



# Air Accident Investigation Unit Ireland

**FACTUAL REPORT**

**SERIOUS INCIDENT**

**Reims Aviation SA, Cessna F172N, EI-GWU  
Birr Airfield, Co. Offaly**

**19 February 2023**



An Roinn Iompair  
Department of Transport

## FINAL 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.

---

<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.



**AAIU Report No: 2024-003**

**State File No: IRL00923007**

**Report Format: Factual Report**

**Published: 7 May 2024**

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 20 February 2023, appointed Ray Jordan as the Investigator-in-Charge to carry out an Investigation into this Serious Incident and prepare a Report.

<b>Aircraft Type and Registration:</b>	Reims Aviation SA, Cessna F172N, EI-GWU	
<b>No. and Type of Engines:</b>	1 x Lycoming, O-320-H2AD	
<b>Aircraft Serial Number:</b>	F172-1524	
<b>Year of Manufacture:</b>	1976	
<b>Date and Time (UTC)<sup>4</sup>:</b>	19 February 2023 @ 09:50 hrs	
<b>Location:</b>	Birr Airfield (EIBR), Co. Offaly, Ireland	
<b>Type of Operation:</b>	General Aviation	
<b>Persons on Board:</b>	Crew – 2	Passengers – Nil
<b>Injuries:</b>	Nil	
<b>Nature of Damage:</b>	Minor	
<b>Commander's Licence:</b>	European Union Commercial Pilot Licence (CPL) Aeroplane (A), issued by the Irish Aviation Authority (IAA)	
<b>Commander's Age:</b>	32 years	
<b>Commander's Flying Experience:</b>	296 hours, of which 131 were on type	
<b>Notification Source:</b>	Aircraft Operator	
<b>Information Source:</b>	AAIU Field Investigation AAIU Report Form submitted by the Instructor	

<sup>4</sup> **UTC** Co-ordinated Universal Time. All times in this report are quoted in UTC unless otherwise stated; local time was the same as UTC on the date of the serious incident.

## FINAL REPORT

## SYNOPSIS

During take-off from Runway 18 at Birr Airfield (EIBR), the Instructor, who occupied the right-hand seat, noticed that the aircraft was not accelerating as expected and that the engine sounded quieter than usual. As the aircraft proceeded down the runway, the Instructor observed that the engine was not developing full power and he instructed the Pilot, who occupied the left-hand seat, to abandon the take-off. The Pilot closed the throttle and both crew members applied the brakes. The aircraft over-ran the end of the runway and impacted with a boundary hedge, sustaining minor damage. No injuries were reported. There was no fire.

## NOTIFICATION AND RESPONSE

The Operator notified the AAIU shortly after the event and provided photographs of the aircraft in situ, taken from a variety of vantage points as directed by the AAIU. Following a review of the photographic evidence, the AAIU permitted recovery of the aircraft to a hangar at the airfield. The following morning, two Inspectors of Air Accidents deployed to the site and commenced an Investigation.

## 1. FACTUAL INFORMATION

### 1.1 History of the Flight

The Instructor arrived early at EIBR for a rostered local flight with a new club member. This was the first flight of the day at the airfield and the Instructor informed the Investigation that he always walks the runway prior to the first departure of the day. He reported that he did not feel a *'sinking sensation on the grass'* but did notice that his shoes were wet following his runway inspection. The Instructor said that following a pre-flight walkaround, he pulled the aircraft out of the hangar and started the engine. The Instructor taxied the aircraft to the fuel pump and noted a *'positive response'* from the brakes when he tested them.

The new club member had by now arrived at the airfield and observed the aircraft with its engine running at the fuel pump. After the engine was shut down, he introduced himself to the Instructor who briefed him on the training objectives for the flight. The new club member (hereafter referred to as the Pilot), held a Private Pilot Licence (PPL) with a Single Engine Piston (SEP) class rating but had no experience on the Cessna 172 aircraft. The Instructor briefed the Pilot that they would first route to the local training area and practise some general handling before returning to the field for circuits<sup>5</sup> and a glide approach. After the aircraft was refuelled to full tanks, the Pilot completed a pre-flight walkaround in the presence of the Instructor.

