force to separate the components. The components were designed to move freely within one another but examination by the helicopter manufacturer's laboratory identified deposits of 'coked' organic products had caused them to seize (Figure 12). The origin of the deposits could not be determined.

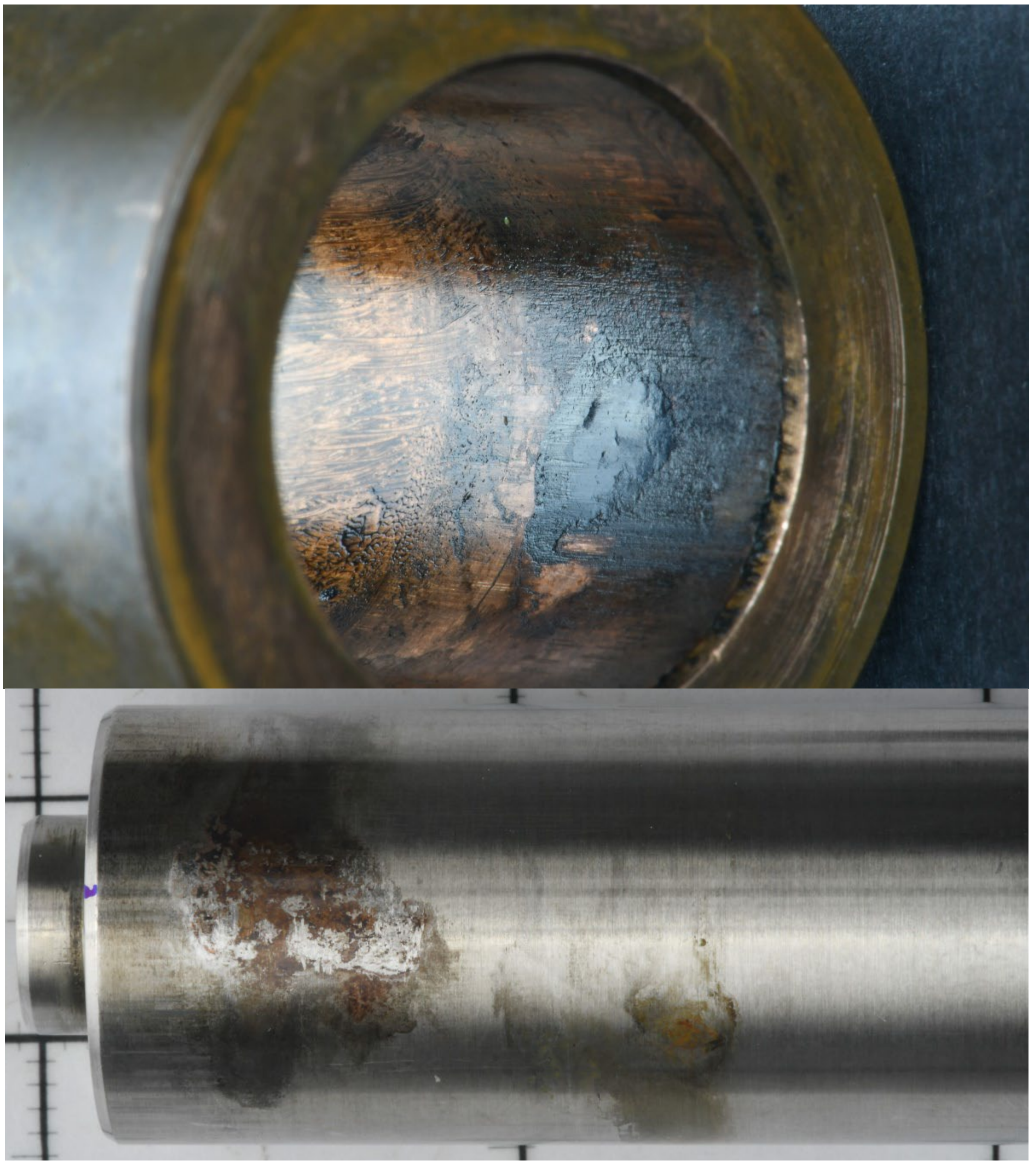


Figure 12

Fretting and deposits on inner diameter of ring (upper image) and associated damage on pad guide (bottom)

Airbus Safety Information Notice (SIN) No. 3947-S-00

On 11 October 2023 Airbus published SIN No. 3947-S-00 (Appendix 2) describing the ‘cliff edge’ effect that local topography can have on windspeed and direction. The phenomenon is where wind is funnelled over a structure causing an up draft. This updraft increases the wind incidence of the rotor blades causing them to lift furthermore into the updraft, exacerbating the issue (Figure 13).

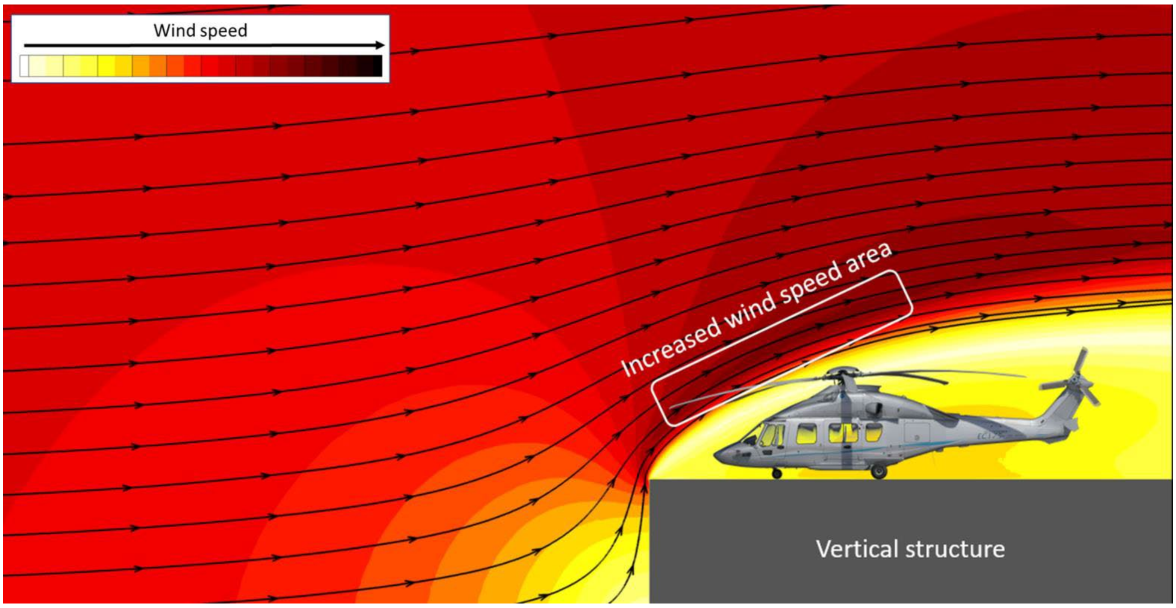


Figure 13

Extract from Airbus SIN 3947-S-00 describing cliff edge effect on rotor blades near the edge of vertical structures

The SIN emphasised the need to move helicopters away from the edge of landing areas on vertical structures when wind speeds were at or near the published limits, or to use an appropriate means of anchoring the helicopter.

CAP 437 - Standards for offshore helicopter landing areas

CAP 437 is a CAA publication first produced in 1981 to *'give guidance on the criteria applied by the CAA in assessing the standard of helicopter offshore landing areas for worldwide use by helicopters registered in the UK.'* It has been updated a number of times, the latest edition, Edition 9, being published on 9 February 2023.

Environmental effects

Chapter 3 contains guidance on the environmental effects to be considered in helideck design. It warns that effects, such as structure-induced turbulence, can seriously degrade the safety of helicopter operations. To limit this, it advocates careful attention to the design and layout of helidecks and, where necessary, the imposition of operational restrictions. Additional information is provided in a separate report (CAA Paper 2008/03 – Helideck Design Considerations – Environmental Effects) referenced in CAP 437.

CAP 437 advises that new-build platforms and modifications to existing platforms, with the potential to affect the airflow around the helideck, should be subject to wind tunnel or Computational Fluid Dynamics (CFD) studies. Early editions of CAP 437 set a limit on the vertical wind component to be encountered over the helideck of 0.9 m/s. Where this vertical flow limit was exceeded, it was intended that operational limits would be imposed to maintain adequate levels of safety. These might include limiting wind conditions for operating to the helideck to those where a vertical flow of 0.9 m/s could be achieved.

For standardisation, measurements of the vertical wind component were taken using a longitudinal free stream velocity of 25 m/s (approximately 50 kt) at main rotor height above the helideck surface across a virtual bounding box which should accommodate helicopter landing and takeoff decision points or committal points. The height of the bounding box is defined as the rotor height of the helicopter, plus the main rotor diameter and an additional 30 ft. The width of the bounding box is not explicitly stated but should be taken to encompass the horizontal extent of the helideck. CAP 437 does not refer to average figures or specific areas of the bounding box when considering wind and turbulence limits.

The CAA study, CAA Paper 2008/02 – Validation of the Helicopter Turbulence Criterion for Operations to Offshore Platforms, reported in 2008 and led to a change to the criterion used in the assessment of wind effects. It specified a limit to the standard deviation of the vertical airflow velocity, in addition to the steady vertical flow velocity which had previously been set at 2.4 m/s, incorporated into the fifth edition of CAP 437, published in August 2005.

A further change was made in the sixth edition of CAP 437, published in December 2008, reducing the standard deviation limit to 1.75 m/s. This was *'to allow for flight in reduced cueing conditions, for the less able or experienced pilot, and to better align the associated measure of pilot workload with operational experience'*. This limit was expected to be readily exceeded and was therefore intended more as a lower limit to raise awareness of potential turbulence, whilst the 2.4 m/s limit remained as an indicator of when design issues may need to be addressed to avoid operational limits being imposed. In addition, the 0.9 m/s vertical wind component criterion was removed as the CAA study 2008/02 had not been able to link the criterion to any helicopter performance (torque related) or handling (pilot work related) hazard.

Tie down points and straps

CAP 437 requires that a helideck is provided with sufficient flush fitting (when not in use) tie down points to secure the maximum sized helicopter for which the helideck is designed, in weather conditions meeting the installation's design considerations. In addition, it requires tie down straps to be held on the installation capable of safely securing a helicopter under these conditions and which fit both the helicopter and helideck tie down points.

Helideck air gap

CAA paper 2008/03 Section 3.4 refers to air gaps under the helideck and is reproduced below.

