



# **Air Accident Investigation Unit Ireland**

**FACTUAL REPORT**

**ACCIDENT**

**Robinson R44 Raven I, G-HWKS  
Near Ballyshannon, Co. Donegal, Ireland**

**28 May 2016**



**An Roinn Iompair  
Turasóireachta agus Spóirt**

Department of Transport,  
Tourism and Sport

# FACTUAL REPORT

## 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<sup>1</sup> to the Convention on International Civil Aviation, Regulation (EU) No 996/2010<sup>2</sup> and Statutory Instrument No. 460 of 2009<sup>3</sup>, 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.

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<sup>1</sup> **Annex 13:** International Civil Aviation Organization (ICAO), Annex 13, Aircraft Accident and Incident Investigation.

<sup>2</sup> **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.

<sup>3</sup> **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, the Chief Inspector of Air Accidents, on 30 May 2016, appointed Mr John Owens as the Investigator-in-Charge to carry out an Investigation into this Accident and prepare a Report.

<b>Aircraft Type and Registration:</b>	Robinson R44 Raven I, G-HWKS
<b>No. and Type of Engines:</b>	1 x Lycoming O-540-F1B5
<b>Aircraft Serial Number:</b>	1747
<b>Year of Manufacture:</b>	2007
<b>Date and Time (UTC)<sup>4</sup>:</b>	28 May 2016 @ 11.35 hrs
<b>Location:</b>	Approximately 2.2 nautical miles (nm) south-east of Ballyshannon, Co. Donegal, Ireland
<b>Type of Operation:</b>	Private
<b>Persons on Board:</b>	Pilot - 1      Passengers - 3
<b>Injuries:</b>	Pilot - Nil      Passengers - Nil
<b>Nature of Damage:</b>	Damage to main rotor blades
<b>Commander's Licence:</b>	Commercial Pilot Licence (CPL), Helicopters (H), issued by the Civil Aviation Authority (CAA) of the United Kingdom (UK)
<b>Commander's Age:</b>	34 years
<b>Commander's Flying Experience:</b>	314 hours, of which 124 were on type
<b>Notification Source:</b>	UK Air Accidents Investigation Branch (AAIB)
<b>Information Source:</b>	AAIU Field Investigation AAIU Report Form submitted by the Pilot

<sup>4</sup> UTC: Co-ordinated Universal Time. All times in this Report are UTC (local time minus one hour on the accident date).

## FACTUAL REPORT

### SYNOPSIS

While attempting to land in an agricultural field in Co. Donegal, Ireland, following a short flight from Belleek, Co. Fermanagh, Northern Ireland, the helicopter's main rotor blades struck and cut electrical wires that were traversing the field. The tail of the helicopter immediately swung downwards and to the right (looking forward), before the helicopter was brought under control. A landing was immediately carried out and the Pilot and the three passengers on board exited the helicopter normally. There was no fire and no injuries were reported.

### NOTIFICATION

The UK AAIB contacted the AAIU Inspector on Call (IOC) on 30 May 2016 to inform him that the AAIB had received a report of an occurrence at a location in Ireland. Following this notification, the AAIU made contact with the Pilot who provided further details and advised that, immediately following the event, the helicopter had been moved back to Belleek. Upon consultation with the UK AAIB, two AAIU Inspectors travelled to Belleek on 2 June 2017 and met with the Pilot to inspect the helicopter, following which the site of the wire strike was also inspected.

## 1. FACTUAL INFORMATION

### 1.1 History of the Flight

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The Pilot reported that on the day of the occurrence the original intention was to fly the helicopter, with three passengers on board, from a field near Belleek to a hotel located at Lough Eske, Co. Donegal in Ireland. The Pilot stated that the passengers were paying for the hire of the helicopter and that he was not receiving any payment for the flight (i.e. a private flight). He said that before the intended flight commenced, he was asked to fly to a field located adjacent to the house of a friend of one of the passengers to allow photographs of the helicopter to be taken. This field was approximately 1 nm to the north-west of the departure field and approximately 2.2 nm southeast of Ballyshannon, and was located within Co. Donegal. The Pilot stated that permission to land had been given by the land owner.

The helicopter departed at approximately 11.30 hrs for the short flight. The Pilot said that he hover-taxed to the south side of the field to facilitate a northerly departure and avoid electrical wires located to the south of the field.

