Air Accident Investigation Unit Ireland

SYNOPTIC REPORT

ACCIDENT

Eurocopter EC 155 B, EI-XHI

Shannon Airport (EINN), Co. Clare, Ireland

15 September 2022

An Roinn Iompair
Department of Transport

Foreword

This safety investigation is exclusively of a technical nature and the Final Report reflects the determination of the AAIU regarding the circumstances of this occurrence and its probable causes.

In accordance with the provisions of Annex 13[1] to the Convention on International Civil Aviation, Regulation (EU) No 996/2010[2] and Statutory Instrument No. 460 of 2009[3], safety investigations are in no case concerned with apportioning blame or liability. They are independent of, separate from and without prejudice to any judicial or administrative proceedings to apportion blame or liability. The sole objective of this safety investigation and Final Report is the prevention of accidents and incidents.

Accordingly, it is inappropriate that AAIU Reports should be used to assign fault or blame or determine liability, since neither the safety investigation nor the reporting process has been undertaken for that purpose.

Extracts from this Report may be published providing that the source is acknowledged, the material is accurately reproduced and that it is not used in a derogatory or misleading context.

[1] **Annex 13**: International Civil Aviation Organization (ICAO), Annex 13, Aircraft Accident and Incident Investigation.
[2] **Regulation (EU) No 996/2010** of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation.
[3] **Statutory Instrument (SI) No. 460 of 2009**: Air Navigation (Notification and Investigation of Accidents, Serious Incidents and Incidents) Regulations 2009.

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In accordance with Annex 13 to the Convention on International Civil Aviation, Regulation (EU) No 996/2010 and the provisions of SI No. 460 of 2009, on 15 September 2022, the Chief Inspector of Air Accidents appointed Clive Byrne as the Investigator-in-Charge to carry out an Investigation into this Accident and prepare a Report.

Aircraft Type and Registration:	Eurocopter EC 155 B, EI-XHI
No. and Type of Engines:	2 x Safran Helicopter Arriel 2C1
Aircraft Serial Number:	6643
Year of Manufacture:	2002
Date and Time (UTC)[4]:	15 September 2022 @ 05:19 hrs
Location:	East Apron, Shannon Airport (EINN), Co. Clare, Ireland
Type of Operation:	Commercial Air Transport
Persons on Board:	Crew – 1 Passengers – 0
Injuries:	Crew – 0
Nature of Damage:	Substantial
Commander's Licence:	Airline Transport Pilot Licence (ATPL) Helicopter (H) issued by the Irish Aviation Authority (IAA)
Commander's Age:	50 years
Commander's Flying Experience:	12,591 hours
Notification Source:	Shannon Airport Duty Manager
Information Source:	AAIU Report Form submitted by the Pilot AAIU Field Investigation

[4] **UTC**: Co-ordinated Universal Time. All times in this report are quoted in UTC unless otherwise stated; local time was UTC + 1 hour on the date of the accident.

SYNOPSIS

Following a flight from Loughrea in Co. Galway and while flying along Taxiway Delta 1 enroute to the Light Aircraft Parking area at Shannon Airport (EINN), control of the Eurocopter EC 155 B helicopter was lost when an attempt was made to flare the helicopter and transition from forward flight to a hover. The helicopter impacted the taxiway surface with significant downward force and forward momentum. It sustained substantial damage but remained upright and continued along the taxiway before coming to a stop at the airport's east apron. There was no fire, and no injuries were reported.

The Investigation determined that the probable cause of the occurrence was loss of control in flight during transition from forward flight to hover due to the collective pitch lever movement being restricted by a portable power bank device which was unsecured in the cockpit. Three Safety Recommendations are made as a result of this Investigation.

NOTIFICATION AND RESPONSE

The EINN Airport Duty Manager advised the AAIU of the occurrence via the 24-hour phone line. Two Inspectors of Air Accidents deployed to Shannon Airport to commence an Investigation.

1. FACTUAL INFORMATION

1.1 History of the Flight

On the morning of the accident, while boarding the helicopter at Kylebrack Helipad (EIKB) in Loughrea, Co. Galway, the Pilot loaded paperwork and other items into the cockpit. The Pilot advised the Investigation that amongst the items he loaded into the cockpit of the helicopter was a portable power bank device used for charging passenger and crew mobile phones. Due to early morning darkness, the Pilot was using a torch for illumination when he stowed the carry-on items, including the power bank, which he put on the aircraft's centre console.

The Pilot was the sole occupant of the helicopter which departed EIKB at 05:05 hrs, on a positioning flight to Shannon Airport (EINN). The helicopter was cleared by Shannon Air Traffic Control (ATC) to route south-west towards the town of Ennis, Co. Clare, before turning south towards EINN. ATC instructed the helicopter to approach the aerodrome from the north and it was then cleared to cross runway (RWY) 24 to the Light Aircraft Parking (LAP[5]) (**Figure No. 2**). During interview, the Pilot stated that he was aware from ATC transmissions of an aircraft inbound to RWY 06 and was expediting his arrival across the aerodrome under his own initiative to clear the way for that inbound aircraft.

Data recovered from the helicopter's flight recorder indicate that the helicopter was travelling at a ground speed of approximately 74 knots (kt) as it aligned with the taxiway (TWY) at the intersection of the Hotel (H) and Delta (D) Taxiways. The helicopter then flew along the D1 TWY towards the LAP. At the time of the accident, cargo aircraft were being loaded and unloaded on the central apron and east apron areas adjacent to the LAP.

[5] **Light Aircraft Parking (LAP) area**: In this report, when the context is clear, the term LAP will be used without the qualifier '*area*'.

The helicopter proceeded along the D1 TWY towards the LAP. Prior to reaching the intersection of the D1 TWY and the LAP, the Pilot increased the helicopter's pitch angle and then attempted to flare the helicopter in order to enter a hover. The Pilot stated that despite a number of attempts, the collective pitch lever[6] *'… would only move up one to two inches from the full down position'* that it had been in during the approach to the LAP. The helicopter was travelling at a ground speed of approximately 43 kt at this point.

The helicopter lost altitude and impacted the taxiway with considerable horizontal and vertical acceleration. The impact damaged the left main undercarriage, sheared the torque link of the nose landing gear and caused significant structural damage to the helicopter. The initial impact was described by a witness as being '*nose heavy*'. Impact marks on the taxiway indicate that the nose wheel impacted with the ground to the left of the taxiway centreline and 31 meters (m) before the entrance to the LAP. The residual forward momentum of the helicopter as it impacted the taxiway, resulted in the helicopter transiting along the taxiway towards the central and east apron areas of the airport following impact. The helicopter remained upright as it continued to travel along the ground towards ground personnel and cargo trailers that were located on the parking stand side of the ATC boundary line at Stand 24/24A in preparation for the pending arrival of an inbound cargo aircraft.

The Pilot stated that he had difficulty in trying to slow the helicopter down. He was conscious that due to the impact, directional stability on the ground may have been compromised and that there was a possibility of the helicopter rolling over if any abrupt control inputs were made. However, as the helicopter was now travelling towards cargo trailers and ground personnel (who took evasive action), the Pilot steered the helicopter to the left using foot-operated differential braking[7] to avoid a collision. The helicopter travelled along the taxiway and crossed the ATC boundary line adjacent to parking Stand 24/24A before it turned to the left towards the east apron area, where it came to rest (**Photo No. 1**).

Photo No. 1: Final position of EI-XHI

The ground marking inside the ATC boundary line and the path that the helicopter followed as it was steered by the Pilot following impact with the taxiway are shown in **Figure No. 1**. This image was taken following the accident and after a cargo aircraft had parked on Stand 23. The Pilot stated that he shut down both engines and then attempted to contact ATC via his radio; however, the transmission attempt was unsuccessful.

[6] **Collective pitch lever:** The control lever in a helicopter which increases or decreases the total lift derived from the rotor by changing the pitch angle of all the main rotor blades collectively.

[7] **Differential Braking:** The ability to apply left or right undercarriage wheel brakes independently using foot operated controls in order to steer the aircraft during ground operations.

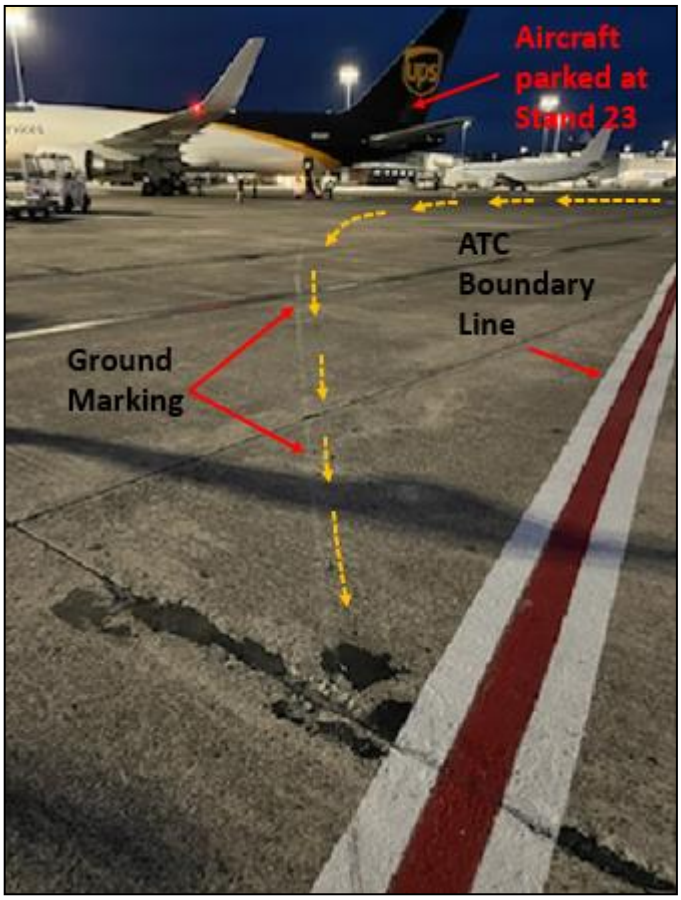

Figure No. 1: Helicopter path and ground marking

Following shutdown of the helicopter, the Pilot identified that the collective pitch lever had been restricted from its full motion of travel by the portable power bank unit which he had placed on the avionics centre console prior to take-off. The power bank had migrated from the avionics centre console, into a space between the Pilot's seat and the console.