> ***'3.4 Helideck Height and Air Gap under the Helideck***
>
> *The height of the helideck, and the presence of an air gap between the helideck and the supporting module are the most important factors in determining wind flow characteristics. The helideck should ideally be located at a height above, or at least equal to, all significant surrounding structures. This will minimise the occurrence of turbulence downwind of adjacent structures. An air gap, separating the helideck from superstructure beneath it, promotes beneficial wind flow over the helideck. If there is not an air gap under the helideck, then wind conditions immediately above the helideck are likely to be severe, particularly if the helideck is mounted on top of a large multi-story accommodation block. It is the distortion of the wind flow around the bulk of the platform that is the cause. Based on previous research work it is recommended that the air gap on production platforms should be in the range 3m - 5m. Helidecks mounted on very tall accommodation blocks require the largest clearance, while those on smaller blocks and with very large helideck overhangs tend to require less. For shallow superstructures of three stories or less, such as often found on semi-submersible drilling vessels, a 1m gap may be sufficient. In combination with an appropriate overhang (see Section 3.3), the air gap encourages the disturbed airflow to pass under the deck leaving a relatively linear and clean flow over the top (see Figure 3).*

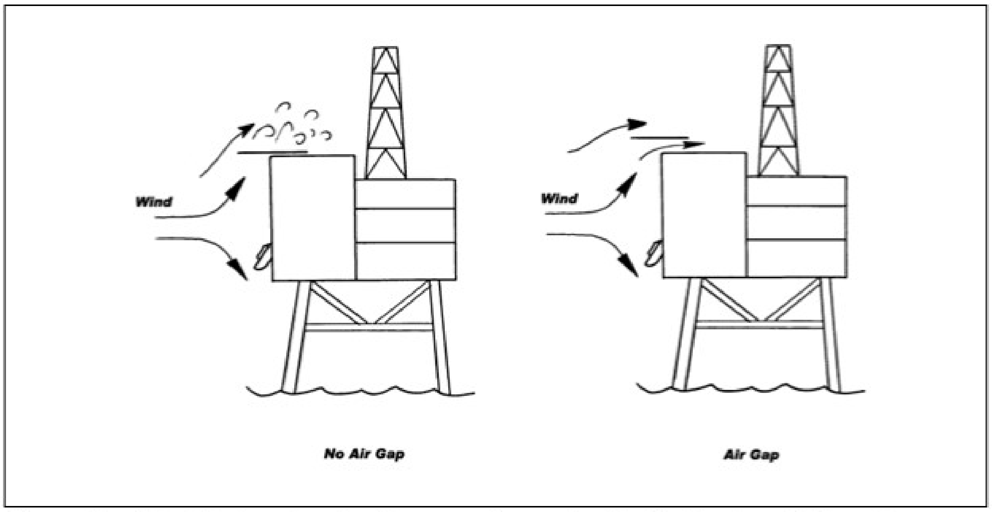


Figure 3 Sketch showing the flow passing under the helideck and clean flow over

> *It is essential that the air gap is preserved throughout installation operational life and does not become a storage area for bulky items that might obstruct the free flow of air through the gap'.*

Helideck Certification Agency

Helidecks are not licenced by the CAA and helicopter operators are responsible for ensuring offshore landing sites are safe to use. They achieve this through the HCA, a private company which audits each offshore landing site every two years against CAP 437, certifying landing sites that meet the required standards.

The HCA chairs a technical committee which reviews exceedances of environmental limits laid down in CAP 437 and decides on any operational limitations necessary to mitigate resulting safety risks. These limitations are then recorded in the helideck information plates published by the HCA. To assist in this work, pilots are able to complete turbulence reports when they encounter wind and turbulence conditions causing a problem. The HCA stated they had received no such reports for the Elgin PUQ.

In May 2023, the HCA published *'Technical Recommended Practice RP 003 – Provision, Rating and Use of Helicopter Tie Down Straps'* (Appendix 3). This was as a result of HCA audits finding varied or inadequate application on offshore assets of the relevant requirements in CAP 437. They have since stated their intention that, as part of their audits, they will ensure the number and type of mooring straps provided are sufficient to meet the aircraft mooring requirements. They will also check that the straps fit both the intended helicopter and the helideck attachment points. It remains the responsibility of the helicopter operator that aircraft carry adequate blade tie down equipment for the expected wind conditions and the means to attach them.

The Elgin PUQ helideck was re-certified by the HCA on 15 February 2023, two days prior to the incident. The checks were reported to include the air gap below the helideck, the weather measuring system on the platform, tie down points on the helideck and the provision of helicopter tie down straps.

The published HCA information plate for the Elgin PUQ (Appendix 4) detailed operational restrictions in place to ensure safe clearance from anti-turbulence panels fitted to the edge of the helideck during helicopter operations. It also included the possible turbulence effects created by the platform's turbine exhaust and exhaust stack. It stated the need to obtain accurate wind speed and direction early en route to plan the approach but made no reference to the restrictions on the accuracy of wind speeds from certain directions due to shielding.

Elgin PUQ Platform (EGEJ)

The Elgin PUQ platform is an offshore facility located in the North Sea about 135 nm to the east of Aberdeen Airport. It has a single helideck which is at an elevation of 166 ft (Figure 14). The helideck is situated on the south-west side of the platform where it is exposed to the prevailing wind.

Figure 14

Elgin PUQ platform helideck prior to addition of accommodation block
(used with permission of HCA)

Environmental considerations

It was apparent during wind tunnel testing of the original platform design in 1997 that the vertical wind component experienced by the helideck would exceed the 0.9 m/s limit recommended at the time by the CAA. A re-design, extending the helideck by 3 m, reduced, but did not eliminate, the problem and was used to construct the platform, which came into service in 2001. The extension was achieved by adding anti-turbulence panels to the edge of the main helideck.

In 2008 a CFD study was conducted to check the effect of adding an accommodation block under the helideck. This concluded that the resulting vertical wind component would exceed the still current CAA recommended limit of 0.9 m/s for a significant portion of the bounding box. The test results showed vertical wind components of 5 m/s, both with and without the accommodation block, at the windward edge of the helideck, but with the area affected increasing when the accommodation block was present. Similarly, when considering standard deviation of the vertical airflow velocity, both with and without the accommodation block present, areas of the helideck were above the 2.4 m/s limit. With the block present, the extent of the affected area increased so that the majority of the helideck was either at or above the CAA limit.

The CFD study considered only a limited number of wind directions, thought to be those most relevant to the new accommodation block. It calculated that the Elgin PUQ would experience winds of 25 m/s, as used in the study, 9% of the time. The study was performed without including the 3 m extension to the helideck. The extension had been created by adding turbulence panels around the edge of the helideck, but the report stated there was not enough information provided on them for their inclusion in the modelling. It stated that their presence would be expected to reduce the turbulence and velocity gradients at the leading edge of the helideck. Much of the report's analysis relied on averaging vertical wind speeds and standard deviations throughout the bounding box as well as looking specifically at those at rotor height. For the study the rotor height used was for the EH101, 4.7 m above the helideck (rotor height for the EC175 is 3.48 m). The accommodation block was later added (Figure 15).

Figure 15

Elgin PUQ platform helideck showing accommodation block
(courtesy Total Energies E&P UK Limited)

The HCA did not hold a record of the wind tunnel or CFD studies, but they did hold a record of operational procedures being put in place in November 2000, at the time the Elgin PUQ was originally constructed. This was to address the infringement created by the presence of the anti-turbulence panels. There is no record of any other review to assess any operational requirements due to the strength of the vertical flow component or potential turbulence, either at the time of the original construction or when the accommodation block was later added.

It is not clear what environmental information was passed to the operator contracted to fly to the Elgin PUQ at the time it became operational. The operator then subsequently changed to that involved in the incident and they confirmed they were unaware of any of the environmental studies that had taken place. There were no environmental limitations imposed on the EC175 operating to the platform, either by the operator or in the HCA plates, at the time of the incident.

Air Gap

A HCA audit of the Elgin PUQ helideck the day prior to the incident estimated an air gap present of about 5 m. The air gap was not fully open on all sides with structure obstructing the gap on the north-east side. Photographs also showed a fuel tank stored under the helideck.

Helimet

Helimet is a weather reporting system collating information provided by different offshore platforms, including the Elgin PUQ. It can be accessed by registered users, such as the operator of G-MCSH, with information being stored for 30 days before being deleted.

Weather reporting

Annex E of CAP 437 provides guidance on the meteorological measuring equipment to be used offshore. It requires a platform to be served by a primary anemometer positioned in an unrestricted air flow. If the location of the primary anemometer is obstructed, then a second anemometer should be fitted at a location in an unrestricted airflow to cover any compass point that may be obstructed from the primary wind sensor. The wind speed measurement should be to an accuracy of within ±1 kt, or ±10% for wind speeds in excess of 10 kt, of the actual wind speed (whichever is the greater).

The Elgin PUQ had two wind sensors (Sensor A and Sensor B), due to shielding, with the sensor providing the highest reading being used as the reported wind speed. A site visit, conducted in October 2022 by the manufacturer of the weather measuring equipment, found the wind sensors were operating properly and within the required accuracy limits. They, however, commented on their position and the need, identified in April 2015, to reposition them to less shielded locations. It considered that where they were positioned at the time of the visit, they may be subject to lower wind speeds than experienced on the helideck itself. The report stated that wind Sensor A was shielded between 080-160°, due to the platform and northern crane, whilst Sensor B was shielded between 080-300° due to a flare stack. Readings were therefore potentially affected when the wind direction was between 080-160°, due to the combined shielding of the sensors.

When questioned, the platform owner stated that one of the anemometers had been raised by 10 m in 2017 and that cabling work had now been completed for the installation of two additional anemometers on the flare stack later in 2025. When questioned, the company that had carried out the check in October 2022 later reported that both sensors had been raised in 2017 by 3 m, with '*a positive effect*'. The same company separately commented that, due to the complexity of their structures, many offshore platforms suffer from problems associated with shielding of anemometers. They reported that this may result in measured wind speeds being lower than they actually are. Equally, some structures could amplify ("funnel") wind speeds at certain locations, in which case the wind speeds measured at the sensor could be higher than those at the helideck. They were looking into new technologies to hopefully resolve this issue, including the use of Lidar.

Examples were provided of wind reports from two groups of platforms which showed inconsistent variations in wind speed, in one case one within 7 nm and one within 10 nm of each other. These differences were thought unlikely to be simply due to variations in the weather. The identification of significant differences in wind reports from nearby platforms would allow users to be notified. It would also allow anemometers in poor airflow to be recognised and remedial action taken. To achieve this the following actions were proposed:

- A manual review of historical data to identify stations where wind data is often different from nearby sites.
- Implementation of a “Sensor Shielding Detection” tool which analyses wind speed/direction patterns to automatically identify sectors where wind speed is less than expected (considering typical climatological patterns throughout the North Sea).
- Helimet to display a warning when producing a weather report if another location within a certain distance is reporting a wind speed that is significantly different from the current location.