Upon reaching the field near Ballyshannon, the Pilot flew across it in a north-westerly direction, before turning to the north. He reported that there were no animals in the field, but noticed that there were "*electricity poles in the middle of large trees surrounding the field*". He stated that he turned to the east (the base leg), but extended this leg and performed a "*slight S-turn*" to avoid overflying a nearby farm. The Pilot said he noticed electricity poles and wires crossing below him as he approached to land and was trying to establish where the wires from one of the poles were going. He then saw that they were going to another pole further up the field to his left. However, he did not notice that there were other wires coming from this pole and crossing the middle of the field from left to right (east to west).



The Pilot said that he had advised his passengers to alert him if they saw “anything at all, especially wires...”. He stated that while on final approach to the middle of the field, at about 30 knots (kts) and at a height of about 30 feet Above Ground Level (AGL), the passenger in the front left seat said “wires”. The Pilot said at that instant, he also saw the wires and “turned the cyclic<sup>5</sup> to the left”. However, the main rotor struck and cut the wires. Video evidence from a witness shows the tail of the helicopter swinging down and to the right (looking forward) at this stage, before the helicopter was brought under control. The Pilot said that after the wires were struck he “lowered the collective<sup>6</sup> gently” and “made a normal landing”. He said that he established that everyone on board was okay and shut down the helicopter. The Pilot was asked by the Investigation whether the sun affected the visibility. He replied that he didn’t recall it being a problem and said that he wasn’t wearing sunglasses and that there were no issues with glare.

## 1.2 Accident Site

The field where the wire strike occurred was approximately 260 m long and 130 m wide. It had a considerable upwards slope along its length, in the direction of landing. It was covered in short grass, and was bounded by trees on the east and west sides, and by trees and farm buildings on the north side. Several residential dwellings were located on the south side of the field, behind which were trees. The layout of the field, the position of the poles and overhead wires, the approach path, and the site of the wire strike are shown in **Figure No. 1** below. The poles were wooden and were approximately 8.5 m in height.



**Figure No. 1:** Field layout, location of poles (red), overhead wires (yellow), final approach path (white) and site of strike (circled) (adapted from *Google Earth*)

<sup>5</sup> **Cyclic Control Lever:** The lever in a helicopter which changes the pitch of the rotor blades during each cycle of rotation.

<sup>6</sup> **Collective Control Lever:** The 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.

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### 1.3 Subsequent Actions

The Pilot told the Investigation that a local farmer informed the Electricity Supply Board (ESB) about the occurrence. The Pilot stated that the damaged electrical wires were not lying close to the helicopter and that he inspected the main rotor blades with the assistance of one of his passengers, who the Pilot said, was a “*helicopter engineer*”. He said that he noticed “*dinks*” on the main rotor blades, but decided to fly the helicopter the 1 nm back to the field where the flight commenced. The Pilot said that before departure, he performed a hover and “*a left pedal turn and a right pedal turn*” and that the helicopter handled perfectly and was free from vibration. The “*helicopter engineer*” accompanied him on the flight, which was commenced approximately one and a half hours after the occurrence.

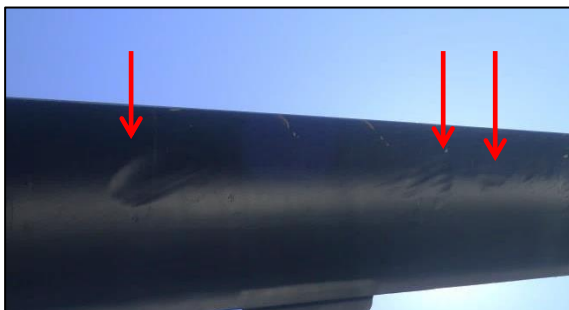
When asked about his rationale for operating a helicopter with known damage to the main rotor blades, the Pilot said he thought that it wouldn’t have been secure over the weekend where it was and that he wanted to make it “*easier recovered*”. The helicopter was then brought by road from Belleek to a maintenance facility, where the main rotor blades were replaced.