The Pilot exited the helicopter uninjured and was promptly assisted by some airport personnel who had witnessed the event. A small fluid leak from the helicopter was observed and as a precaution, the Airport Police and Fire Service (APFS) attended the scene and applied fire retardant foam to the affected area. There was no fire.

1.2 Injuries to Persons

No injuries were reported to the Investigation and the Pilot stated that he was wearing the helicopter's five-point seat belt harness.

1.3 Damage to Helicopter

The helicopter was substantially damaged as a result of the accident. The left main undercarriage strut had decompressed, and the nose wheel undercarriage torque link was fractured. The fractured torque link scraped along the concrete surface, marking the surface and causing a portion of the torque link to be ground flat (**Photo No. 2**).

Photo No. 2: Fractured nose landing gear torque link

The fluid leak was identified to be from a displaced transmission deck drain; the fuel, lubrication, and hydraulic systems were not compromised. There was significant structural disruption of the fuselage evident in the nose-to-cabin attachment area.

Following the accident, the helicopter was sent to an overhaul facility for a more detailed inspection. As part of that inspection and at the request of the Investigation, the helicopter's radio system was operationally tested and was found to be serviceable and capable of making and receiving transmissions on both Comms 1 and Comms 2.

1.4 Airport Information

1.4.1 General

Shannon Airport (EINN) is located 13.5 nautical miles west of Limerick City at an elevation of 46 ft AMSL (Above Mean Sea Level). It has one runway which is designated 06/24. A representation of the aerodrome produced from the Irish Aeronautical Information Publication (AIP) is shown in **Figure No. 2.** The area of interest for the subject accident (east apron and D1 TWY area) is identified within the dashed box and is shown in more detail in **Appendix A.**

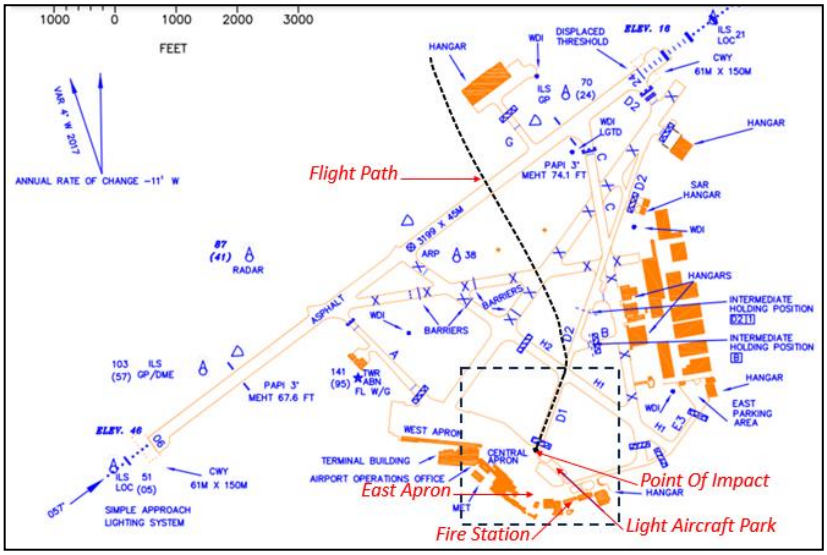

Figure No. 2: Shannon Aerodrome Chart
(*Adapted from AirNav Ireland AIP, EINN AD 2.24-1, 26 March 2020*)

1.4.2 Shannon Airport Authority DAC

Shannon Airport Authority DAC (Shannon Airport) is a subsidiary of the Shannon Group which was incorporated in 2014 following enactment of the *State Airports (Shannon Group) Act 2014*. Shannon Airport is responsible for the management, operations and development of Shannon Airport and as such provides, *inter alia*, the infrastructure necessary to facilitate aircraft movements to and from the airport.

1.5 AirNav Ireland

On 1 May 2023, in accordance with the Irish Air Navigation Transport Act 2022, AirNav Ireland was established. This was as a result of the Irish Government's decision to separate Ireland's air safety regulation division and air traffic navigation services operation. Consequently, AirNav Ireland is the commercial semi-state company that is responsible for providing, operating and managing air navigation services in Irish airspace. When it considers it appropriate, AirNav Ireland is also responsible for operating and managing terminal services at State aerodromes and licensed aerodromes within the State; specifically, AirNav Ireland operates and manages terminal services at Shannon, Cork and Dublin Airports.

1.6 Aircraft Information

1.6.1 General

The helicopter, a Eurocopter EC 155 B, is fitted with two Safran Helicopter Arriel 2C1 turboshaft engines driving a fully articulated, five-bladed main rotor of 11.93 metre (m) disc diameter, and a ten-bladed fenestron-type tail rotor of 1.10 m diameter. The helicopter fuselage is 12.47 m in length, 3.48 m in width and 4.35 m in height. The helicopter has a maximum take-off mass of 4,800 kg. It is certified for single pilot operation from the right seat. Both front crew seats in the subject aircraft were B/E Aerospace Fischer GmBH manufactured high energy absorption seats of the 230/260 H110 type and 9606 model. The seats incorporate energy absorbing devices to absorb severe vertical loads. Each of the front crew seats are fitted with a five-point seat belt harness.

The subject helicopter was manufactured in 2002. Its Certificate of Airworthiness was issued by the IAA on 10 April 2019 and its associated Airworthiness Review Certificate was issued on 29 June 2022. The helicopter was fitted with an Emergency Locator Transmitter (ELT) beacon and it also had a Combined Voice and Flight Data Recorder (CVFDR) known as a Multi-Purpose Flight Recorder (MPFR) which had been installed as an after-production approved modification (**Section 1.9.8** refers). The subject helicopter had two VHF[8] radios (VHF Comms 1 and VHF Comms 2) fitted. Comms 1 was powered by the engine generator's (Main BUS) and Comms 2 was powered directly by the battery (Battery BUS). At the time of the accident, the helicopter had flown a total of 2,681 hours since manufacture.

[8] **VHF:** Very High Frequency. A typical frequency band used to provide two-way communications to aircraft.

1.6.2 Helicopter Flight Controls

The helicopter type's dual flight controls are of conventional configuration and the helicopter could be controlled from either of the front seat positions. At the time of the accident, the helicopter was being flown from the front right seat in a single pilot configuration.

The flight controls consist of a cyclic pitch stick[9] in front of the pilot's legs, a collective pitch lever to the left of the pilot seat and anti-torque foot pedals (yaw control) located in the footwell of the cockpit. Full and free movement of the flight controls at all times is essential for safe operation. When on the ground, braking of the main undercarriage wheels to assist in steering is achieved by depressing the tops of the anti-torque foot pedals.

The collective pitch lever to the left of each front seat is used to increase or decrease the pitch (angle of attack) of the main rotor blades at the same time (collectively). The collective pitch lever is typically moved through a range of pitch settings depending on the power demanded by the pilot for a given flight regime. The collective pitch lever has a friction lock adjuster which provides the pilot with the ability to adjust the friction on the collective pitch lever so as to hold it at a particular required setting. The adjuster consists of a knurled metal sleeve positioned at the pedestal end of the collective lever. The interface between the sleeve and the collective lever forms a slight step. The position and arrangement of the collective pitch lever is shown in **Figure No. 3**, with the collective pitch control lever in the fully down position.

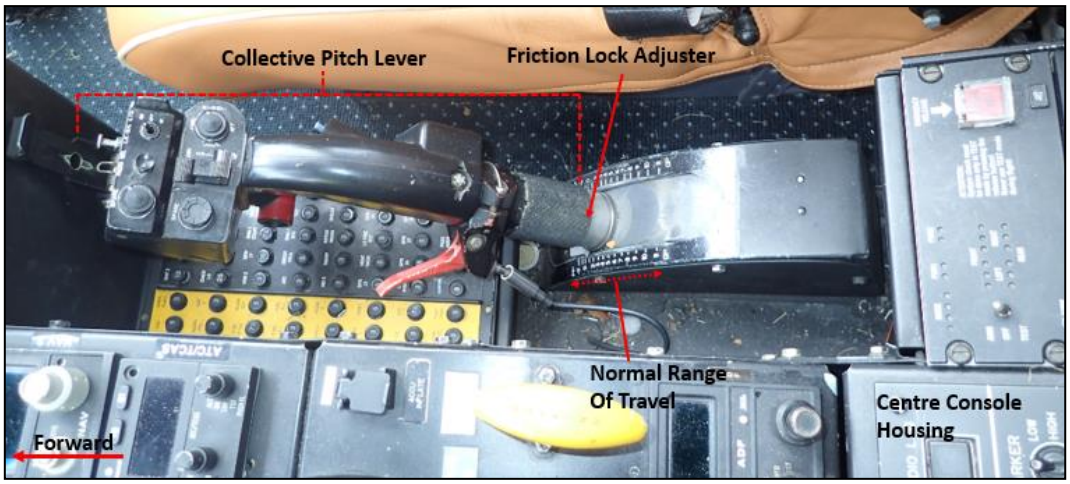

Figure No. 3: Collective pitch lever location

1.6.3 Helicopter Taxiing

Helicopter taxiing refers to the operation of a helicopter on, or close to the surface of the ground. In general, there are three types of helicopter taxiing techniques, namely hover-taxi, surface-taxi and air-taxi. Hover-taxi is used when operating at less than 25 ft above ground level (AGL) to move the helicopter over short distances. Surface-taxi can be used by helicopters with a wheeled undercarriage when the helicopter is on the ground. This technique minimises the effects of downwash from the main rotor blades. Air-taxi is used when travelling over larger distances with the helicopter normally remaining below 100 ft AGL.