The first two points would need to be agreed and financed by the relevant parties before they could be undertaken, but the company involved in the management of the Helimet system intends to implement the final point during the first half of 2025.

Meteorology

The area of operation was affected at the time of the incident by Storm Otto. This initially brought south-westerly winds to the area which veered, becoming north-westerly late in the morning as the area of low pressure moved eastwards. An aftercast obtained from the Met Office reported that at Aberdeen Airport, gust speeds were forecast to peak between 0600-0900 hrs at 64 kt, although the highest gust actually observed was 51 kt. Offshore, wind speeds of 55-65 kt at 0600 hrs were forecast, increasing to 70-80 kt at 1200 hrs.

The reported Helimet wind speed on the Elgin PUQ when G-MCSH landed was approximately 240° at 40 kt, gusting to 49 kt, and on shutdown was approximately 240° at 38 kt gusting to 48 kt.

The sea state at the time the helicopter landed was reported by the on-station Emergency Response Rescue Vessel to be below the CAA recommended operating limit of sea state 6 (a significant wave of height 4-6m)[7]. At about 0935 hrs, 1.5 hrs after the helicopter had landed, the same vessel reported sea level wind speeds gusting to 50-60 kt.

The 10-minute averaged wind speeds for the Elgin PUQ and two neighbouring platforms are presented in Figure 16. The Shearwater platform is 4 nm east-north-east and the Culzean platform is 11 nm north of the Elgin PUQ.

Footnote

[7] CAP 1145 - CAA Safety review of offshore public transport helicopter operations in support of the exploitation of oil and gas.

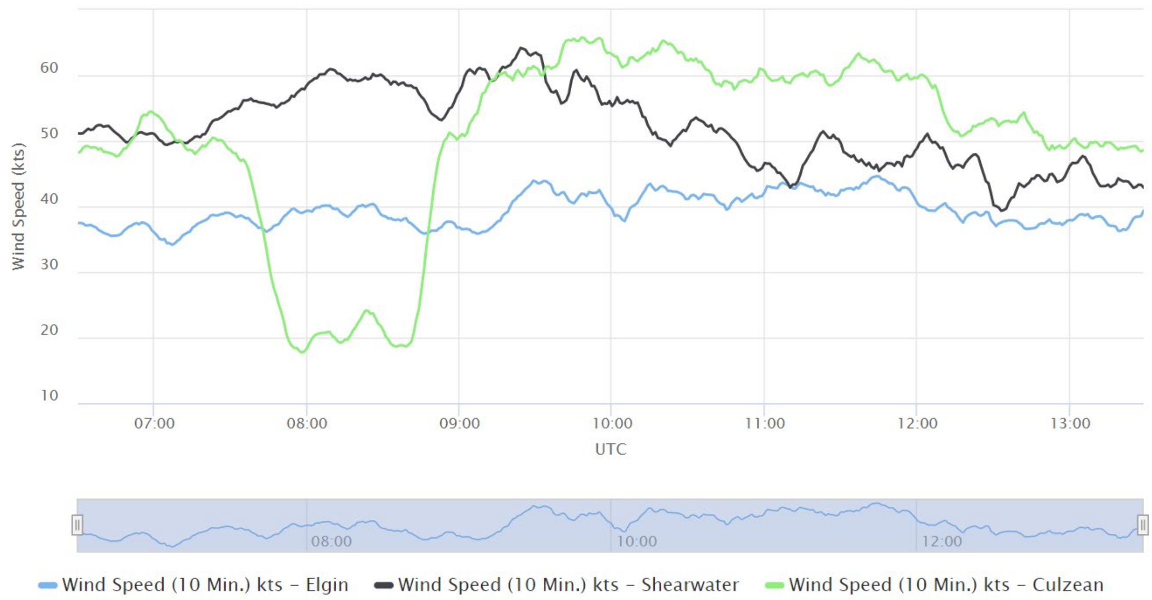


Figure 16

Ten-minute Averaged Wind Speeds for Elgin, Shearwater and Culzean Offshore Platforms

The wind measured at the Shearwater platform between 0700-1000 hrs is consistently about 15-20 kt greater than that measured at the Elgin PUQ. The wind speed displayed by the helicopter's FMS of 56 kt during landing is more closely aligned to the wind recorded at the time on the Shearwater platform of 60 kt than the 40 kt recorded at the Elgin PUQ. The wind measured at the Culzean platform is similar to that at the Shearwater platform, other than during the unexplained drop in the windspeed between about 0730-0900 hrs.

It has not been possible to explain the discrepancies between the three platforms through any technical issues, but they may be due to localised weather effects. Similarly, it has not been possible to explain the drop in windspeed recorded on the Culzean platform between about 0730-0900 hrs. Further comparisons since the event have not identified significant general differences in reported wind speeds between the three platforms. However, on 22 January 2024, the area was affected by Storm Isha and similar differences in wind were once again noted by the operator. They reported that at 0555 hrs the Elgin PUQ was reporting a wind of 43 kt with no gusts whilst the Shearwater, 4 nm away, was reporting winds of 62 kt, gusting 75 kt.

Previous incident

On 8 December 2011, a EC225LP helicopter (G-CHCM) operated by a different company, landed on the Elgin PUQ due to a tail rotor gearbox problem. The helicopter could not be repaired in time to avoid being affected by strong winds of 65-70 kt. The helicopter was moored to the helideck and blade ties were fitted to the main rotors. It was reported that there was difficulty attaching the mooring straps to the anchor points set into the helideck as the anchor points were too small for the attachment points on the straps. A number of the anchor points were also reported to be overpainted or corroded.

One of the blade tie downs could not be properly attached and the affected blade subsequently partially detached from the aircraft. Overnight, the wind speed increased to 90 kt, snapping one of the blade tie ropes.

The published weather limits for the EC225 required the main rotor blades to be tied down between 35–60 kt and in addition to have blade poles attached between 60-80 kt. Above 80 kt the main blades should be removed or folded and secured.

Other information

A paper by Newman in 1995[8] described the blade sailing phenomena experienced. It stated:

> *'Should the weather be calm then as the rotor speed varies the centrifugal and aerodynamic flapping moments are dependent on the square of the rotor speed. The balance between them is maintained and the blade flapping remains under control. However, if the weather is inclement then the wind speed will rise and the aerodynamic forces will increase. Since the centrifugal restoring moment is wholly dependent on rotor speed the two effects will go out of balance and the blade flapping can grow quite markedly. When the airframe experiences a horizontal wind then the blade flapping is not too alarming. However, if a vertical wind component is generated through the disc the blade flapping motion will become excessive and the fuselage, flight crew and any ground personnel are under a distinct threat.'*

Analysis

Decision making

The crew reported that the forecast winds used when planning their flights were within their company limits. Information from the aftercast indicates that the wind conditions were forecast to be near, if not slightly above, the landing limit of 60 kt, however, the crew had the option of not landing and returning to Aberdeen had they encountered winds in excess of 60 kt on reaching the Elgin PUQ.

The wind speed provided by the Elgin PUQ when they were en route was 36-46 kt for the helideck, with the FMS giving a maximum speed of 60 kt during their approach to land. This confirmed to the crew they were still within limits to land and change passengers. They were indeed able to make an apparently uneventful landing and passenger transfer.

The detection of a TGB chip still allowed continued operation of the helicopter, but this would have meant a flight with a problem of unknown severity into strong headwinds, with no opportunity of easily diverting should the situation escalate. As the helicopter was already on the platform it seemed appropriate to shut down and await engineering support, even though the helicopter would be unsheltered as the storm passed through. In making this decision, it was expected that it would be possible to safely secure the helicopter to the

Footnote

8 Newman, S (1995) 'An investigation into the phenomenon of helicopter blade sailing'. Available at: https://eprints.soton.ac.uk/458800/1/86973.pdf [Accessed 7 May 2025]

helideck and apply the rotor blade tie down straps. It is only with the benefit of hindsight that it became clear that the cause of the chip detection would not, in itself, have caused an issue had they decided to continue back to Aberdeen.

When considering this chain of events, what remains unclear is the cause of the apparent break down in communications which resulted in the lack of investigation of the fault with the rotor brake prior to departure at Aberdeen. This had become apparent when the helicopter was towed out of the hangar and, had this been done, then it is likely the helicopter would not have dispatched in the first place.

Rotor brake

Having decided to remain on the platform, the failure of the rotor brake to operate effectively allowed the rotor head to continue turning. The investigation found that the rotor brake right pad guide was seized within its ring, the cause of which was identified to be a build up of organic material at the interface between components.

When the rotor brake was applied by the pilot, the lever on the brake assembly moved applying a force to the back of the mobile pad. With only one pad guide allowing brake pad movement, the brake pad was unable to translate symmetrically. It, therefore, was deformed in bending, allowing approximately 1/3 of the normal contact area of brake pads to act on the brake disk, significantly reducing the brake's effectiveness. This resulted in the brake being unable to stop the rotor when it was being driven by the wind passing through the rotor disc. It is also likely that the prevailing wind acted through the tail rotor, further driving the transmission and increasing the load acting on the rotor brake.

The origin of the organic material that caused the seized pad guide could not be determined, but it is possible that the guide was seized in the weeks preceding the event, as indicated by the increased rotor slow down time, prior to the event. Although the manufacturer had identified a change on 8 March 2023, there were no reported issues with the assembly when a 100-hour general visual inspection was carried out, however, this was a static assessment with no requirement to apply the brake. If brake application had been part of the visual inspection, it may have enabled the identification of the seized brake pad guide and caused it to be replaced.

> Since the incident, the operator has taken safety action by requiring pilots to record the rotor stop time after brake application on each shutdown. If the stop time was found to exceed 40 seconds a check of the brake and its adjustment is required.

After considering the findings from the investigation, the helicopter manufacturer is working to improve the rotor brake maintenance procedures. The changes include:

- The introduction of a functional test of the rotor brake in the 100-hour visual inspection.
- Increasing the frequency between conducting the braking time check from 400 flying hours to 200 flying hours.

- Revising the dimensional criteria for the brake disc and pads.
- Revising the setting criteria of the spring box.

The following Safety Recommendation is made to address the maintenance procedures:

Safety Recommendation 2025-003

It is recommended that Airbus Helicopters expedite the inclusion of the improved rotor brake maintenance procedures in the EC175 Aircraft Maintenance Manual.