### 1.4 Damage to Helicopter

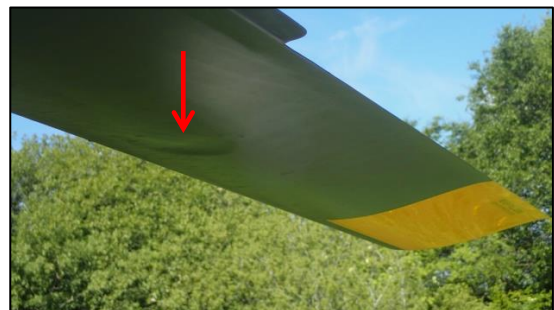
When the AAIU inspected the helicopter at Belleek, prior to it being transferred to the maintenance facility, damage was evident on both main rotor blades, with one blade appearing to have sustained more damage than the other.

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The more heavily damaged blade had several indentation marks on its leading edge (**Photo No. 1**), with an indentation also visible on its lower surface (**Photo No. 2**). In addition, several angled scrape-like marks were visible on the upper surface of the leading edge (**Photo No. 3**), with the outermost mark extending to the lower surface (**Photo No. 4**). Blade skin material was also found to have been partially torn from the upper surface of the blade’s trailing edge, approximately halfway along the blade’s length (**Photo No. 5**). Indentation damage was evident on the upper surface of this blade, following the removal of the blades from the helicopter (**Photo No. 6**).



**Photo No. 1:** Indentations on main rotor blade leading edge



**Photo No. 2:** Indentation on main rotor blade lower surface





**Photo No. 3:** Damage on upper surface of main rotor blade leading edge



**Photo No. 4:** Damage on lower surface of outer section of the leading edge



**Photo No. 5:** Damage to main rotor blade trailing edge



**Photo No. 6:** Indentation damage to upper surface of main rotor blade

### 1.5 Other Damage

Two 10 kV<sup>7</sup> copper-stranded parallel overhead electrical wires, each with an approximate diameter of 7 mm, were severed by the helicopter's main rotor blades, which resulted in a loss of power to several properties. The wires were repaired by the ESB later that day.

### 1.6 Personnel Information

Total all types:	314.4 hours
Total on type:	124.1 hours
Total P1 on type:	116.8 hours
Last 90 days:	14.9 hours
Last 28 days:	6 hours

### 1.7 Helicopter Information

The four-seat helicopter, a Robinson R44 (Raven), was manufactured in 2007. The type is fitted with a six-cylinder reciprocating engine, which powers a two-bladed (aluminium/composite) main rotor with a diameter of 10.06 metres (m) and a two-bladed tail rotor with a diameter of 1.47 m.

<sup>7</sup> kV: Kilovolt (1,000 volts)

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G-HWKS had operated for a total of 1,402 hours up until the date of the occurrence. The last scheduled maintenance inspection carried out prior to the occurrence was a '50 hour' inspection, which was performed on 20 May 2016, at a total operating time of 1,395.5 hours. The helicopter's Certificate of Airworthiness was issued by the CAA on 7 November 2013. The Airworthiness Review Certificate was valid until 13 September 2016.

### 1.8 Meteorological Information

Met Éireann, the Irish Meteorological service, was requested to provide details of the meteorological conditions prevailing in the Ballyshannon area at the time of the occurrence. The conditions were reported as follows:

Surface Wind:	100° at 5 knots (kts)
Surface Temperature:	17° Celsius (C)
Mean Sea Level (MSL) Pressure:	1016 hectopascals (hPa)
Visibility:	15 kilometres (km)

These details were in line with those reported by the Pilot, who advised that the "*weather was perfect for flying, nil wind, >10k visibility and a temperature of around 16 degs*".

### 1.9 Federal Aviation Administration Airworthiness Directives

#### 1.9.1 General

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The US Federal Aviation Administration (FAA) issued Airworthiness Directive (AD) 2007-26-12, which mandated specific inspections of the main rotor blades of certain Robinson R22 and R44 helicopters. The AD was issued following reports of "*blade debond*" and in-flight vibration and became effective on 18 January 2008. Its stated purpose was to "*detect blade skin debond and to prevent blade failure and subsequent loss of control of the helicopter*". In addition to a detailed initial inspection, the AD required a visual inspection of the rotor blades before each flight for "*any exposed (bare metal) skin-to-spar bonded area on the lower surface of each blade...*". The AD stated that the pre-flight inspection may be performed by an "*owner/operator (pilot) holding at least a private pilot certificate*" who "*must enter compliance into the aircraft maintenance records...*".