[9] **Cyclic pitch stick:** This control stick changes the pitch of the main rotor blades during each cycle of rotation, resulting in the rotor disc tilting in a particular direction and causing the helicopter to move in that direction.

Standardised definitions for types of helicopter taxiing can vary from different sources, however, the United States Federal Aviation Administration's (FAA) '*Helicopter Flying Handbook*'[10] provides the following definitions of the three typical types of helicopter hovering techniques noted above.

> ***Hover-Taxi:***
> *A hover-taxi is used when operating below 25 feet above ground level.* […] *hover taxi is just like forward, sideward, or rearward hovering flight* […].
>
> ***Surface-Taxi:***
> *A surface-taxi is used to minimize the effects of rotor downwash in wheel-type helicopters. Surface taxiing in skid type helicopters is generally not recommended due to the high risk of dynamic rollover.*
>
> ***Air-Taxi:***
> *An air-taxi is preferred when movements require greater distances within an airport or heliport boundary.* […] *it is expected that the helicopter will remain below 100 feet AGL with an appropriate airspeed and will avoid over flight of other aircraft, vehicles, and personnel.*

In addition, EASA's Easy Access Rules for Standardised European Rules of the Air (SERA), (Dec 2024) describes and defines '*air-taxiing*' as '[…] *movement of a helicopter/vertical take-off and landing (VTOL) above the surface of an aerodrome, normally in ground effect and at a ground speed normally less than 37 km/h (20 kts)'*.

1.6.4 Transition From Forward Flight To Hover

The manoeuvre to transition a helicopter from forward flight to flaring prior to landing requires coordinated movement of the helicopter's flight controls. In its discussion of '*Advanced Flight Maneuvers*', chapter 10 of the FAA '*Helicopter Flying Handbook*' notes that a '*Rapid Deceleration*' or '*Quick Stop*' manoeuvre (**Figure No. 4**, Positions 1-5) is often used to simply terminate forward flight (Position 1). Despite the manoeuvre's name, the actions are performed slowly and smoothly with primary emphasis on coordination of the flight controls for a successful outcome. As the helicopter levels off at the correct altitude for the helicopter type (Position 2), a deceleration of the helicopter is initiated by the application of an aft cyclic stick input which reduces forward ground speed (Position 3).

The collective lever is simultaneously lowered to counteract any climbing tendency, and the anti-torque foot pedal is applied as necessary in order to maintain a correct heading. The balance between cyclic and collective at this point is critical to attaining the desired ground speed and hovering height. Once the desired ground speed and height is attained (Position 4), the pilot initiates the recovery and lowers the helicopter's nose, thereby allowing the helicopter to descend to a normal hovering height in level flight with zero ground speed (Position 5). During this recovery phase, the collective pitch lever should be increased (raised) as necessary to stop the helicopter at an appropriate hovering height while maintaining the correct rotor speed (revolutions per minute (RPM)) throughout the manoeuvre.

[10] **FAA Helicopter Flying Handbook**: FAA-H-8083-21B, 2019, Chapter 9.

In general, and depending on the helicopter type and arrangement, engine power is controllable directly through the movement (raising/lowering) of the collective pitch lever. The subject helicopter's engine power was controllable in this manner.

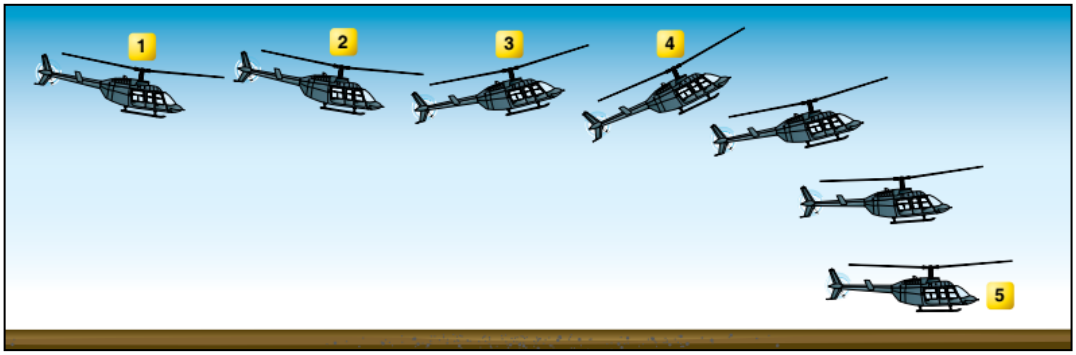

Figure No. 4: '*Rapid Deceleration*' or '*Quick Stop*' manoeuvre (*FAA-H-8083-21B, 2019*)

1.6.5 Obstruction of Flight Controls

On inspection of the helicopter following the accident and during interview with the Pilot, it was identified that the movement of the helicopter's collective pitch lever had been restricted to a very small range of motion when the power bank device became lodged between the collective pitch lever and the centre console housing. As describer earlier, the Pilot described how the collective pitch lever was restricted and *'would only move up one to two inches from the full down position'*. The position of the power bank was noticed by the Pilot following shutdown of the helicopter.

The power bank measured 185 mm (l) x 125 mm (w) x 20 mm (d), weighed 622 grammes, and had a smooth aluminium alloy case. The dimensions of the power bank were such that it slipped easily into the gap between the collective pitch lever friction lock adjuster sleeve and the centre console housing.

During the post-accident inspection of the helicopter, the Pilot repositioned the power bank to demonstrate to the Investigation what he had observed following the accident (**Figure No. 5**). The power bank is shown *in situ* with the collective pitch lever in the fully down position. The range of movement available between the body of the power bank and the centre console housing, when the power bank was in place, was in the order of 20-25 millimetres (mm).

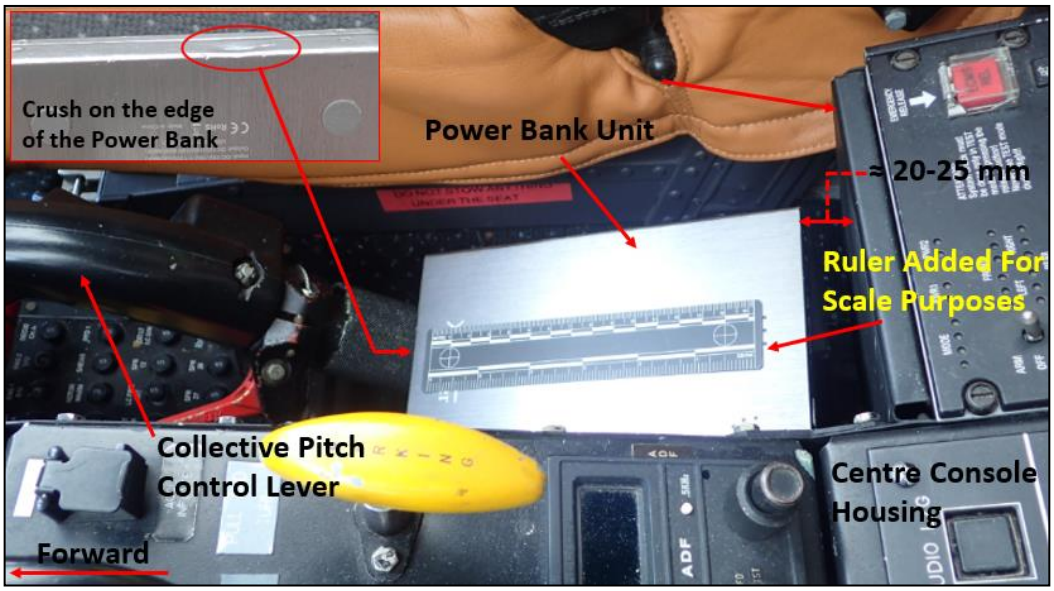

Figure No. 5: Obstruction Caused by Power Bank

Witness marks (crushing) on the edge of the power bank, as highlighted by the red oval in **Figure No. 5**, aligned with the friction lock adjuster sleeve and confirmed the general obstruction position.

1.6.5.1 Additional Information

Helicopter occurrences where the obstruction of cockpit flight controls have been determined to be the probable cause, are highlighted in a number of accident investigation reports, for example, AAIU Investigation Report No. 2001-007 and the U.S.A. National Transportation Safety Board (NTSB) Report #CEN22FA331.