The manufacturer is also undertaking a design study to determine the feasibility of an upgraded or new rotor brake design.

Blade sailing

The forces generated by the wind passing through the rotor disk, possibly exacerbated by the wind effect on the tail rotor, were sufficient to overcome the braking force being applied by the rotor brake. With the blades continuing to turn it was not possible to apply the tie down kit carried on the helicopter, leaving the blades free to flap. The relative airflow brought about by the advancing blade meeting the strong wind caused aerodynamic forces on the blade to produce lift, causing the blade to 'sail'. The blade tips followed an ever-increasing arc upwards, beginning at the nose of the helicopter through to an apogee of approximately 40°, where they begin to 'flap down' at an increased downward trajectory. The blade sail phenomena increased to a point where the underside of the blades were exposed to the natural wind forces, bending the blades ever higher, until they failed in bending through excessive aerodynamic loading without the restorative centrifugal load associated with normal operational rotor speeds.

Helicopter mooring and blade tie down

The decision to moor the helicopter to the helideck was in accordance with the manufacturer's procedures. CCTV images showed the helicopter rocking and tilting to the left prior to the straps being attached and it is considered that without being tied down the helicopter would have blown over.

The HCA audit reported the presence of tie down straps on the helideck, but not their suitability. This led to delays in obtaining other straps from the platform which were still both difficult and time consuming to attach to the anchor points on the helideck. The platform operator has been unable to explain why the tie down kit kept at the landing area did not fit. The delay in finding straps resulted in personnel having to work in worse conditions than necessary, endangering themselves, the helicopter and the platform. As it was, the first blade that detached only narrowly missed hitting one of the team with potentially serious consequences.

The HCA audit also did not take account of the need for additional straps as well as blade mooring poles in order to provide proper protection in wind speeds above 65 kt.

> The HCA has taken action to address issues highlighted by this incident including publishing recommended practice on the matter. They have committed to ensure future audits confirm the suitability of mooring straps provided, including checking that they would fit both the helicopter and helideck anchor points.

These audits would also ensure that all the necessary types and levels of equipment were present to provide protection at higher windspeeds, as detailed in CAP 437. This will require closer co-operation between the operator, helideck owner and HCA to identify exactly what equipment is required. The fact that only four straps were present and accepted by the audit when twelve should have been provided confirms this change is needed.

As was seen in the incident in 2011 at such windspeeds, without the correct equipment in place, or appropriate actions taken, damage is likely to be caused.

Wind Effects

It is apparent from the wind testing carried out when designing the Elgin PUQ, and the subsequent addition of the accommodation block, that the windward edge of the helideck was subject to vertical wind speeds considerably in excess of the limit in force at the time. This, and the indicated turbulence levels meant consideration should have been given to applying operational limits to the helideck. Whilst there were no apparent problems reported by the initial helicopter operator to the platform, future operators should have been appraised of these exceedances so that they too were in a position to make any necessary operational changes. This is especially so when a different type of helicopter is used and a lack of previous issues may become irrelevant. This also highlights the importance of suitable records being retained by the HCA, such as wind studies and related operational discussions, to allow for future reference.

The limits described in CAP 437 were intended only for consideration of flying operations. Despite this, the fact the vertical flow exceeded the limit so substantially at the windward edge of the helideck, highlights the *'cliff edge effect'* described by SIN 3947-S-00.

The presence of the air gap should have helped mitigate such an effect on the wind. The effectiveness of the air gap on the Elgin PUQ was compromised by obstacles preventing a free flow of air under the helideck. Removing these obstacles where they are part of the platform structure is impractical, but efforts should be made to remove any other obstacles present that may reduce the gap's effectiveness. It also serves to emphasise the importance of such matters in the design and construction of platforms and any alterations made to them.

The CFD report's reliance on average values and values at main rotor height in its analysis does not comply with CAP 437's own requirements. In addition, the report tested only limited wind sectors and comprised modelling without the helideck turbulence plates in place.

In response to these findings the HCA will re-assess the CFD report against current requirements and ensure that any necessary operational restrictions are in place. It also acknowledges gaps in its own historic record keeping which it intends to address through improved internal procedures.

Wind reporting

During the period of the final approach and landing, the Helimet wind speed for the Elgin PUQ indicated 40 kt gusting to 49 kt. This differed from the helicopter's FMS derived wind speed, which peaked at 60 kt during the approach, before reducing slightly to 56 kt when landing. The Helimet data for the Shearwater platform, which was 4 nm from the Elgin PUQ, indicated a wind speed of 60 kt; consistent with that calculated by the FMS.

The unexplained difference in windspeeds between adjacent platforms meant it is possible the windspeeds on the Elgin PUQ were higher than those actually reported. The wind was not from a direction known to be affected by shielding, although this may still have been a factor. The record keeping related to the positioning of the anemometers on the Elgin PUQ in response to the findings in 2015 did not allow a proper assessment of improvements that had reportedly been made after they were repositioned in 2017. The addition of a further anemometer later in 2025 will be some ten years after this problem was first raised, an excessive time period for such action to be taken, even when taking into account the initial anemometer re-positioning work in 2017. When this is finally done, it is hoped it will further enhance the accuracy of wind readings on the platform.

Irrespective of the cause, it is considered the windspeed recorded on the Elgin PUQ at the time of the storm passage was likely to have been lower than actually experienced. Evidence indicates this situation is a wider issue affecting other platforms at various times and under various conditions. In order to ensure such differences can be identified and affected helicopter operations alerted, the following Safety Recommendation is made:

Safety Recommendation 2025-004

It is recommended that Leading Offshore Energy Industry Competitiveness Limited incorporates comparative wind speed analysis as part of the Helimet quality control and notification system.

Loss of chronological flight data recording

Testing showed that the loss of chronological recording of flight data by the FA5000 CVFDR was a result of the internal brownout capacitors not reaching their fully charged state prior to external electrical power being removed. This led to the corruption of memory pointers and associated loss of chronological recording.

In 2021, the manufacturer of the CVFDR introduced software part number 840-E5498-12. This was to resolve an image data recording anomaly found during testing of an FA5000 recorder on a EC225 helicopter, for which the cause was identified as the helicopter's electrical input power profile to the recorder. Testing in support of this investigation demonstrated that software part number 840-E5498-12 also resolves the loss of chronological flight data recording on FA5000 CVFDR recorders.

To date, a loss of chronological flight data recording has been identified on EC175, EC155 and UH-72 helicopters fitted with FA5000 CVFDRs. The EC145 helicopter model may also be similarly affected. This equates to more than 700 helicopters.

The input power profile which led to the corruption of memory pointers was not included in the electrical test requirements applied during approval of the FA5000 CVFDR. The reason that the electrical input power profile subsequently differs on occasion from that expected by the helicopter manufacturer is not known. Testing has demonstrated that only one short duration application of power can result in the loss of chronological flight data recording on FA5000 CVFDRs that are not installed with software part number 840-E5498-12.

It is possible that other helicopter and fixed wing aircraft types equipped with FA5000 CVFDRs could also be affected by an undetected loss of chronological recording. This is because maintenance detailed by the CAA and other aviation authorities, requires only that data from the last flight is checked. If this guidance is followed, it will not detect the problem if it exists.

When a loss of chronological recording occurs on an the FA5000 CVFDR, only the most recent 15 hours of flight data will be available undisrupted. This complies with the EASA and UK CAA requirement of a minimum 10-hour recording duration for flight data on helicopters. This is, however, less than the 25 hours required by the FAA for both fixed wing aircraft and helicopters. Therefore, the following Safety Recommendation is made:

Safety Recommendation 2025-005

It is recommended that the Federal Aviation Administration set a compliance date by which every Acron Aviation FA5000 Cockpit Voice and Flight Data Recorder will be installed with software part number 840-E5498-12 (or equivalent) that ensures the correct recording of chronological flight data.

The loss of chronological recording, however, means that the 25 hour recording duration required by the EASA for fixed wing aircraft is not met. Whilst the 10 hour recording duration is met for helicopters, it is important that flight recording systems operate correctly so that accident investigators have full access to complete chronological flight recordings. Therefore, the following Safety Recommendation is made:

Safety Recommendation 2025-006

It is recommended that the European Union Aviation Safety Agency set a compliance date by which every Acron Aviation FA5000 Cockpit Voice and Flight Data Recorder fitted to European Union Aviation Safety Agency certified fixed wing aircraft and helicopters are to be installed with software part number 840-E5498-12 (or equivalent) that ensures the correct chronological recording of flight data.

5 second loss of flight recording at 10-minute intervals

The investigation has identified that the ARINC 717 loopback signal provided by FA5000 CVFDR and FDR models is out of specification when the data rate is at 512 or 1,024 words per second (wps). This, in conjunction with the operation of the Helionix software Version 8 equipped to EC175 and EC145 helicopters, results in the loss of 5 seconds of flight data every 10 minutes whenever the Aircraft Management Computer (AMC) has been continuously operating for a period of more than 3 hours 15 minutes when at a recording rate of 512 wps. At the higher data rate of 1,024 wps, which the manufacturer is intending to implement, the 5 second data loss would occur after about 40 minutes of AMC operation.

The loss of 5 seconds of flight data significantly exceeds the maximum specified by EUROCAE specification ED-112, on which the FA5000 FAA Technical Standard Order (TSO) and European TSO (ETSO) approvals are based. This loss of data could significantly impede an incident or accident investigation.

The helicopter manufacturer is working on an update to its Helionix software that will prevent flight data losses. However, no end date for completion of these activities, or embodiment on affected helicopters, has been set by national aviation authorities. Therefore, the following Safety Recommendations is made:

Safety Recommendation 2025-007

It is recommended the European Union Aviation Safety Agency, with an appropriate compliance date, requires Airbus Helicopters to modify the FA5000 Cockpit Voice and Flight Data Recorder system fitted to EC175 and EC145 helicopters to prevent the loss of recorded flight data.

The manufacturer of the FA5000 CVFDR had advised that it was developing a modification that corrects the out of specification ARINC 717 loopback signal. However, it has since informed the AAIB that it now considers the fault may be due to other system integration issues and that its investigation was ongoing.

Irrespective of the manufacturer's consideration of the cause of the issue identified, the ARINC 717 loop back signal remains out of specification. It is possible that this could affect the correct operation of flight data recording systems installed on other helicopter types, as well as fixed wing aircraft, fitted with FA5000 series CVFDR or FDR models. Therefore, the following Safety Recommendation is made:

Safety Recommendation 2025-008

It is recommended that the Federal Aviation Administration, with an appropriate compliance date, requires Acron Aviation to correct the ARINC 717 loopback signal of the FA5000 series of recorders so that they comply with the specification requirements.