The AD was superseded by AD 2011-12-10, which became effective on 5 July 2011. This AD expanded the applicability to include "*all serial-numbered model helicopters*" but limited the applicability to specific blade part numbers. It was applicable to the main rotor blades on G-HWKS. In addition to the initial inspection requirement, this AD included a further requirement for a detailed inspection to be performed every 100 hours in-service time. However, the pre-flight visual inspection requirement was amended to only require an inspection before the first flight of each day and not before every flight.

AD 2011-12-10 was then superseded by AD 2014-23-16, which became effective on 9 January 2015. In addition to the requirements of the previous iterations, AD 2014-23-16 requires the main rotor blades to be replaced within five years of the effective date of the AD.





A copy of AD 2011-12-10 and associated information from the helicopter Manufacturer was included as part of documentation carried on board the aircraft. A sign-off sheet was also contained within the documentation. This referenced the earlier AD (2007-26-12), and recorded the performance of the visual inspection of the main rotor blades. The Pilot advised the Investigation that he performed the visual inspection before departing from Belleek on the occurrence flight. This inspection had been recorded on the sign-off sheet. This sheet also records that the Pilot had performed the inspection on several previous occasions.

## 1.9.2 Legislative Requirements

Regulation (EU) No 1321/2014 (continuing airworthiness requirements), in Section M.A.803 (pilot-owner authorisation), permits pilot-owners to carry out certain technical inspections, if it is specifically permitted by the AD. In accordance with the Regulation, to qualify as a pilot-owner, the person must:

1. *hold a valid pilot licence (or equivalent) issued or validated by a Member State for the aircraft type or class rating; and [emphasis added]*
2. *own the aircraft, either as sole or joint owner; that owner must be:*
  - (i) *one of the natural persons on the registration form; or*
  - (ii) *a member of a non-profit recreational legal entity, where the legal entity is specified on the registration document as owner or operator, and that member is directly involved in the decision making process of the legal entity and designated by that legal entity to carry out Pilot-owner maintenance.*

In this case, the Pilot was not the owner of the helicopter. Part M.A.606 permits non-owner operators (flight crew) to perform technical inspections; however, such personnel must be specifically approved by an organisation approved by an Airworthiness Authority in accordance with the Regulation.

## 1.10 Additional Information

### 1.10.1 Previous AAIU Reports

Collision with overhead wires is a common cause of aviation accidents and serious incidents in Ireland and elsewhere, with events involving both rotary wing and fixed wing aircraft. Such events have been the subject of numerous AAIU investigations. AAIU Report [2013-004](#), regarding a wire strike accident involving a military helicopter, contains pertinent information in relation to wire strikes (this information is restated in AAIU Report [2014-013](#), which relates to a wire strike involving an R44 helicopter):

*...most helicopter wire strikes occur during daytime with good visibility and with experienced pilots in charge. Wires are difficult to see, partly because of the way the human eye functions and partly because of the effects of background camouflaging...The movement of wires in sunlight and changing sunlight patterns can also obscure wires. Whether a pilot sees a wire or not, is the product of a complex relationship between wire visibility, human limitations, topography and situational awareness. Visibility of suspended wires is notoriously variable.*

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*...The human eye has physical limitations in its performance. One such limitation is its power of resolution - that is, the minimal size of an object that can be registered - due to the construction of the sensor (retina). In some respects the retina resembles the grain in black and white photographic film. The grain in the eye is determined by the finite size of the sense organs, the cones. The size of grain limits the detail that can be obtained. The periphery of the retina is coarse grained and picks up movement but not detail. The central part is fine grained and registers detail. Under specific conditions, i.e. against a plain contrasting background such as the sky, the eye has a compensating mechanism that relies on this contrast. In effect, we perceive the break in continuity of the background rather than 'seeing' the wire itself. The brain translates this into seeing. However, if contrast is reduced and the plain background is broken up, then the basic visual mechanism becomes limited by the grain (cone) size. The wire literally disappears as it is simply beyond the limits of the eye to see it.*

### 1.10.2 Safety Information

In 2010, the IAA launched a wire strike awareness campaign following a Safety Recommendation from the AAIU (IRLD2010015) which arose from an Investigation<sup>8</sup> into a fatal wire strike accident, which occurred in 2009. In addition, the IAA published a Safety Leaflet, IGA 6, entitled '[Wire Strikes – The hazard to Aviation](#)'. The leaflet states the following:

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*Although poles provide pilots with one of the most reliable indicators of the presence of wires, the poles themselves are not always easy to see. Wooden poles, in particular, can be easily camouflaged by the landscape or hidden by foliage and trees. Since poles are typically used by pilots to alert them to the presence of a wire run, the concealment of poles may increase the risk of a wire strike.*

Another source of safety information regarding wire strike avoidance is a video entitled '[Surviving the Wires Environment](#)' available on the Helicopter Association International website.