AAIU Report 2001-007 relates to a non-fatal incident in Ireland in August 2001 involving an EC-120 helicopter. The final report concluded that:

> '*The incident was caused by a loose article in the cockpit, a mobile phone, sliding along the cockpit floor, and falling off the edge of the floor into the underfloor area and jamming the yaw control horn.*'

NTSB Report #CEN22FA331 relates to a fatal accident in the USA in July 2022 involving a CH-47D helicopter. The NTSB determined the probable cause of the accident to be:

> *'The failure of the flight crew to properly secure a company-issued iPad, leading to its migration into and jamming of the copilot's left pedal, preventing the pilot from arresting a left yaw, and resulting in a loss of control.'*

The NTSB have issued a Safety Alert, SA-026[11] titled '*All Secure, All Clear*', revised Dec 2015, which focuses on the problem and prevalence of '*forgotten and unsecured items within an aircraft*' that can lead to accidents or incidents as they move during flight.

[11] https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-026.pdf (Accessed 17/06/2024).

1.7 Personnel Information

The Pilot held a valid ATPL (H) issued by the IAA and had a current Class 1 medical certificate. The Pilot's flying experience is outlined in **Table No. 1** below. The Pilot held a valid type and instrument rating for the subject helicopter.

Total all types:	12,591 hours
Total on type:	1,096 hours
Last 90 days:	84 hours
Last 28 days:	22 hours
Last 24 hours:	2.6 hours

Table No. 1: Pilot's flying experience

1.8 Meteorological Information

The Meteorological Aerodrome Report (METAR) issued by *Met Éireann* for 05:30 hrs UTC indicated generally benign conditions, a north-westerly wind of 2 kt, few clouds at 1,600 ft, and a temperature of 12 degrees Celsius. The reported trend indicated that there would be no significant change in weather conditions during the subsequent two hours.

1.9 Recordings and Communications

1.9.1 Introduction

Various recordings relating to the accident flight were available to the Investigation and these were reviewed. These included the helicopter's flight recorder, CCTV (Closed-Circuit Television) footage, radar recordings and recordings of communications between the helicopter, ATC and the Irish Coast Guard (IRCG) Maritime Rescue Coordination Centre (MRCC).

1.9.2 Emergency Locator Transmitter (ELT)

ELTs are radio beacons installed on an aircraft which are designed to activate and broadcast a signal when an accident occurs. Any ELT carried on an Irish-registered aircraft must be registered with the IAA. Once the ELT is registered, is issued with a unique hexadecimal code which must be programmed into the ELT. As noted on the IAA's application for ELT Registration form:

> *'The purpose of registering the ELT with the IAA is to ensure that the code issued by the IAA to the owner/operator is included in the database which the IAA provides to the rescue services (MRCC). The application form requires a main point of contact and an alternate contact. In the event of an ELT activation, MRCC will use the information supplied to establish the aircraft's location and status through the registered points of contact.'*

1.9.3 ELT Activation

The following factual details are taken from the IRCG Incident Log for an ELT alert in Shannon on 15 September 2022.

A transmission from the helicopter's ELT beacon was detected at 05:19 hrs on the 406 MHz frequency and was accompanied by a homing signal on the 121.5 MHz frequency at the same time. The ELT signal was identified by ATC in Shannon Airport, and they notified the IRCG National Maritime Operations Centre (NMOC) by phone at 05:20 hrs stating that '*We have picked up a strong burst on 121.5 on Mt Gabriel antenna'*[12]. The ELT activation was also detected by the United Kingdom Maritime Component Command (UKMCC), and this was notified to the NMOC at 05:20 hrs.

The ELT activation continued, and using the IAA ELT register to identify the aircraft, the MRCC contacted the helicopter owner directly by phone at 05:26 hrs. The ELT activation was immediately confirmed by the owner who advised that it was '*caused by* [a] *heavy* [hard[13]] *landing in Shannon'*. MRCC contacted ATC in Shannon at 05:29 hrs to advise that the owner of EI-XHI had been contacted and that they had confirmed the ELT activation was due to a '*heavy landing*' in Shannon Airport. EINN ATC confirmed that they could see the helicopter and it had landed in EINN. Following notification to the aircraft owner, EINN ATC and the UKMCC, the IRCG Incident Log was closed, stating, '*no further assistance required*'.

1.9.4 Air Traffic Control

Recordings reviewed by the Investigation show that the helicopter was given clearance by ATC to initially route south-west towards the town of Ennis and then towards Shannon Airport. The helicopter was subsequently cleared to cross RWY 24 and route to and let down at the LAP. The Pilot reported clear of the active runway (RWY 24) and was cleared to let down at the LAP by ATC. The Pilot proposed that the helicopter would route in along the D1 TWY and air-taxi from there towards the LAP which was agreed by ATC. Radar recordings identified the subject helicopter during its flight to EINN. The last recorded ground speed of the helicopter on the radar before the transmission was lost was 55 kt.

Once the helicopter was clear of RWY 24, a cargo aircraft, which was inbound from the south-west, was given clearance to land onto the reciprocal runway (RWY 06). Following the landing and taxi, the cargo aircraft was scheduled to park on Stand 23 on the east apron which is situated close to the LAP (**Section 1.4**, **Figure No. 2**).

At 05:20 hrs, the APFS watch-room contacted ATC to advise that the helicopter had '*parked*' on the east apron rather than at the LAP. Between 05:21 hrs and 05:22 hrs, ATC tried to contact the Pilot three times to understand why the helicopter was on the east apron rather than at the LAP; however, no response from the Pilot was received.

[12] **Mt. Gabriel Antenna:** A radar station located on the Mizen peninsula in Co. Cork, Ireland.
[13] **Hard Landing:** A landing where the manufacturer's touchdown limitation, expressed either as a rate of descent or as a '*g*' loading value, has been exceeded. '*Heavy Landing*' is often used interchangeably with the term '*Hard Landing*', although a '*Heavy Landing*' specifically refers to an overweight landing.

ATC then contacted the APFS watch-room at 05:22 hrs to ascertain the location of the helicopter and assess if its position would interfere with the cargo aircraft taxiing towards Stand 23. The watch-room confirmed that the helicopter was clear of Stand 23 and that they could see that the handling agent was at the helicopter. At 05:26 hrs, the watch-room advised ATC that the helicopter had *'… landed heavy, the front nosewheel is down and we have an oil leak … Operations are there and we have a van over there, everything is ok, and everyone is safe'*

1.9.5 Aircraft Radio Transmission

Examination of the cockpit voice recordings confirmed that the Pilot was in contact with Shannon ATC following lift-off from EIKB, enroute to EINN, and while traversing the aerodrome. Transmissions were of a routine nature. The recordings end when the helicopter impacted with the taxiway.

The Pilot advised the Investigation that he attempted to contact ATC via the helicopter's VHF radio a number of times following the accident but was '*… unable to hear or transmit despite the radios being on'.*

The maintenance facility that completed the post-accident inspection on the helicopter and carried out an operational check on the radios advised the Investigation that, transmission using Comms 1 would not have been possible following engine shut down. Transmission through Comms 2 would have been available as it was powered by the Battery BUS and remained available following engine shutdown.

1.9.6 CCTV

Shannon Airport has a number of CCTV cameras which cover the aerodrome. At the time of the accident, the camera that covered the area of interest for the subject accident was focused on the scheduled inbound cargo aircraft and consequently did not show the helicopter as it flew along the D1 TWY or the accident sequence. The CCTV camera panned to the disabled helicopter shortly after the accident when the helicopter had come to a stop on the east apron. The helicopter's navigation lights, and flashing anti-collision light were illuminated and the Pilot could be seen walking around the helicopter.

Assistance from another operator's ground crew, and airport operations vehicles are evident from the CCTV. The arrival of the APFS to the disabled helicopter was also recorded. The arrival of the cargo aircraft onto Stand 23 on the east apron was recorded at 05:27 hrs.

1.9.7 Navigation Software

The Pilot provided the Investigation with data from a proprietary navigation application that he used during the flight. This data provided the flight track taken as well as times and indicated ground speed from take-off to the time that the helicopter impacted with the ground close to the LAP at EINN. The flight track is shown in **Figure No. 6**.

Figure No. 6: Flight Track (*Google Earth*)

Data from the navigation device shows the helicopter approaching EINN from the north following a typical flight.

1.9.8 Multi-Purpose Flight Recorder

The helicopter was fitted with an MPFR under an EASA[14] Supplemental Type Certificate (STC). This is a process where approval for a modification or repair to a certified aircraft is sought from an airworthiness authority. The MPFR was fitted to the helicopter by an EASA-approved third-party maintenance organisation in France in December 2020. The application for an STC to permit the installation of the MPFR was made to EASA and was approved under EASA STC 10074897.

As part of the MPFR installation, the helicopter was fitted with an inertial switch in the aft cargo roof area. The inertial switch shuts off electrical power to the MPFR in the event of a loading event (impact) that exceeds the predetermined acceleration threshold (g range). The inertial switch installed on the helicopter was rated to activate (switch off power to the MPFR) at a threshold of 6*g*[15]. The cessation of data recordings indicated that the inertial switch had activated.

When an accident occurs and the recorded data is required for analysis, a data frame layout document is required to assist safety investigation authorities to decode and convert the recorded binary data into engineering units and values. This is stipulated in EU Ops[16] CAT.GEN.MPA.195, *Handling of flight recorder recordings: preservation, production, protection and use*, which states:

> *'(d) The operator shall keep and maintain up to date documentation that presents the necessary information to convert raw flight data into flight parameters expressed in engineering units.'*

[14] **EASA:** European Union Aviation Safety Agency.
[15] **Acceleration due to gravity (*g*):** Acceleration due to gravity (*g*) is described in units of force called g's and is measured in metres per second squared (1*g* = 9.81 m/s^2). On the ground, humans are typically exposed and accustomed to gravity at a standard equalling 1*g*.
[16] Commission Regulation (EU) No 965/2012 of 5 October 2012.