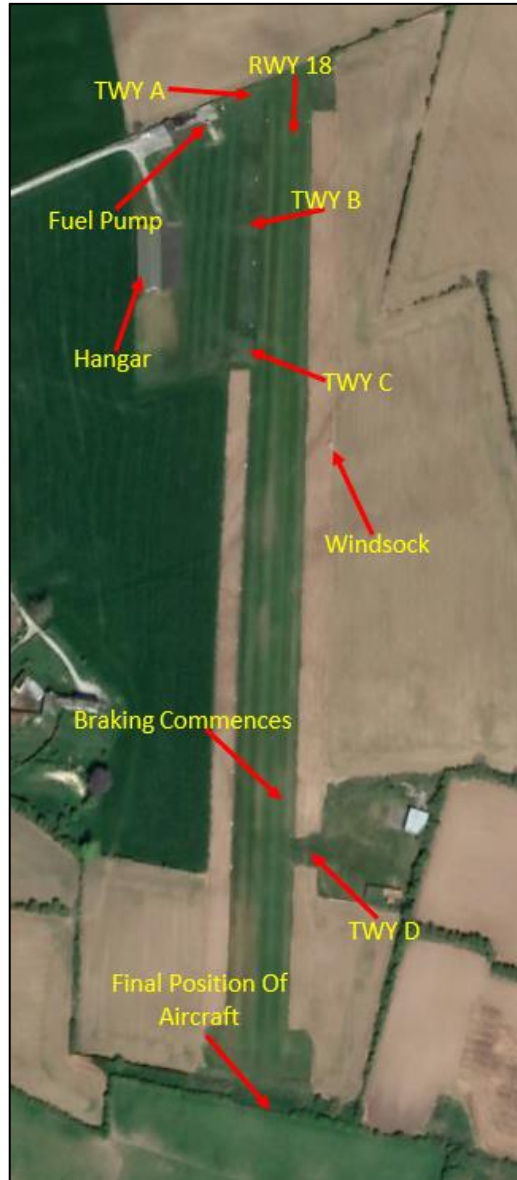
Following completion of the technical log in the club house, both crew members took their respective seats in the cockpit. Prior to starting the engine, the Pilot stated that the Instructor briefed him on the various cockpit instruments and the best speeds for take-off, climb and glide.

---

<sup>5</sup> **Circuits:** The specified path to be flown by aircraft operating in the vicinity of an aerodrome.



The Instructor reported that the engine was started without any issues and that the temperatures and pressures were observed to be in the normal ranges. The aircraft was taxied on the grass surface to a point abeam Taxiway (TWY) B (Bravo) and positioned on a southerly heading to conduct power checks (**Figure No. 1**).



**Figure No.1:** Birr Airfield (*Google Earth*)

The Pilot, who was using a laminated checklist, recalled applying carburettor heat for about *'three or four seconds'* during the completion of the *'POWER CHECKS'* and observed an expected drop in engine speed of approximately 100 rpm<sup>6</sup>. After the power checks were completed, the Instructor stated that he visually checked that the carburettor heat control was in the fully cold position and the engine ignition *'was on both mags'*<sup>7</sup>.

<sup>6</sup> rpm: revolutions per minute.

<sup>7</sup> **Mags:** An abbreviation of the term magnetos, which are self-contained components providing the necessary electrical voltage for the spark plugs.

## FINAL REPORT

The Pilot completed the 'PRE-TAKEOFF' checks and extended the flaps to 10 degrees. A Threat and Error Management (TEM) briefing was conducted by the Instructor which consisted of, amongst other things, actions to be taken in the event of an abandoned take-off, engine failure and emergency evacuation. The Instructor's preferred option for take-off was for a full length departure as he said, *'the more[runway] we have, the better'*. The Pilot taxied the aircraft to the holding point for Runway (RWY) 18 via TWY A (Alpha), where a visual check for any approaching aircraft was conducted. The aircraft lined up on RWY 18 and the Pilot applied some aileron into wind to compensate for a crosswind from the right. The Pilot applied full power and commenced the take-off run. The Instructor stated that the aircraft *'accelerated as normal'* and that he *'didn't feel anything slowing us down'*.

The Instructor said that he expected the take-off run to be a bit longer than usual due to the wet grass but thought something was wrong as they approached abeam the windsock. This was the position on the runway he would have expected to be airborne by, but they were still *'stuck to the ground'*. He glanced down at the tachometer and noticed that it was indicating between 2,000 and 2,100 rpm and the airspeed had stagnated between 50 and 55 knots. The Pilot confirmed to the Instructor that the throttle was in the fully open position but he was concerned that they were not going to get airborne. The Instructor called for the take-off to be abandoned and the Pilot immediately closed the throttle. The Instructor pulled the mixture control and both crew members applied the brakes approximately 190 metres from the boundary hedge (as the aircraft approached TWY D). The Instructor stated that the aircraft began to decelerate but there was insufficient runway remaining to prevent the aircraft from entering rough ground and impacting with the boundary hedge beyond the end of the runway (**Photo No. 1**). Following the impact, both crew members evacuated the aircraft through the main cabin doors. There was no fire.



**Photo No 1:** Final position of EI-GWU (with flaps extended)

## 1.2 Injuries to Persons

No injuries were notified to the Investigation.



## 1.3 Interviews with the Crew

### 1.3.1 Instructor

The Instructor said that he had flown EI-GWU for approximately twenty hours prior to the day of the occurrence. He said that on the day of the occurrence he tested the fuel for the presence of water and particulate matter. The first occasion was in the hangar during his initial pre-flight, the second was a sample taken directly from the fuel pump and the third occasion again from the aircraft following refuelling at the pump. He reported that on all three occasions the samples were clear. The Instructor also said that prior to the flight he accessed the *Met Éireann* Self Briefing System and was aware of the general meteorological situation in the Birr area on the day.