In addition, several helicopter safety-related leaflets have been produced by the European Helicopter Safety Team (EHST)<sup>9</sup>. One such leaflet, '[Off Airfield Landing Site Operations](#)' (HE3), includes sections on the various stages of a flight, including a section in relation to the 'Landing Site Recce [reconnaissance]'. It states that a landing site recce is required to "assess the suitability of the site for the individual pilot/aircraft capability, the given wind velocity, the best approach/departure path, and local hazards" and describes, in detail, a 'High Recce' and a 'Low Recce', both of which include a check for wires.

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<sup>8</sup> AAIU Report No. [2010-009](#), published 5 August 2010.

<sup>9</sup> **EHST**: One of the three components of the European Strategic Safety Initiative (ESSI). It brings together major helicopter airframe, engine and systems manufacturers, operators, regulators, helicopter and pilots associations, research organisations, accident investigators from across Europe, and some military helicopter operators. The other two components of ESSI are the European Commercial Aviation Safety Team (ECAST) and the European General Aviation Safety Team (EGAST).



## 2. AAIU COMMENT

### 2.1 Wire Strike

The Pilot of G-HWKS was aware of the hazards presented by overhead wires and how poles in or surrounding a field can indicate their presence. He commented that on take-off from the departure field, he hover-taxed to the south of the field to facilitate a northerly departure and *“avoid electrical wires...”*. Then, on arrival at the field near Ballyshannon, he flew over it and noticed that there were *“electricity poles in the middle of large trees surrounding the field”*. Also, he said that he requested his passengers to alert him if they saw *“anything at all, especially wires”*. Furthermore, when he approached to land, he tried to establish where the wires from one of the poles were going and then observed that they were going to another pole further up the field to his left. However, he did not notice that there were wires coming from this pole and crossing the field from his left to right.

The subsequent wire strike further highlights the limitations of the human eye and the difficulties in noticing objects such as electrical or telephone wires traversing a field, particularly one bounded by trees and other obstacles, even when consciously on the lookout for such hazards. Additionally, the considerable upslope in the direction of landing in this case, likely brought the wires below the horizon (as viewed from the cockpit), making them more difficult to see. This occurrence also highlights the increased risk of a wire strike when landing at an unfamiliar location and the importance of carrying out a structured landing site recce, similar to that outlined in the EHEST HE 3 leaflet, before attempting a landing at such a location.

### 2.2 Subsequent Flight

Following the wire strike, a cursory inspection of the helicopter was performed by the Pilot with the assistance of one of the passengers, who the Pilot said, was a *“helicopter engineer”*. The Pilot then flew the helicopter back to the departure field with this person on board. This was done despite noticing damage to the main rotor blades and being aware of the potentially catastrophic consequences of operating a helicopter with damage to the main rotor blades as highlighted in AD 2011-12-10 and subsequently in AD 2014-23-16, both of which were applicable to G-HWKS. The Investigation does not consider that this was a prudent course of action.

### 2.3 Regulations regarding Main Rotor Blade AD Inspection

The Investigation notes the restrictions contained in Regulation (EU) 1321/2014 regarding technical inspections performed by pilots, in that they can only be performed by pilot-owners (or by flight crew specifically approved by an airworthiness authority-approved organisation). The Pilot was not the owner of G-HWKS.

The Investigation also notes that the AD contained in the helicopter’s technical log book (2011-12-10) had been superseded by AD 2014-23-16. However, the inspection criteria is unchanged (the revised AD requires the main rotor blades to be replaced before 9 January 2020). Furthermore, the sign-off sheet for the AD only references the initial AD (2007-26-12). These anomalies were brought to the attention of the helicopter owner, who advised that the ADs and sign-off sheet have since been updated.

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.

Produced by the Air Accident Investigation Unit

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