A copy of the applicable data frame layout documentation was requested from the Operator following the accident. The Operator had not been furnished with a copy of the necessary document following the installation of the MPFR. However, the Operator provided the Investigation with a parameter database in a proprietary format and a copy of the proprietary software that is used to interpret the data which had been provided by the third-party maintenance organisation following the MPFR installation.

A copy of the applicable data frame layout document was requested from the EASA-approved third-party maintenance organisation that fitted the MPFR; however, it was unable to furnish the Investigation with the required documentation.

When the parameter database obtained from the Operator was used in conjunction with the proprietary software, the data from the recorder was read; however, many parameters were incorrect, including the latitude/longitude parameters which were exhibiting a systematic error as shown in **Figure No. 7** when compared to the known take-off and accident positions. The red line indicates the actual flight path (as indicated by the navigation app used by the Pilot); the blue line indicates the data with the incorrect flight path as produced from the decoding database supplied to the Operator.

Figure No. 7: Systematic GPS error identified (*Google Earth*)

This, coupled with some other anomalies, brought uncertainty as to the accuracy of the data that was being decoded from the helicopter's flight recorder system. Following further inquiries with the third-party maintenance organisation and with the assistance of the French BEA[17], the third-party identified that, after the installation of the equipment under the STC, it had provided the Operator with the wrong proprietary decoding database for the helicopter. A different decoding database was then provided to the Investigation which again required the use of the proprietary software to interpret; however, no data frame layout document was provided.

Subsequently, and as a result of this Investigation, a data frame layout document for the modification was produced over 12 months after the accident by the third-party maintenance organisation. This document had not been part of the original EASA application or approval process and was produced as a response to the Investigation's inquiries.

[17] **BEA:** Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (French Civil Aviation Safety Investigation Agency).

The Investigation contacted EASA in relation to the STC Certification and the potential gap in the approvals process regarding the necessary documentation required and examined by EASA when approving an STC for a flight recorder installation. The Investigation wished to establish how the STC was approved by EASA without ensuring that a data frame layout document was developed, and which the Operator would subsequently use to maintain the aircraft as per EU Ops CAT.GEN.MPA.195: *'Handling of flight recorder recordings: preservation, production, protection and use'*.

EASA acknowledged that there was a gap between the certification basis and the operational requirement, and stated that this was neither an unusual situation, nor was it specific to the subject EC 155 STC.

EASA further noted that CS 29, (Certification Specifications, Acceptable Means of Compliance and Guidance Material for Large Rotorcraft) Amdt. 9, issued 14 June 2021, introduced a revised AMC (Acceptable Means Of Compliance) 29.1459. EASA specifically referred the Investigation to subparagraph 4 which sets out the requirement for, and the minimum content of, FDR documentation.

EASA also informed the Investigation that, '*Although AMC 29.1459 at Amdt. 9 was not in place at time of the STC certification* (August 2020)*, any discrepancy in the availability of a decoding method (software or document) should have been highlighted during the relevant initial and recurring inspections for operational suitability of the helicopter.*' Additionally, while acknowledging that AMC 29.1459 at Amdt. 9 was issued after the certification of the STC installation, EASA advised that *'The clarification provided by AMC 29.1459 at Amdt. 9 already fills the potential gap that the AAIU highlighted, after the difficulties encountered during the subject investigation.'*

1.10 Emergency Response

EINN ATC was initially unaware that an accident had occurred and therefore did not raise the alarm with the APFS. CCTV footage shows that an APFS patrol car arrived at the helicopter at 05:23 hrs followed by a second APFS patrol car at 05:24 hrs.

The APFS, whose station was located adjacent to the final position of the disabled helicopter, first became aware of the severity of the accident at 05:26 hrs and its understanding was that the helicopter had landed hard, had nosewheel damage and had suffered an oil leak. The APFS had also confirmed in a call to ATC that *'Operations are there and we have a van over there, everything is ok, and everyone is safe'*.

At 05:31 hrs and following a verbal alert from another operator's ground crew member who ran to the station from the helicopter, the APFS learned that the event was potentially more serious than previously thought and deployed their fire tenders as a precaution. This was notified to ATC accordingly.

The APFS deployment time, from being verbally informed by the ground crew member regarding the severity of the event, to the attendance of three fire tenders at the accident site, was less than two minutes. There was however, an APFS presence at the helicopter in the form of a patrol car(s) from 05:23 hrs.

1.11 Helicopter Operations at Shannon Airport

1.11.1 General

Section EINN AD 2.16 of the Irish AIP specific to Shannon Airport (AIP Ireland, EINN AD 2 – 1, 02 Nov 2023) relates to the '*Helicopter Landing Area'* at EINN. The section is marked as '*NIL*'.

1.11.2 Previous Helicopter Occurrence at EINN

An event at EINN in March 2022 which involved a helicopter landing without clearance was deemed by the airport regulator to be a runway incursion. As part of the review of that event by the IAA, which was responsible for Air Traffic Services at that time, it was noted that:

> *'AIP Ireland EINN AD 2.16 states that there are 'Nil' helicopter landing areas on the airfield. This is interpreted to mean that helicopters, like airplanes, must use the runways for landing and take-off. Transition to/from a stand or parking area should be via hover taxi or ground taxi. STBU MATS[18] II does not describe any specific procedures for the handling of helicopters on the airfield.'*

One of the findings of the IAA's review into this event, stated that:

- *'The omission of a landing clearance was a simple error most probably as a result of a common practice in Shannon to permit certain helicopters to operate directly to/from a parking area without use of the runway for take-off or landing.*

- *AIP Ireland states nil helicopter landing areas on the airfield.'*

A number of recommendations were made by the IAA following the internal review, including the following:

> *'It is recommended that helicopter operations at Shannon Airport are reviewed in consultation with the SAA* [Shannon Airport]. *AIP Ireland states that there are 'nil' landing areas on the airfield yet it appears that helicopters routinely arrive/depart from apron areas and taxiways. This also appears to* […] *have been common practice for many years.'*

Subsequent to the runway incursion event noted above, and as part of an internal review of helicopter operations at Shannon Airport, a number of recommendations were identified which included:

- Coordination between AirNav Ireland and Shannon Airport to take place to identify parking areas prior to a helicopter arrival at the aerodrome.

- A review of helicopter infrastructure and facilities to facilitate helicopter movements at the aerodrome.

[18] **STBU MATS:** Shannon Terminal Business Unit, Manual of Air Traffic Services.

- Issuance of a safety reminder to air traffic controllers reinforcing the extant MATS 1 procedures regarding helicopter operations.

- Issuance of an ATS[19] Operations Notice to ensure that helicopters are not issued landing/take-off clearances to the LAP or apron areas.

1.11.3 Shannon Airport Authority DAC

Notwithstanding the AIP entry of *'NIL'* in relation to a '*Helicopter Landing Area'* at EINN, the Investigation contacted Shannon Airport in relation to the operational position regarding helicopter operations at the airport prior to EI-XHI's accident flight, and any proposed changes to procedures for helicopter operations.

When Shannon Airport was requested by the Investigation to describe helicopter operations at the airport prior to the accident they responded as follows:

> *'AIP Ireland states that there are 'nil' helicopter landing areas at Shannon (EINN AD 2.16). This has been the case since the AIP was published. The only FATO*[20] *available in the absence of helipads for an airport is its runway, which is Runway 06/24 in Shannon.*

Shannon Airport also stated that adequate procedures for helicopters landing and taking off in areas other than the runway had not been promulgated but that direct approaches to areas such as the LAP and taxiways were facilitated, mainly with the intention of maintaining a certain level of efficiency.

In November 2024, the Investigation was informed that:

> *'AirNav/Shannon Airport recently* [November 2024] *completed a joint hazard and risk assessment with our current operations involving helicopters on the airfield and this resulted in a Class C risk level. Whilst the risk is considered tolerable, this only holds true where further mitigation is either unavailable or not feasible to reduce the risk. In this case, to reduce the risk level to AirNav ATC operations, all landing and take-offs involving helicopters must be undertaken to/from the runway FATO. AirNav have recently revised their MATS manual for helicopter ops to reflect this.'*

When requested by the Investigation to describe any proposed changes to procedures for helicopter operations at EINN, Shannon Airport responded in November 2024 as follows:

> *'*[…]*, in response to issues raised re FATO(s), SAA* [Shannon Airport] *have engaged an aviation consultant to assist us in the provision of more operationally viable FATO(s)/TLOF(s)* [Touchdown and Lift-Off area]. *This process may take up to 6 months to complete. In the meantime, to enable adequate risk reduction* […]*, AirNav have revised their* MATS *procedures to mandate that all helicopters at Shannon operate to and from the runway FATO.'*

[19] **ATS:** Air Traffic Services.
[20] **FATO:** Final Approach and Take-off Area. A defined area over which the final phase of the approach manoeuvre to hover or landing is completed and from which the take-off manoeuvre is commenced. (ICAO Annex 14, Aerodromes, Volume II).

Shannon Airport further informed the Investigation that in December 2024, it presented a plan to the IAA regarding the positioning of three strategically located FATOs at EINN. On 20 May 2025, the IAA agreed in principle with the provision of two FATOs at the airfield. The runway FATO will continue to be available. In May 2025, Shannon Airport advised the Investigation that it will now proceed to examine a project scope and necessary funding to carry out such works as necessary for the additional two agreed FATO locations. A timeline for this project is not currently known.