Conclusion

The investigation highlighted issues with wind reporting on the Elgin PUQ and other offshore platforms. No cause for these inaccuracies could be provided which remains a problem for operations relying on accurate wind information, especially when nearing high wind limits. Improved quality assurance would assist in identifying potential causes and allow notification where helicopter operations may be affected.

The cause of the TGB chip light would not have prevented continued operation of the helicopter, but this information was not known at the time and shutting the helicopter down on the offshore helideck was considered appropriate, despite the oncoming storm conditions.

An opportunity to identify the failure of the rotor brake prior to departure was missed which became a significant factor in the sequence of events leading to the blade failures. This led to an inability to apply the blade ties after shutdown on the platform, although these would not have necessarily prevented damage to the blades occurring due to the strength of the winds experienced. The investigation identified inappropriate and missing mooring equipment being kept on the platform. The HCA is taking action to address this, but will require the co-operation of the operator and helideck owner in doing so. There were also no blade mooring poles being carried on the aircraft in view of the high winds.

The rotor brake was found to be partially seized because of organic material build up on one of the brake pad guides, allowing restricted movement of the mobile brake pad and reduced braking force to slow and stop the rotor system when the rotor brake was applied. The cause of the organic material build up could not be identified.

A review of the environmental reports related to the construction of the Elgin PUQ and later addition of an accommodation block raised issues over exceedances of CAA limits and a lack of operational procedures to compensate. Both the operator and current management within the HCA were unaware of this information and they will now be carrying out their own review.

The loss of chronological flight data recording was caused by the helicopter's input power profile providing insufficient time for the FA5000 CVFDR brownout capacitors to achieve their fully charged state. A software modification to the CVFDR is available that corrects this. The CVFDR ARINC717 loop back signal was also found to be out of specification, for which the helicopter manufacturer's analysis showed that it resulted in a loss of flight data at 10 minute intervals. The helicopter manufacturer has provided a change to the flight recording system and intends to improve its Helionix software. The CVFDR manufacturer initially advised it was developing a hardware modification to resolve the loss of data, but subsequently advised it had stopped this activity as it considered the root cause may be due to other system integration issues. It stated its investigation was ongoing.

Safety Recommendations and Action

The following Safety Recommendations are made in this report:

Safety Recommendation 2025-003

It is recommended that Airbus Helicopters expedite the inclusion of the improved rotor brake maintenance procedures in the EC175 Aircraft Maintenance Manual.

Safety Recommendation 2025-004

It is recommended that Leading Offshore Energy Industry Competitiveness Limited incorporates comparative wind speed analysis as part of the Helimet quality control and notification system.

Safety Recommendation 2025-005

It is recommended that the Federal Aviation Administration set a compliance date by which every Acron Aviation FA5000 Cockpit Voice and Flight Data Recorder will be installed with software part number 840-E5498-12 (or equivalent) that ensures the correct recording of chronological flight data.

Safety Recommendation 2025-006

It is recommended that the European Union Aviation Safety Agency set a compliance date by which every Acron Aviation FA5000 Cockpit Voice and Flight Data Recorder fitted to European Union Aviation Safety Agency certified fixed wing aircraft and helicopters are to be installed with software part number 840-E5498-12 (or equivalent) that ensures the correct chronological recording of flight data.

Safety Recommendation 2025-007

It is recommended the European Union Aviation Safety Agency, with an appropriate compliance date, requires Airbus Helicopters to modify the FA5000 Cockpit Voice and Flight Data Recorder system fitted to EC175 and EC145 helicopters to prevent the loss of recorded flight data.

Safety Recommendation 2025-008

It is recommended that the Federal Aviation Administration, with an appropriate compliance date, requires Acron Aviation to correct the ARINC 717 loopback signal of the FA5000 series of recorders so that they comply with the specification requirements.

Following this Serious Incident, the following safety actions were taken:

> Since the incident the operator took safety action by requiring pilots to record the rotor stop time after brake application on each shutdown. If the stop time was found to exceed 40 seconds a check of the brake and its adjustment is required.
>
> The HCA has taken action to address issues highlighted by this incident including publishing recommended practice on the matter. They have committed to ensure future audits confirm the suitability of mooring straps provided, including checking that they would fit both the helicopter and helideck anchor points.
>
> In response to these findings the HCA will re-assess the CFD report against current requirements and ensure that any necessary operational restrictions are in place. It also acknowledges gaps in its own historic record keeping which it intends to address through improved internal procedures.

Appendix 1

Cockpit image recorder anomaly

A Vision 1000 camera system manufactured by Appareo[9] was fitted in the cockpit. Images from its integral camera and GNSS derived data were recorded to two internal solid state memory devices and a removeable Secure Digital (SD) memory card. The Vision 1000 is not designed, nor required, to meet any internationally agreed specification for flight recorders, such as ED-112 or ED-155.

The internal memory and SD card data were initially downloaded using software tools manufactured by the Vision 1000 manufacturer. This provided GNSS data for the entire incident flight but no image recordings; the presence of the GNSS data confirmed that the unit was powered throughout the flight. Several images and short duration GNSS data were also available from when the helicopter was on the ground at Aberdeen on 16 February 2023 and whilst on the Elgin on 18 February 2023. The SD card was forensically examined and no further recorded data was found.

The internal memory devices from the camera were subsequently removed and readout using software tools developed by the AAIB. No images were found to have been recorded during the incident flight. However, additional images from flights flown on 16 February 2023 were recovered.

The US National Transportation Safety Board (NTSB) and the BEA in France advised that they had also experienced similar recording anomalies with Vision 1000s. Of thirty cameras downloaded by the BEA, eight had not been operating correctly.

The manufacturer of the EC175 did not require nor recommend a routine check of the Vision 1000 system. This differed from the Vision 1000 manufacturer, who recommended an annual check was performed. The operator of G-MCSH had started the process of amending its maintenance program to incorporate a routine check, but this was not in place at the time of the incident. The inclusion of the check was in response to a recommendation[10] made by the International Association of Oil and Gas Producers (IOGP). Following the incident, the manufacturer of the EC175 also amended its maintenance program to incorporate an annual check of the recording and a check of the Vision 1000 status indication every 110 flight hours.

CVFDR recording anomalies

ARINC 717 flight data signal

On EC175s, the FA5000 CVFDR is provided with encoded flight data by the Aircraft Management Computer (AMC). The AMC forms part of the helicopter manufacturer's Helionix integrated avionic system, for which the software version installed on G-MCSH was Version 8.

Footnote

[9] Appareo [Accessed 7 May 2025].
[10] Offshore Helicopter Recommended Practices | IOGP Publications library [Accessed 7 May 2025].

The AMC flight data signal conforms to the ARINC 717 specification, for which the data rate was set at 512 words per second (wps). The maximum permissible error rate for flight data, as specified by European Organisation for Civil Aviation Equipment (EUROCAE) Specification ED-112[11] (ED-112), is one bit error in every 105 bits. At a data rate of 512 wps, this equates to a maximum of 1 bit error occurring during 16 seconds of data.

FA5000 CVFDR approval

The FAA TSO and European TSO (ETSO) applicable to the FA5000 CVFDR refer to the recorder meeting the requirements specified by ED-112.

The FA5000 series of recorders, which includes CVFDR, FDR and CVR models, are fitted to helicopters and fixed wing aircraft. For commercially operated helicopters, such as the EC175, the EASA and CAA require that the minimum recording duration of flight data to a crash protected recorder is 10 hours; for commercially operated fixed wing aircraft it is 25 hours. The FAA require a minimum recording duration of 25 hours for both commercially operated helicopters and fixed wing aircraft. These are defined in the relevant regulations[12].

Recorder operation and recorded data anomalies

G-MCSH was equipped with a FA5000 CVFDR part number 5001-6103-11, which was installed with software part number 840-E5498-07. Flight data and CVR audio is recorded to two solid state memory devices within the crash protected memory module. One memory device is referred to as the primary and the second as the backup, with the data on the devices intended to be near identical.

The use of two memory devices provides compliance with ED-112 concerning segregation of memory devices and loss of recorded information. The same design principles are used across the FA5000 model range, of which approximately 1,400 units have been manufactured. FA5000 CVFDRs are equipped to EC175s and other helicopter models including EC225, EC135, EC145, UH-72, EC155 and EC160. The FA5000 CVFDR and FDR models are also fitted to fixed wing aircraft, which include those manufactured by Bombardier, Embraer and Gulfstream.

Flight data is recorded chronologically to the primary and backup memory devices, with the oldest data being overwritten with new data[13]. FA5000 CVFDR part number 5001-6103-11 has a recording capacity of about 144 hours of flight data and 17 hours of CVR audio. The CVFDR was fitted to G-MCSH on 2 November 2021, since which time the helicopter had operated for about 1,100 hours prior to the recorder being removed after the incident.

Footnote

[11] Minimum operational performance specification for crash protected airborne recorder systems, applicable to part number 5001-6103-11 as per FAA Technical Standard Order TSO-C124b and European ETSO-C124b.

[12] CAA UK: CAT.IDE.H.190 Flight data recorder (caa.co.uk), the EASA: Commission Regulation (EU) 965/2012 EU 965/2012 EUR-Lex (europa.eu) and FAA: FAR Part 135 [Accessed 7 May 2024].

[13] Once the available memory capacity is reached ie if the available capacity is 25 hours, then the oldest data will not be overwritten until >25 hours of recording time.

The AAIB has equipment[14] that downloads the primary and backup memory devices. This differs to equipment available to operators and maintenance organisations, which downloads data from the primary memory device only. Equipment used by operators and maintenance organisations include the Recorder Data Interface (RDI) manufactured by Acron Aviation and the Professional Ground Station (PGS)[15] manufactured by Flight Data Vision.

The primary and backup memory from G-MCSH's CVFDR provided 127 and 128 hours of flight data respectively. A complete recording of the incident flight was available from both memory devices. However, recording anomalies were found with the flight data. No anomalies were present with the CVR audio recording.

The following anomalies were identified with the flight data recordings:

- Both memory devices contained multiple flights for which flight data was not recorded for 5 seconds every 10 minutes.
- The primary memory did not contain a recording of three flights operated on the evening of 15 February 2023 and three flights operated on the morning of 16 February 2023, totalling 5.5 hours. Data from these flights were, however, contained in the backup memory.
- The primary memory contained only a partial recording of a flight flown on the morning of 16 February 2023. Data for this complete flight was, however, contained in the backup memory.
- The primary memory did not contain a recording of a flight operated on 10 February 2023 or a recording of the takeoff and cruise phases from another flight flown the same day. Data from these flights were, however, contained in the backup memory.
- Both memory devices contained flight data from 2022, which should have been overwritten with newer data.
- Both memory devices contained flight data that was not in chronological order.
- Of the total data recorded, about 50 hours related to the helicopter's most recent operation but the remaining, approximately 78 hours, was of older data that should have been overwritten with more recent flight recordings.