1.11.4 AirNav Ireland

The Investigation contacted AirNav Ireland in relation to air traffic management of helicopter operations at EINN. AirNav informed the Investigation in December 2024, that on foot of one of the IAA recommendations (**Section 1.11.2**), work has been ongoing with Shannon Airport, the Irish Coastguard (IRCG) Helicopter Operator(s), and the IAA to establish a temporary FATO on the airfield to facilitate more efficient and expeditious SAR (Search And Rescue) helicopter movements. This temporary FATO will be used exclusively by the IRCG helicopter for both SAR and training missions as part of the transition of service providers for the IRCG SAR helicopter which involved two separate locations at the airport.

Regarding general helicopter operations at the airfield, AirNav informed the Investigation that:

> '*AirNav Ireland are still operating with the runway as the only surface permissible for landing and departing of all aircraft, with the exception of the temporary FATO for the Irish Coastguard helicopters (departures only, landing was not approved by the IAA for this).*

In relation to the temporary FATO for the Irish Coastguard helicopters, AirNav has amended its procedures manual (STBU MATS II 2.10.7) on 18 December 2024 to capture the use of a temporary FATO at Taxiway D1 until a permanent FATO has been established on the airfield. The Temporary FATO is approved until 27 August 2025. On 13 May 2025, the new operator of the IRCG SAR helicopter moved to the IRCG hangar which is closer to the FATO located at the runway. The temporary FATO and procedures put in place on 18 December 2024 was approved until 17 August 2025.

1.12 Helicopter Landing Areas

A review of the Irish Aeronautical Information Publication (AIP) for details regarding Helicopter Landing Areas at licenced Irish Aerodromes (AD) identified that in Part 3 – Aerodromes, Section AD 2.16, the majority of Irish Aerodromes are marked as '*NIL*' which is also the status at EINN.

The IAA informed the Investigation that while recognising that the AIP currently lists '*NIL*' under Section AD 2.16 for most aerodromes, including EINN, runways are used as the designated FATO for helicopter operations at aerodromes covered by the AIP and that '*is consistent with practices in other EASA States, where helicopters at large aerodromes operate similarly to fixed-wing aircraft, using the runway for approach and departure'.*

The IAA advised the Investigation that in order to address any potential ambiguity regarding this issue, they are '*drafting guidance to all aerodrome operators recommending the inclusion of clarifying notes in their AIP entries*'.

2. ANALYSIS

2.1 Accident Sequence

The Pilot arrived at the helicopter at EIKB in the early morning while it was still dark and using a torch for illumination, he loaded some carry-on items including a portable power bank into the helicopter. The unsecured power bank was positioned on the helicopter's centre console which is located between the two front seats. Following preflight checks, the helicopter lifted off from EIKB, the Pilot contacted ATC and routed towards EINN.

Data from an onboard navigation device shows that the helicopter approached EINN from the north following an uneventful flight. The helicopter was cleared by ATC to cross RWY 24 and onward to the LAP. The Pilot acknowledged this and advised that he would route along the Delta TWY, air-taxi from there, and let down at the LAP.

The helicopter's recorded data indicated that, at the intersection of D1 and H1, the ground speed was approximately 74 kt. The helicopter then flew along the D1 TWY towards the LAP, which is adjacent to the airport's east apron area. The Pilot stated that he was expediting his arrival across the aerodrome under his own initiative due to the pending arrival of a cargo aircraft. The Pilot was not instructed to expedite the arrival by ATC.

Prior to the intersection of D1 TWY and the LAP, while traveling at a ground speed of 43 kt, the Pilot attempted to transition from forward flight to hover-taxi. During the transition, the Pilot attempted to flare and simultaneously control the rate of descent by raising the collective pitch lever; however, due to a restriction of the movement of the collective pitch lever, controlling the rate of descent was not possible.

During the flight from EIKB, the unsecured power bank migrated from the centre console, likely as a result of vibration and helicopter flight attitudes, and came to rest in the space between the collective pitch lever and the centre console housing. This restricted the collective pitch lever and prevented it being moved from a low pitch setting, as would be the typical collective position during higher speed forward flight, through its normal range of travel. Due to the Pilot's inability to raise the collective lever to initiate a flare, control of the helicopter was lost, and it impacted the ground nose first at a force of at least 6*g* (the threshold setting for the inertial switch which had activated, shutting off the data recording system). The residual forward momentum of the helicopter, coupled with damage to the undercarriage, rendered the helicopter difficult to steer on the ground. The helicopter travelled along the remaining taxiway and entered the east apron area of the airport.

Another operator's ground crew operatives were on Stand 24/24A awaiting the imminent arrival of the cargo aircraft to Stand 23. The ground crew operatives took evasive action when they observed the oncoming helicopter as it travelled from the taxiway toward the east apron. Despite the damaged undercarriage, the Pilot was able to use differential braking and managed to steer the helicopter, which had crossed over the ATC boundary line, in an arc away from Stand 23 and onto the east apron south of the LAP. The helicopter came to rest adjacent to the APFS building.

The Pilot secured the helicopter, shut down both engines and attempted to contact ATC on the helicopter's radio to inform them of the accident. The transmission was not successful and consequently ATC was initially unaware of the event. Comms 1 is powered by the Main Bus, which is supplied by both engine generators. It is therefore likely that the communication attempts were made using Comms 1.

A section of the Shannon Aerodrome Parking/Docking Chart, which highlights the helicopter's general location and direction of travel, as indicated by a dashed black line, towards the intended parking location at the LAP is shown in **Figure No. 8**. The impact point of the helicopter following loss of control and subsequent traversing of the apron area is indicated by the blue dashed line. The final location of the helicopter on the east apron is noted by a red X.

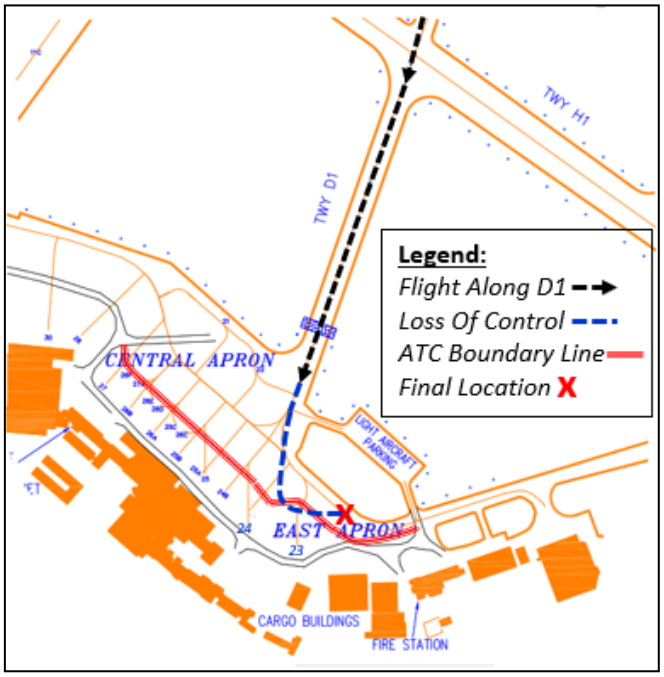

Figure No. 8: Flight direction and location of accident
(Adapted from AirNav Ireland AIP, EINN AD 2.24-2, 25 April 2019)

The full Shannon Aerodrome Parking/Docking Chart (AIP 25 April 2019) is provided in **Appendix A** for reference.

No injuries were reported to the Investigation as a result of the accident; however, the trajectory of the helicopter across the ATC boundary line of the east apron following impact with Taxiway Delta 1, caused ground personnel at Stand 24, who were awaiting the incoming cargo aircraft, to take evasive action. The path the helicopter took, as evidenced from the ground marking, indicates that had the cargo aircraft have been parked on Stand 23 prior to the helicopter accident, the possibility of a collision between the helicopter and a parked aircraft existed. The Investigation notes that an inbound cargo aircraft parked on Stand 23 eight minutes after the accident.

2.2 Obstruction of the Collective Lever

Following shutdown of the helicopter on the east apron, the Pilot identified that the collective pitch lever's range of motion had been restricted by a portable power bank unit which had been placed on the avionics centre console prior to take-off. The power bank migrated from the centre console during flight, eventually becoming trapped between the knurled metal sleeve of the collective pitch lever and the centre console housing. This obstructed subsequent attempts to raise the collective lever which was restricted to a range of movement in the order of 20-25 mm. Witness marks on the power bank aligned with the friction lock adjuster sleeve and confirmed the general obstruction position. With the collective pitch lever restricted to the low power range, the Pilot was unable complete the intended flare manoeuvre.

2.2.1 Previous Occurrences

The obstruction of helicopter flight controls due to loose items in the cockpit moving in flight and, unknowingly to the flight crew, becoming jammed in cockpit flight controls has been identified in a number of occurrence investigation reports. The consequences may vary from a recoverable incident to a fatal accident. Securing items in the cockpit prior to and during a flight is essential in order to militate against inadvertent jamming and restriction of flight controls which may only become apparent during a critical phase of flight.

2.3 Survivability

The helicopter was fitted with energy absorbing seats which are designed to absorb severe vertical loads. The Pilot reported that he was wearing the helicopter's five-point seat belt harness and despite the considerable impact loading, of at least 6g, which caused structural damage to the helicopter, no injuries were reported as a result of the accident.

2.4 Ground Speed Recordings

The MPFR recording stopped immediately following impact of the helicopter with the ground. The MPFR was fitted with an inertia switch which is designed to cut off power to the MPFR following an impact at a predetermined load. The switch was set at a threshold of 6g. Electrical power to the helicopter was not affected and the engines continued to operate until they were shut down and secured by the Pilot.

At the intersection of the H and D taxiways, the helicopter's recorded ground speed was approximately 74 kt. As the helicopter approached the LAP area and the Pilot attempted to flare, the helicopter's recorded ground speed was approximately 43 kt.

Ground speed recordings were recovered from the ATC radar recording and a proprietary navigation application that was used during the flight. Both sources recorded ground speed values consistent with those recovered from the MPFR.

2.5 Inspection of Helicopter's Radio System

During a detailed inspection of the helicopter following the accident, a test transmission from the helicopter's VHF radios was conducted using both VHF Comms 1 and VHF Comms 2. The transmissions on both Comms 1 and 2 were received by a local ATC tower without any issue. Comms 1 on the subject helicopter was powered by the helicopter generators (Main BUS), while Comms 2 was powered via the main battery (Battery BUS).

In consultation with the maintenance facility that completed the post-accident inspection on the helicopter, it was noted that if the Pilot was using Comms 1 during the approach and the subsequent accident, transmission using Comms 1 would not have been possible after both engines, and consequently the generators, were shut down. Had Comms 2 been selected following engine shutdown, transmission would have been possible as it was powered by the Battery BUS.

2.6 Emergency Response

2.6.1 General

At the time of the accident (05:19 hrs), ATC at EINN was not immediately aware of the event and was in communications with an inbound cargo aircraft that had just been cleared to land on RWY 06. The APFS was also not immediately aware of the event and was monitoring the inbound cargo aircraft. Another operator's ground crew personnel from the nearby parking stands, who were awaiting the inbound cargo aircraft, and who witnessed the accident, reacted immediately and attended the scene to offer their assistance to the Pilot. CCTV footage shows that there was however, an APFS presence at the helicopter in the form of a patrol car(s) from 05:23 hrs. Subsequently, one of the ground crew ran to the APFS building and alerted the APFS that the event was potentially more serious than previously thought.

2.6.2 Recordings and Communications

A review of CCTV footage showed that, at the time of the accident, the CCTV camera, which covered the area of interest for the subject accident, was focused on the main runway area as an inbound cargo aircraft was due. The camera then panned across to the east apron; however, from the CCTV operator's perspective, the helicopter appeared to be parked on the east apron and its navigation lights and flashing anti-collision light were illuminated as would be normal. The camera panned again and focused on the inbound cargo aircraft as it taxied toward Stand 23 and then panned back to the helicopter. Recordings of ATC radio transmissions confirm that ATC was communicating with the cargo aircraft at the time the helicopter impacted with the taxiway.

At 05:31 hrs, which was approximately 12 minutes after the accident, a member of the ground crew who attended the helicopter could be observed making their way to the APFS station on foot to alert the APFS crew directly about the severity of the event. The APFS deployed three fire tenders to the scene which arrived in less than two minutes of the ground crew member entering the APFS building to raise the alarm. The cargo aircraft taxied onto Stand 23 eight minutes after the helicopter impacted with the taxiway.

A homing signal on the 121.5 MHz frequency, which was picked up by the Mt. Gabriel Radar Station on the Mizen Head peninsula, was noted by EINN ATC at 05:19 hrs and they notified the IRCG NMOC immediately. The signal that was detected did not contain any information to link it with the subject helicopter. The IRCG subsequently identified the unique hexadecimal code from the ELT and using the IAA's ELT Register made contact with the helicopter owner at 05:26 hrs.

2.7 Helicopter Operations

2.7.1 Introduction

The accident occurred as a result of an obstruction of the helicopter's collective lever. Notwithstanding this, the accident highlights that the absence of specific procedures and guidance regarding the handling and movement of helicopters within the airport environs presents a safety risk. This safety risk is particularly acute when helicopters travel along taxiways at significant speeds, when in close proximity to aircraft stands and at parking areas. The modes of transition for helicopters from the runway to a stand or parking areas are significantly different to that of fixed wing aircraft which dissipate their forward momentum during landing on the runway which is remote from the apron and terminal areas of an airport.

EINN is a licensed aerodrome and subject to regulatory oversite by the IAA. In its own internal review regarding a runway incursion event in March 2022, which was prior to the accident involving EI-XHI, the IAA identified the need for a review of helicopter infrastructure and facilities to facilitate helicopter movements at EINN and made several recommendations accordingly. Following its establishment in May 2023, ownership of these recommendations transferred to AirNav Ireland.

2.7.2 Helicopter Operations at EINN

Following the helicopter runway incursion event in March 2022, which was prior to the accident involving EI-XHI, a working group was formed to review helicopter operations at Shannon Airport. As of October 2024, AirNav Ireland, which is now responsible for providing air traffic services in Ireland, issued an ATS Operations Notice in relation to *Helicopter Operations at Shannon Airport,* which outlines and reiterates the procedures for dealing with helicopters operating at the airport.

In November 2024, a joint hazard and risk assessment with regard to helicopter operations on the airfield was conducted by AirNav and Shannon Airport which resulted in a Class C risk level. This risk level was deemed '*tolerable',* but the report noted*, 'this only holds true where further mitigation is either unavailable or not feasible to reduce the risk*'. As part of the mitigation of the risk '*all landing and take-offs involving helicopters must be undertaken to/from the runway FATO'.*

AirNav has confirmed that the runway at EINN is the only surface permissible for landing and departure of all aircraft, with the exception of a temporary FATO at Taxiway D1 for the Irish Coastguard helicopters. This exception covers departure only; landing at this temporary FATO is not approved by the IAA. On 18 December 2024, AirNav amended their STBU MATS II Manual accordingly to include the temporary FATO at Taxiway D1. This amendment is to remain in place until permanent FATO(s) have been established on the airfield. As a result of the actions taken, no Safety Recommendation in this regard is made to AirNav.

In December 2024, Shannon Airport presented a plan to the IAA regarding the provision of an additional three FATOs at strategic locations on the aerodrome. In May 2025, the IAA approved in principle the provision of an additional two FATO locations on the aerodrome. Shannon Airport stated that it will now proceed to examine a project scope and identify the necessary funding in order to carry out such works for the two agreed locations. A timeline for this project is currently unknown. Accordingly, the Investigation makes the following Safety Recommendation to the Shannon Airport Authority DAC:

> **Safety Recommendation No. 1**
>
> The Shannon Airport Authority DAC should, in conjunction with the relevant stakeholders, consider augmenting the existing infrastructure for helicopter operations at Shannon Airport, to mitigate the identified safety risks (**IRLD2025004**).

2.8 Helicopter Operation at Irish Aerodromes

A review of Part 3 – Aerodromes, of the Irish Aeronautical Information Publication identified that Section AD 2.16: Helicopter Landing Areas, is annotated as '*NIL*' for the majority of locations, including EINN. The IAA advised the Investigation that in order to address any potential ambiguity regarding Helicopter Landing Areas at Irish Aerodromes, they are drafting guidance to all aerodrome operators recommending the inclusion of clarifying notes in their AIP entries.

Accordingly, the Investigation makes the following Safety Recommendation to the Irish Aviation Authority:

> **Safety Recommendation No. 2**
>
> The Irish Aviation Authority (IAA) should, in conjunction with the relevant stakeholders, conduct a review of infrastructure and procedures for helicopter operations at certified/licensed aerodromes in Ireland, in order to determine the risks related to helicopter operations and implement appropriate mitigations (**IRLD2025005**).

2.9 EASA STC Approvals Process

EASA confirmed to the Investigation that at the time when the STC was approved to permit the installation of the MPFR under EASA STC 10074897, a gap in the STC approvals process existed. This resulted in the STC being approved without the production of necessary documentation. This documentation is required to allow an aircraft to be maintained in accordance with current legislation, EU Ops CAT.GEN.MPA. 195: *'Handling of flight recorder recordings: preservation, production, protection and use'*.

The gap between certification basis and operational requirement was noted by EASA as not being specific to the subject EC 155 STC. However, EASA pointed to CS 29, (Certification Specifications, Acceptable Means of Compliance and Guidance Material for Large Rotorcraft) Amdt. 9, issued 14 June 2021 (after the certification of the STC), where AMC 29.1459, sub paragraph 4 now addresses this gap.

In light of this identified gap, which is accepted by EASA as not specific to the subject EC 155 STC, there are likely other similar STC approval anomalies that pre-date the amendment. Deficiencies relating to the pre AMC 29.1459 Amdt. 9 subparagraph 4 should be identified and rectified so as to permit operators to comply with their obligations under EU Ops CAT.GEN.MPA.195: *'Handling of flight recorder recordings: preservation, production, protection and use'*. Accordingly, the Investigation makes the following Safety Recommendation to EASA:

Safety Recommendation No. 3

EASA should, in conjunction with the relevant stakeholders, conduct a review of TC/STC FDR system approvals issued since 2009 that predate for compliance with CS 29, (Certification Specifications, Acceptable Means of Compliance and Guidance Material for Large Rotorcraft) Amdt. 9, issued 14 June 2021, in order to identify and rectify any gaps for operators in the handling of flight recorder recordings, preservation, production, protection and use (**IRLD2025006**).

3. CONCLUSIONS

3.1 Findings

1. The airworthiness certification for the helicopter was valid.

2. The Pilot's licence and medical certification were valid.

3. On arrival at the helicopter, the Pilot loaded carry-on items into the helicopter, including paperwork and a power bank device used for charging passenger and crew mobile phones.