Figure 17 depicts the flight data downloaded from the primary and backup memory. Where an arrow is included, this represents a date range (e.g. flights flown between 7 February and 16 February 2023 recorded in the backup memory).

Footnote

[14] Accident Investigator Recovery Equipment manufactured by the recorder manufacturer.
[15] PGS is the equipment typically provided by Airbus Helicopters to operators.

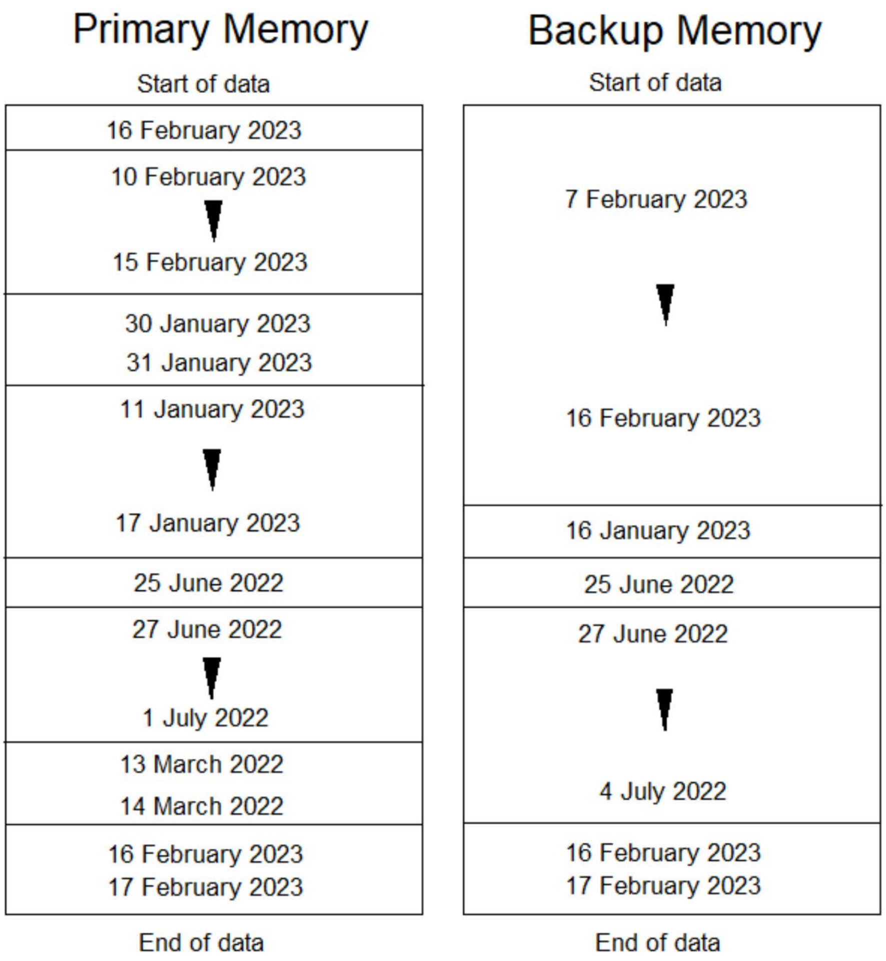


Figure 17

G-MCSH –flight data within the primary and backup memory

The FA5000 CVFDR has a BIT function that provides fault status signals to the EC175 AMC. If the fault is detected, a white FDRS (flight data recording system) message is displayed on the cockpit Multi-Function Displays (MFDs)[16]. The fault message is also recorded by the helicopter's avionic system, which was routinely checked by the operator and helicopter manufacturer. No FDRS faults had occurred on G-MCSH since the CVFDR was fitted on 12 November 2021.

The last CVFDR readout inspection for G-MCSH was performed by the operator in November 2022. The operator checked the most recent two hours of flight data and reported that no anomalies were identified. CAA guidance[17] referred to checking a representative flight, for which the most recent flight is normally selected. There is no requirement to check all recorded flight data. The CAA guidance is consistent with the recommendations and requirements of other national aviation authorities such as the EASA, FAA and Transport Canada.

Footnote

[16] The operator of G-MCSH advised that the MFD's on their fleet of EC175s were configured to show this information on two MFDs as default when the helicopter was first powered.

[17] CAP 731: Approval, Operational Serviceability and Readout of Aircraft Flight Recorders (caa.co.uk) [Accessed 7 May 2025].

At the request of the AAIB, the operator of G-MCSH, using its PGS equipment, checked the FA5000 CVFDR flight data recordings from four other EC175 helicopters (registrations G-MCSG, G-MCSN, G-MCSO and G-MCSP). All were equipped with Helionix software Version 8 and equipped with the same FA5000[18] part number as G-MCSH.

When the operator attempted to download the CVFDR flight data from G-MCSO, PGS terminated with an error. The operator subsequently found that it was only possible to download approximately the most recent 15 hours of flight data without PGS terminating with an error. When the 15 hours of data was reviewed, it was found to contain data from 2022. The CVFDRs fitted to G-MCSG, G-MCSN and G-MCSP all downloaded normally, and the data was chronologically correct. However, the data from all four helicopters contained several flights where 5 seconds of data was missing every 10 minutes. This was consistent with the anomaly identified on G-MCSH.

The FA5000 CVFDR[19] from G-MCSO was subsequently downloaded at the AAIB. This showed the same loss of chronological recording as G-MCSH (Figure 18). The CVFDR was fitted new to G-MCSO in 2020, of which it had since operated for about 2,100 hours with no FDRS fault having been indicated.

Primary Memory	Backup Memory
Start of data	Start of data
11 April 2023 13 April 2023	11 April 2023 13 April 2023
30 March 2023 31 March 2023	7 April 2023
21 February 2023 24 February 2023	30 March 2023 31 March 2023
17 January 2023	8 March 2023 9 March 2023
28 December 2022 30 December 2022	22 February 2023 24 February 2023
3 December 2022	7 February 2023 8 February 2023
5 December 2022 6 December 2022	22 December 2022 24 December 2022
15 November 2022 16 November 2022	27 December 2022 30 December 2022
14 Apr 2023	14 Apr 2023
16 Apr 2023 17 Apr 2023	16 Apr 2023 17 Apr 2023
End of data	End of data

Figure 18

G-MCSO – flight data within the primary and backup memory

Footnote

[18] The FA5000s fitted to G-MCSN and G-MCSG were installed with software part number 840-E5498-06, and on G-MCSO and G-MCSP the software part number was 840-E5498-07.

[19] Serial number 001287919 with software version 840-E5498-07.

The AAIB was subsequently advised by the FA5000 manufacturer that the most recent 15 hours of flight data was also separately recorded with the CVR audio. Figure 19 depicts the memory segregation of the FA5000 CVFDR data. This recording function operated differently to that which stored flight data to the memory area capable of retaining approximately 144 hours. The manufacturer advised that the recording of flight data combined with the CVR audio was incorporated to meet the requirement of ED-112 concerning the maximum permissible time by which data shall have been stored to the crash protected memory.

The recorder manufacturer provided additional software to the AAIB that downloaded the 15 hour recordings of flight data that was combined with the CVR audio. This flight data was found to be chronologically correct for G-MCSH and G-MCSO CVFDRs. However, in both recordings, flights were present with 5 seconds of data missing at 10 minute intervals, as found in the flight data recordings from the larger 144 hour memory areas.

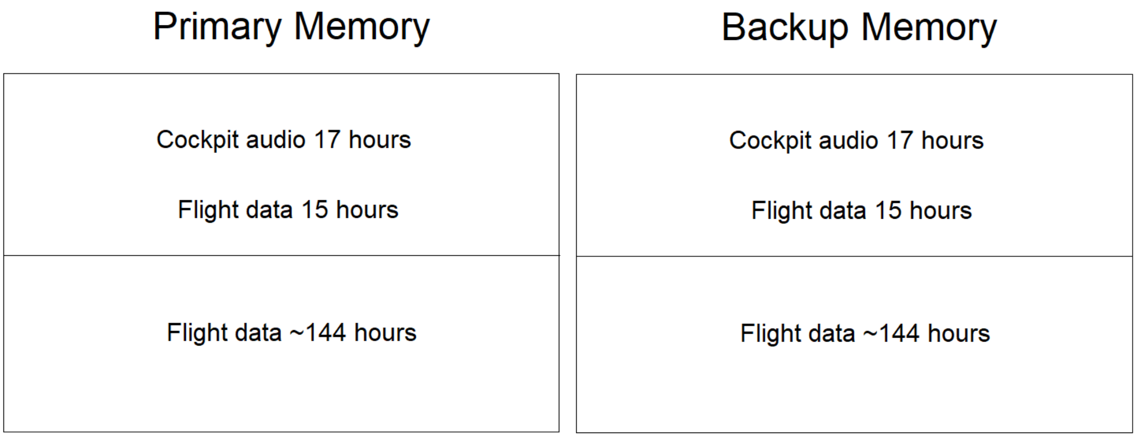


Figure 19

FA5000 CVFDR crash protected memory segregation

FA5000 brownout capacitor operation

ED-112 specifies that flight recorders shall be capable of recording within 500 milliseconds (ms) of electrical input power being applied and continue to record if power is thereafter lost for periods of up to 200 ms; this is referred to as the brownout[20] period. The FA5000 recorder series is fitted with capacitors, that when fully charged provide power to enable operation during brownout periods. The capacitors start to be charged once external power is applied and require a minimum of 700 ms to reach their full charged state. Once external power is removed, the capacitors fully discharge.

On the EC175, the CVFDR is powered from a 28 V DC bus[21]. When the input voltage increases above 18 V DC, the FA5000 powers-up, during which memory pointer[22] information is accessed. This information is used to ensure that flight data and CVR audio is recorded

Footnote

[20] Brownout, a period when the electrical power drops but subsequently returns to normal operating level.
[21] The bus is powered either from an external power supply when on the ground, the helicopters battery or its electrical power generation system.
[22] Memory pointers are a data type that contain memory addresses, such as where the start and end of data occurs.

chronologically. When the input power reduces to 18 V DC or less, the FA5000 enters its power-down mode. The brownout capacitors provide power during this period, which enables the unit to perform housekeeping tasks, that include stopping recording and saving memory pointer information.