4. The loading and storage of the carry-on items by the Pilot was conducted in the early morning while it was still dark, using a torch for illumination.

5. The Pilot, who was the sole occupant, flew the helicopter from the right seat.

6. The Pilot was in contact with ATC at EINN during the flight.

7. The helicopter was cleared to cross RWY 24, to air-taxi along the D1 TWY and to park at the Light Aircraft Parking (LAP) area which is located adjacent to the east apron.

8. The Pilot flew the helicopter along the D1 TWY and prior to the entrance of the LAP at a speed of approximately 43 kt, which is higher than the SERA-defined 20 kt air-taxi speed, an attempt was made to flare the helicopter in order to enter a hover.

9. Movement of the collective pitch lever was restricted due to the power bank becoming lodged between the lever and the centre console housing.

10. At 05:19 hrs, the helicopter lost altitude and impacted the taxiway with considerable vertical and horizontal acceleration.

11. The left main landing gear and the nose landing gear were damaged in the impact and directional control of the helicopter was compromised.

12. The helicopter remained upright as it travelled along the taxiway towards another operator's ground crew who were positioned on the east apron beyond the ATC boundary line at parking Stand 24/24A.

13. The helicopter transited along the east apron, crossing over the ATC boundary line and came to rest on the east apron adjacent to the APFS building.

14. At the time of the accident, ATC was monitoring an arriving cargo aircraft which was inbound to land on RWY 06, taxi, and was scheduled to park on Stand 23.

15. The Pilot shut down both engines and then attempted to contact ATC on VHF Comms 1 however, the radio transmissions were not received by ATC because VHF Comms 1 is not connected to the battery bus and only receives electrical power when the engines are running.

16. At 05:20 hrs, EINN ATC contacted the IRCG MRCC and reported a homing signal on 121.5 MHz which was detected by the Mt. Gabriel Radar Station on the Mizen Head peninsula.

17. Between 05:20 hrs and 05:22 hrs, EINN ATC tried unsuccessfully to contact the subject helicopter.

18. At 05:22 hrs, EINN ATC contacted the APFS, who confirmed that the subject helicopter was located on the east apron close to the APFS and that its position would not interfere with a cargo aircraft due to park on Stand 23.

19. There was an APFS presence at the helicopter in the form of a patrol car from 05:23 hrs.

20. At 05:26 hrs, the IRCG MRCC made direct contact by phone with the owner of the helicopter owner using the IAA's ELT Register. The helicopter owner confirmed that the ELT alert was caused by a hard landing in Shannon.

21. At 05:26 hrs, APFS notified EINN ATC that the helicopter had a '*heavy landing*' and that '*… everything is ok, everyone is safe*'.

22. At 05:29 hrs, ATC was notified by the IRCG MRCC that the homing signal detected by the Mt. Gabriel Radar Station was registered to the subject helicopter and that the owner had confirmed that the helicopter had a hard landing.

23. Ground personnel, who had been awaiting the arrival of a cargo aircraft, attended the helicopter and subsequently at 05:31 hrs, verbally alerted the APFS as to the severity of the event.

24. Once aware of the severity of the event, the APFS deployed three fire tenders to the accident site which arrived in less than two minutes.

25. An inbound cargo aircraft parked on Stand 23 on the east apron eight minutes after the helicopter impacted the ground.

26. The runway FATO at EINN was the only surface permissible for landing and departing of all aircraft; however, the helicopter was cleared to approach and land at the LAP.

27. Part 3 – Aerodromes, Section AD 2.16 of the Irish AIP identifies that, for the majority of locations in Ireland, including EINN, Helicopter Landing Areas are annotated as '*NIL*'.

28. When analysed, the MPFR data displayed a systematic error in GPS positioning information.

29. An incorrect decoding database for the helicopter had been provided to the Operator following the installation of the MPFR equipment under an EASA STC.

30. A corrected decoding database was provided to the Investigation by the third-party maintenance organisation who installed the MPFR equipment.

31. A frame layout document for the modification was produced over 12 months after the accident by the third-party maintenance organisation who installed the MPFR equipment.

32. The STC major modification approvals process, as applied in this case to a flight recording system, did not ensure that the necessary operational requirement had been satisfied regarding the conversion of downloaded raw flight data into engineering units.

3.2 Probable Cause

Loss of control in flight during transition from forward flight to hover due to the collective pitch lever movement being restricted by a loose article.

3.3 Contributory Cause

Carriage of an unsecured item in the cockpit.

4. SAFETY RECOMMENDATIONS

No.	It is Recommended that:	Recommendation Ref.
1.	The Shannon Airport Authority DAC should, in conjunction with the relevant stakeholders, consider augmenting the existing infrastructure for helicopter operations at Shannon Airport, to mitigate the identified safety risks.	IRLD2025004
2.	The Irish Aviation Authority (IAA) should, in conjunction with the relevant stakeholders, conduct a review of infrastructure and procedures for helicopter operations at certified/licensed aerodromes in Ireland, in order to determine the risks related to helicopter operations and implement appropriate mitigations.	IRLD2025005
3.	EASA should, in conjunction with the relevant stakeholders, conduct a review of TC/STC FDR system approvals issued since 2009 that predate for compliance with CS 29, (Certification Specifications, Acceptable Means of Compliance and Guidance Material for Large Rotorcraft) Amdt. 9, issued 14 June 2021, in order to identify and rectify any gaps for operators in the handling of flight recorder recordings, preservation, production, protection and use.	IRLD2025006
	View Safety Recommendations for Report 2025-009	

Appendix A: Description of Appendix

A.1 Airport Information

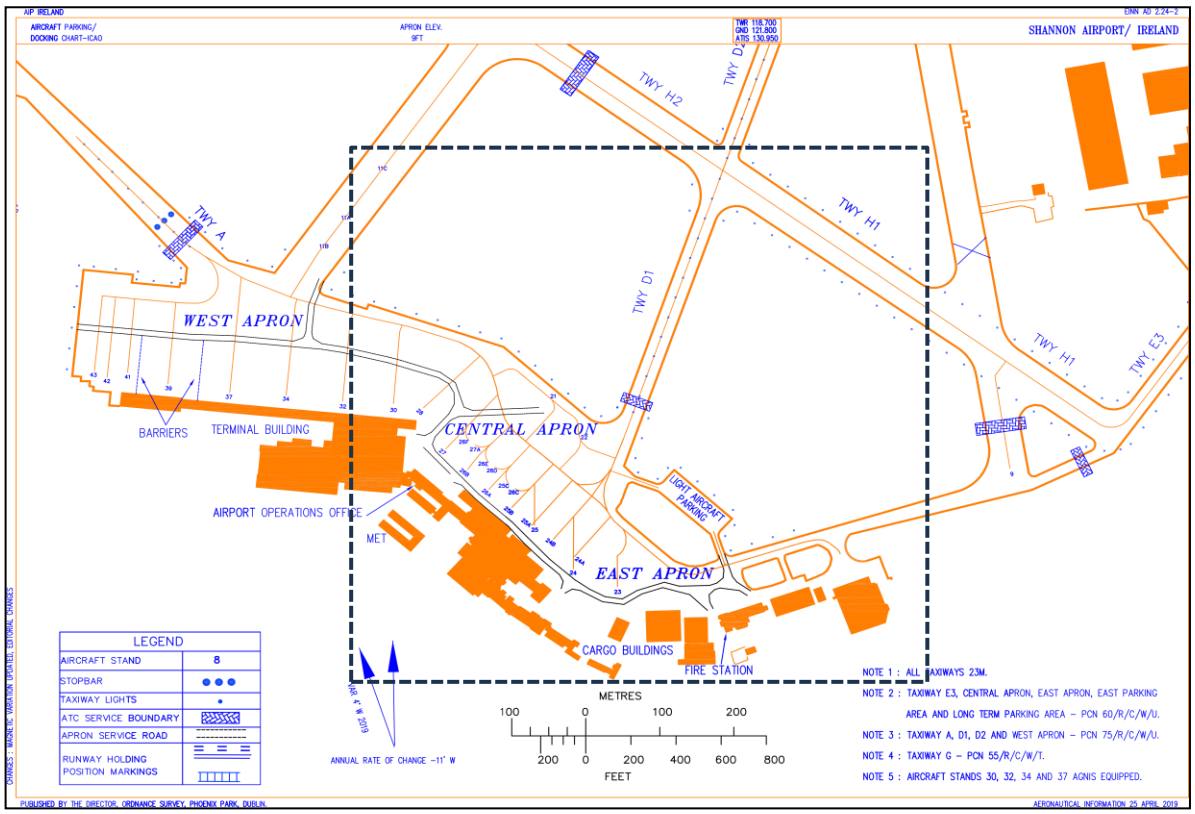

Figure No. A1: Shannon Aerodrome Parking/Docking Chart.
(*Adapted from AirNav Ireland AIP, EINN AD 2.24-2, 25 April 2019*)

The area of interest for the subject accident (east apron area) is identified within the dashed black box.

- END -

In accordance with Annex 13 to the Convention on International Civil Aviation, Regulation (EU) No. 996/2010, and Statutory Instrument No. 460 of 2009, Air Navigation (Notification and Investigation of Accidents, Serious Incidents and Incidents) Regulation, 2009, the sole purpose of this investigation is to prevent aviation accidents and serious incidents. It is not the purpose of any such investigation and the associated investigation report to apportion blame or liability.

A safety recommendation shall in no case create a presumption of blame or liability for an occurrence.

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