The manufacturer advised that if the brownout capacitors failed, or did not achieve their fully charged state prior to the unit entering its power-down mode, it was possible that memory pointer information could become corrupted. This could then result in the loss of chronological recording.

Fault analysis

Fault logs from the FA5000 CVFDR fitted to G-MCSH and G-MCSO showed that both recorders had experienced multiple sequences of input power being applied but then quickly removed. The logs also indicated that on occasion, both units had not fully completed their power-down tasks. There was also evidence of more memory blocks being marked as bad[23] than would normally be expected; this was the reason that only about 128 hours of data was available from the nominal 144 hour memory area.

The review of the logs in conjunction with examination of the recorded flight data also showed that the loss of 5 seconds of data at intervals of 10 minutes was due to missing data bits within the incoming ARINC 717 signal. The loss of data equated to more than 30,000 data bits during a 5 second period, which exceeded the maximum data loss specified by ED-112, which was 1 data bit per 16 seconds.

The FA5000 provides a loopback of the ARINC 717 signal, which is connected to the AMC on the EC175 and is used to confirm correct data synchronisation (Figure 20). The helicopter manufacturer's analysis of the Helionix Version 8 software operation concluded that if the ARINC 717 loopback signal from the FA5000 was out of specification, this would result in a AMC software buffer overflow error. At a data rate of 512 wps, an error would occur after about 3 hours and 15 minutes of continuous AMC operation. Thereafter a loss of the AMC ARINC 717 output signal to the CVFDR would occur for periods of about 5 seconds every 10 minutes. The data loss would continue until the AMC was subsequently powered off (i.e at helicopter shutdown). Removal of power would then clear the buffer overflow error until the next operation of the AMC for a period of 3 hours and 15 minutes, following which the data loss would occur again.

At a higher data rate of 1,024 wps, for which the helicopter manufacturer intended to increase the recording rate on EC135, EC145, EC160 and EC175 helicopters, the buffer overflow error would occur after about 40 minutes of AMC operation.

Footnote

[23] In NAND memory, a block is the smallest amount of memory than can be erased, written and read. It is expected that block errors will occur as the number of write/read cycles increases / the memory device ages and this results in blocks being marked as bad. No new data is written to bad blocks and as the number of bad blocks increases, the total available recording capacity for new data will reduce accordingly.

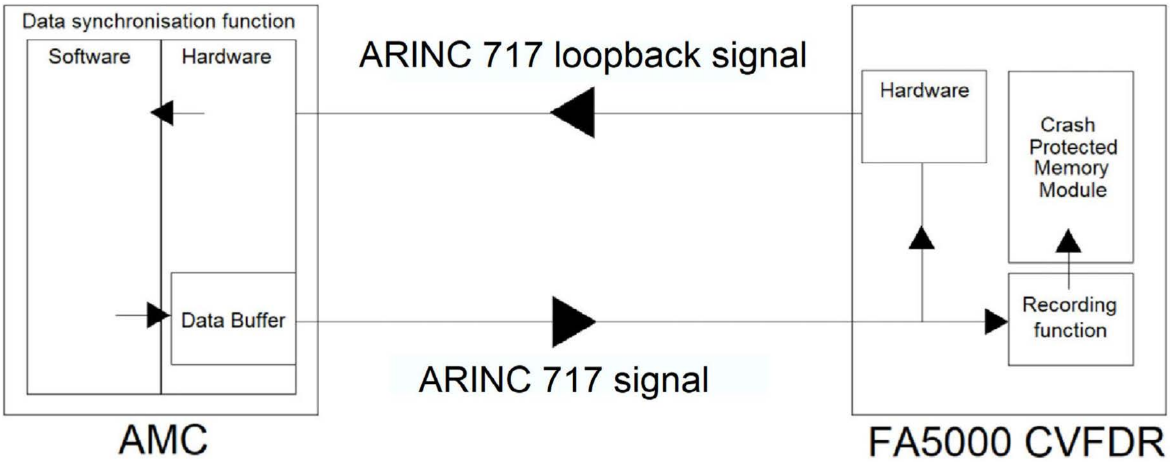


Figure 20
AMC - FA5000 ARINC 717 loopback signal

Loss of chronological recording on EC225 helicopter

In 2020, a loss of chronological recording of image data was found during qualification testing of a FA5000 Digital Video Recorder (DVR) (part number 5011-6133-11) fitted to an EC225 helicopter. This was found to have been caused by the characteristics of the helicopter's electrical power profile, whereby power to the DVR was being initially applied but then removed shortly after.

The DVR was operating with software part number 840-E5498-07, which was the same as that installed to the FA5000 CVFDRs removed from G-MCSH and G-MCSO. The recorder manufacturer subsequently resolved the DVR recording anomaly by developing new software for the FA5000, which is identified as part number 840-E5498-12[24]. This altered the operation of the recorder to cater for the scenario whereby the brownout capacitors had not achieved their fully charged state prior to power being removed.

Testing

Loss of chronological recording

The FA5000 CVFDR from G-MCSH and G-MCSO were taken to the recorder manufacturer where no faults were found with their internal brownout capacitors.

An FA5000 of the same part number and installed with the same software (840-E5498-07) was then tested in accordance with the electrical interface requirements specified by the manufacturer of the EC175; these tests were consistent with the standards normally applied to helicopters and fixed wing aircraft. This included testing for momentary loss of power[25] as per RTCA DO-160G[26]. However, this test was not required to be performed until after the CVFDR was operating normally, by which time the brownout capacitors had achieved their fully charged state. No loss of chronological recording was observed during these tests.

Footnote

[24] See Service Bulletin and Service Information Bulletin section.
[25] DO-160G section 16.6.1.3(d).
[26] Environmental conditions and test procedures for airborne equipment.

The 28 V DC bus power profile[27] was also captured from an EC175 at the manufacturer's facility in France. This included monitoring the power during engine start, and varying configurations using external and helicopter battery power. The captured profile was then applied under laboratory conditions to the FA5000 under test. No loss of chronological recording occurred.

A sequence of laboratory tests were then performed whereby power was applied to the FA5000 at just above 18 V DC (the lowest operating threshold), followed by a rapid loss of power. Each test started with no power being applied for 10 seconds, followed by power at test intervals of 10 ms, then at 50 ms followed by further increments of 50 ms until reaching a maximum of 1,000 ms. Between each power on period the power was turned off for 4 seconds which would fully discharge the brownout capacitors. Each test cycle was performed several times (i.e start of test - power-off 10 seconds, power on 100 ms, power-off 4 seconds, power on 100 ms, power-off 4 seconds, power on 100 ms, power-off - end of test). Following each test sequence, the recorded flight data and logs were checked.

These tests subsequently confirmed that when the power on period was set between 100 and 200 ms, a loss of chronological flight data recording would occur. This only affected the memory area cable of storing about 144 hours of flight data. The content of the logs from the test unit were also consistent with those from G-MCSH and G-MCSO, showing the unit had not fully completed its shutdown routine. It was also established that only one occurrence of momentary power application was required to cause a loss of chronological recording. No loss of chronological recording was present within the 15 hours of flight data combined with the CVR audio. This was also consistent with the FA5000 CVFDR from G-MCSH and G-MCSO.

The test unit was then installed with software part number 840-E5498-12, and the power-off tests repeated. No loss of chronological recording was found to occur.

ARINC 717 loopback signal

Testing of the FA5000 CVFDR ARINC 717 loopback signal showed that it did not conform to specification when the data rates were at 512 or 1,024 wps, with the signals maximum rise and fall times being exceeded.

The manufacturer stated that during approval testing they had checked the loopback signal was present but had not performed signal measurements.

BIT function

The recorder manufacturer confirmed that the FA5000 BIT function would not detect a loss of chronological recording nor provide an alert if the ARINC 717 input signal was lost for periods of about 5 seconds. The threshold for a loss of the input signal was set at 10 seconds, which the manufacturer stated was agreed with aircraft manufacturers.

Footnote

[27] A recording that characterised the variation in DC voltage.

Other reports of FA5000 loss of chronological flight data recording

In October 2023 a loss of chronological flight data recording was identified on a FA5000 CVFDR fitted to a military operated UH-72A helicopter. The FA5000 part number was 5001-6103-11 and installed with software part number 840-E5498-06. The loss of chronological recording was consistent with that found on G-MCSH and G-MCSO. The UH-72A is the military version of the EC145 helicopter for which its manufacturer confirmed that the recording anomaly could similarly occur on this model of helicopter as well.

In 2024, a further loss of FA5000 CVFDR chronological flight data recording was identified on a EC155, and another UH-72A helicopter.

None of FA5000 CVFDRs for which the loss of chronological flight data recording occurred were installed with software part number 840-E5498-12. They were all equipped with older software versions.

Service Bulletin and Service Information Letter

In February 2021, the FA5000 manufacturer issued Service Bulletin (SB) SB001-FA5000 which installed software part number 840-E5498-12 (referred to as 'MOD 12').

In response to the findings of this investigation the recorder manufacturer:

- Updated SB001-FA5000 to provide additional information concerning changes to the recorder operation in relation to the ED-112 brownout requirements.
- Issued Service Information Letter (SIL) 003-5000 that recommended operators check the full recording duration of FA5000 CVFDR and FDR models for a loss of chronological flight data recording or missing flight(s). If anomalies were found, it recommended that SB001-FA5000 be embodied.

Manufacturer actions to address the loss of flight data

In May 2024, the FA5000 manufacturer advised that it was developing a hardware modification that ensured the ARINC 717 loopback signal conformed with specification, with the activity to be completed by the end of 2024. However, it advised in April 2025 that it was no longer progressing with the modification as it considered the root cause of the loss of data may be due to other system integration issues and that the investigation was ongoing. This differed to the analysis performed by the helicopter manufacturer. As a hardware modification continues to be outstanding, the FA5000 ARINC717 loop back signal is not compliant with the ARINC 717 specification at data rates of 512 and 1,024 wps.

The EC175 helicopter manufacturer advised that it is developing an update to its Helionix software which will no longer use the ARINC 717 loopback signal. However, they stated this would be an interim solution until FA5000 corrective action was completed, at which point the loopback monitoring function would be re-instated. The manufacturer indicated that it may take several years to update the Helionix software across all affected helicopters.

Appendix 2

AIRBUS HELICOPTERS

No. 3947-S-00

SAFETY INFORMATION NOTICE

SUBJECT: GENERAL

Cliff edge effect

For the attention of

AIRCRAFT CONCERNED	Version(s)	
	Civil	Military
AL II ASTAZOU	3180 , 318B , 318C	
AL II	3130 , 313B	
AL III	3160 , 316B , 316C , 319B	
MBB-BK117	A-1 , A-3 , A-4 , B-1 , B-2 , C-1 , C-2 , C-2e , D-2 , D-2m , D-3 , D-3m	D-2m, D-3m
BO105	C , C23 , CB , CB-4 , CB-5 , CBS , CBS-4 , CBS-5 , CS , D , DB , DB-4 , DBS , DBS-4 , DBS-5 , LS A-3 , S	CBS-5 KLH , E-4
EC120	B	
AS365	N , N1 , N2 , N3	F , Fi , Fs , K , K2
AS366		GA
AS565		MA , MB , MBe , SA , SB , UB
EC155	B , B1	
SA365	C1 , C2 , C3	
EC135	EC635 P2+ , EC635 P3 , EC635 P3H , EC635 T1 , EC635 T2+ , EC635 T3 , EC635 T3H , P1 , P2 , P2+ , P3 , P3H , T1 , T2 , T2+ , T3 , T3H	
EC175	B	
AS350	B , B1 , B2 , B3 , BA , BB , D	L1
AS355	E , F , F1 , F2 , N , NP	
AS550		A2 , C2 , C3 , U2
AS555		AF , AN , AP , SN , UF , UN
EC130	B4 , T2	
SA341	G	B , C , D , E , F , H
SA342	J	L , L1 , M , M1 , Ma
H160	B	
SA315	315B	
WG13		MK4
SA330	J	Ba , L , Sm
AS332	C , C1 , L , L1 , L2	B , B1 , F1 , M , M1
AS532		A2 , AC , AL , SC , U2 , UE , UL

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AIRBUS HELICOPTERS

No. 3947-S-00

EC225	LP	
EC339		KUH/Surion
EC725		AP

Context

A recent event occurred on an oil rig, with an aircraft parked in high wind conditions. The main rotor blades could not be tied down and snapped off the main rotor, in particular due to wind conditions.

In the frame of the still ongoing technical investigation, a contributing factor to the event has been identified. Without presuming the conclusion of this investigation and in line with Airbus Helicopters constant commitment to improve safety, Airbus Helicopters publishes this safety information notice.

Cliff edge effect

Limitations for wind speed and direction are defined in the flight manual and in the maintenance documentation.

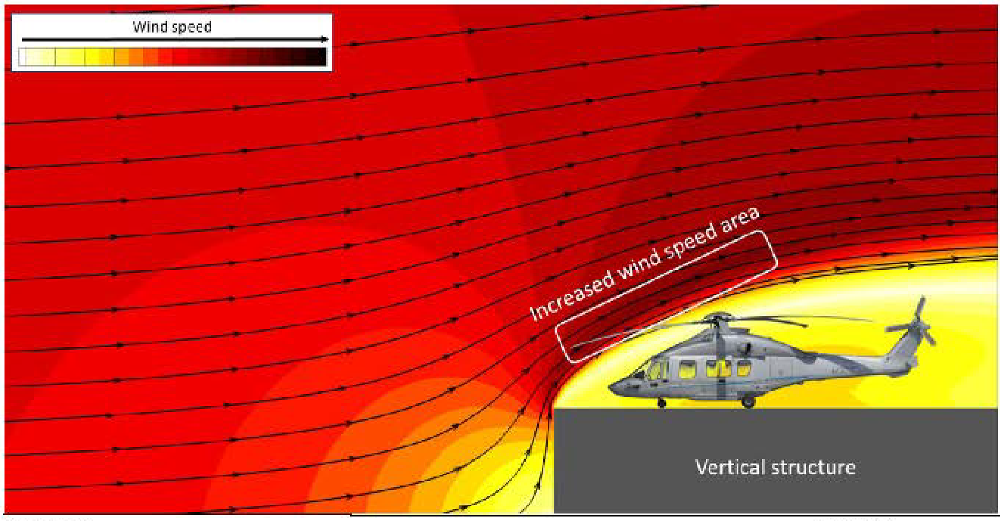
Airbus Helicopters would like to draw customers' attention to the fact that local aerology may have an impact on wind speed and direction and consequently may affect wind conditions around the aircraft. Thus, local aerology shall be taken into account to comply with the applicable limitations.

This safety information notice highlights a local aerology phenomenon that is the "cliff edge effect".

When the helipad is located on the top of a vertical structure, wind speed and direction on this helipad may be significantly affected. The vertical structures include but are not limited to buildings, tall boats, oil rigs or any kind of vertical structures that is located below the helipad and that would be an obstacle for the continuous airflow. On such structures, the airflow is deviated, resulting in:

- Turbulences
- Local wind speed increase
- Modification of wind direction

Hereafter an illustration of such a phenomenon, with a simplified analysis of a theoretical laminar wind blowing on a vertical structure from the left.



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AIRBUS HELICOPTERS

No. 3947-S-00

In the example above, with the aircraft located close to the edge of the vertical structure, the local speed and direction of the wind affecting the front of the main rotor disk are significantly impacted: speed is increased and wind direction is changed.

Thus, the local speed and direction of the wind can be locally outside the applicable limitations defined in the flight manual and in the maintenance documentation, potentially resulting in damage to the aircraft and/or injuries to people.

Airbus Helicopters would like to draw customer's attention to the fact that the increased wind speed area is affecting the blades aerodynamic loading and therefore should be taken into consideration to comply with the applicable wind limitations. Consequently, if the wind conditions get close to the applicable limitations, Airbus Helicopters recommends moving the aircraft as far as possible from the edge of the vertical structure. If necessary, secure as soon as possible the aircraft with mooring kits in accordance with applicable technical documentation.

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This document is available on the internet : www.airbushelicopters.com/techpub/

Appendix 3

Technical Recommended Practice

RP 003

Provision, Rating and Use of Helicopter Tie-Down Straps

Purpose:

During recent helideck inspections it has become apparent on many offshore assets the number, the SWL, the end fittings and the use of tie-down straps for securing a helicopter which has shut down on a helideck is varied and/or inadequate. The purpose of this HCA Recommended Practice is to ensure that every offshore asset complies with CAP437 – Standards for offshore helicopter landing areas Section 3 paragraph:

3.48 Tie-down strops held on the installation or vessel should be compatible with the bar diameter of the helideck tie-down points. Tie-down points and strops should be of such strength and construction so as to secure the helicopter when subjected to weather conditions pertinent to the installation design considerations. The maximum bar diameter of the tie-down point should be 22 mm in order to match the strop hook dimension of typical tie-down strops. Advice on recommended safe working load requirements for strop/ring arrangements for specific helicopter types can be obtained from the helicopter operator.

Number of Tie Down Straps:

Depending on the helicopter type used the asset should determine the number of tie-down straps required. However the number should always reflect the largest aircraft acceptable to that helideck depending on "T" and "D" Values, example:

Aircraft Type	Minimum Number of Straps Required	SWL
S92	6	5000kgs
H175	4	5000kgs
AW189	4	5000kgs
AW139	4	5000kgs
AW169	4	3000kgs

Connections:

The end connections of the tie-down straps should be compatible with the tie-down points on the helideck, these can either be bars or rings. The end connections should be checked initially and at each time a strap is changed out to ensure correct fitment. Suitable SWL rated shackles between tie-down point and strap hook is also acceptable. The aircraft end of the strap should be complimentary to the aircraft tie-down point (normally a ring).

Technical Recommended Practice

RP 003

Straps:

Straps should be to BSEN 12195-2 standard (or equivalent), have a ratchet type tension device and rated to the correct SWL. The straps should be free from cuts, knots or fraying, be kept clean, ratchets should be lubricated and the complete assembly stored in a weatherproof container easily accessible to the deck crew. Ensure the straps are in date and the ratchet is function tested on a regular basis.

Securing the aircraft:

When securing the aircraft provision should be made for the ratchet unit to be closer to the helideck tie-down than the aircraft.

The ratchets should be used to tighten just enough to take up the slack in the strap. Compressing the landing gear oleo struts or tyres would be deemed excessive.

Note: Pilot's direction/approval is required bef*ore anything is attached to the aircraft.*

Training:

Bear in mind that an aircraft shutdown on a helideck is an unusual event which may occur during inclement weather, in the dark or in high winds (or all 3!!). **HLO's should ensure the**y, and their deck crew, are familiar with the tie-down straps, the ratchet assemblies and be trained how to use them.

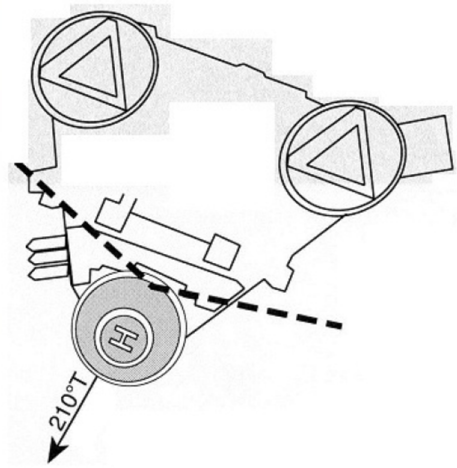
The provision and use of tie-down straps, end connections, ratchets and deck tie-downs points form part of the biennial helideck inspection.

- END -

Appendix 4

HELIDECK INFORMATION PLATE

HELIDECK Elev **166 ft**	VAR **0**	POSITION **N57° 00.44' E01° 50.24'**	EGEJ **Elgin PUQ**	
HEIGHT OF INSTALLATION: **509** HIGHEST OBSTACLE WITHIN 5NM: **Top of Rig**		VHF **Traf 122.330** **Log 129.705**	NDB **N/A**	Issue Date **21 Feb 2023**
FUELLING INSTALLATION: **Yes** STARTING EQUIPMENT: **Yes**		Operating Company **Total Energies**		Issued By **Helideck Certification Agency**
HELIDECK D value: **22.8m** P/R/H Category: **F** Max Weight: **15.0t** Circle & H Lights: **Yes**				



Wind (T°)	Kts	Limitation /Comment
		Please ensure you obtain accurate wind speed & direction early en route to plan your approach
• 015-055	• 0-15	• Possible turbulence from Turbine Exhaust and Exhaust Stack
All winds	• 0-30	• Table 1 (T) for all operations due to anti turbulence panels.
	• 31+	• No restriction

	Non Compliance
210°	Fixed Handrails and Refuelling Cabinet (south-east) 1.15m, Monitor A (north) 400mm, Monitor B (west) 500mm, Monitor C (south) 450mm, Glass Dome (west) 550mm, Small Dome (west) 300mm
150°	Handrails 1.15m ADL at 1.25m from SLA (run-off north) if not collapsed
5:1	West Foam Monitor Platform 1.8m from SLA Anti Turbulence Panels 2.8m from SLA

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