He said that the aircraft skidded following application of the brakes due to the effect of wet grass and that he was wearing his seat belt but not his shoulder harness. He informed the Investigation that he was mindful of the relationship between relative humidity and the potential formation of carburettor icing.

### 1.3.2 Pilot

The Pilot stated that he wanted to fly the Cessna 172, but had never flown this aircraft type before and therefore needed some training. He informed the Investigation that following engine start, it was approximately 10 to 15 minutes before the take-off was commenced and between three and five minutes following the power/carburettor heat checks before they lined up on RWY 18. He said that the throttle '*was right at the firewall*' (i.e., set to full power) prior to abandoning the take-off and that the aircraft impacted the boundary hedge at '*running pace*'. He said that following the runway excursion, they immediately rang the club's Chief Flying Instructor and that he (the Pilot) took three photographs on his phone of the aircraft in situ. He also confirmed to the Investigation that the aircraft he was used to flying had a similar type of brake system to the occurrence aircraft type.

He stated that an individual arrived at the scene to offer assistance. This individual reportedly asked the Pilot if they had a problem prior to departure, as it seemed to this person that it took a long time before commencing the take-off roll. The Pilot further stated that he was aware of the threats posed by carburettor icing. He said that on the day of the occurrence he was '*convinced we had a partial power failure on take-off*'.

## 1.4 Damage to Aircraft

The aircraft was damaged during the runway excursion and subsequent impact with the boundary hedge. The propeller spinner was deformed and there was minor scuffing of the propeller itself (**Photo No. 2**). The engine cowling was damaged and the lower section of the exhaust had bent rearwards. The nose wheel spat had partially disintegrated during the impact sequence.

**FINAL REPORT**

**Photo No. 2:** Final position of EI-GWU showing aircraft damage

### 1.4.1 Engine Ground Run

Following the occurrence, the AAIU agreed to a request from the Operator for an aircraft maintenance engineer to perform a ground run of the aircraft in the presence of a Club official. The engineer stated that engine start-up was normal with no rough running and that oil pressure rose within five seconds of engine start. Engine power was increased to 1,700 rpm and the ignition switch was moved to the R (right) position where a drop of 60 rpm was observed. The ignition switch was selected to BOTH, then to the L (left) position where a drop of 70 rpm was observed. According to the Pilot's Operating Handbook (POH), the rpm drop when individual magnetos are selected should not exceed 125 rpm on either magneto and the differential between magnetos should not exceed 50 rpm. A carburettor heat check resulted in a drop of 80 rpm.

The engineer performed a full power static engine run up which resulted in an observed rpm of 2,300. The POH stated that the engine should run smoothly at approximately 2,280 to 2,400 rpm with carburettor heat off and the mixture full rich. The engine idled at 650 rpm with both temperature and pressure indications in the normal range. The engineer stated that the engine ran as expected with no anomalies observed.

## 1.5 Aircraft Information

### 1.5.1 General

The Cessna F172N is an all metal, high-wing aircraft, with a wingspan of 36 feet (11 metres). It is powered by a Lycoming O-320-H2AD normally aspirated piston engine, driving a two-blade McCauley fixed-pitch, metal propeller. It has a maximum take-off weight of 2,300 lbs.

Section 4 of the aircraft's POH deals with normal procedures and states that before take-off and with the throttle at 1700 rpm, a function check of the 'Carburetor Heat' should be performed.



The purpose of this check is to observe a drop in rpm due to the introduction of hot air into the carburettor system, and after returning the selector to the cold position, checking for any rise in rpm above the initial setting. The POH does not state for how long this check should be performed or by how much the rpm should drop.

Section 3 of the POH deals with emergency procedures and states the following regarding an engine failure during the take off run:

1. Throttle—IDLE
2. Brakes—APPLY
3. Wing Flaps—RETRACT
4. Mixture—IDLE CUT-OFF
5. Ignition Switch—OFF
6. Master Switch—OFF

Step 3 of this procedure (retracting the flaps) reduces lift, which increases the weight on wheels and thereby increases braking effectiveness.

### 1.5.2 Airworthiness Certification

The Certificate of Airworthiness for the aircraft was issued by the IAA on 8 December 2021. The associated Airworthiness Review Certificate (ARC) was issued on 19 January 2023 and was valid until 8 February 2024. The total engine operating hours at the time of ARC renewal was 763.36.

### 1.6 Meteorological Information

*Met Éireann*, the Irish meteorological service, provided the Investigation with an aftercast of the estimated meteorological conditions at the time of the occurrence. Details from the report received are reproduced in **Table No. 1**.

<b>Meteorological Situation:</b>	Ireland lies in a strengthening south-westerly airflow between an anticyclone to the south and a depression centred south-west of Iceland.
<b>Surface Wind:</b> <b>Wind at 2,000 feet (ft):</b> <b>Surface to 300 ft:</b>	South-west 7-12 knots (kt). West to south-west 25-30 kt. West to south-west 10-20 kt.
<b>Visibility:</b>	40 + kilometres (km).
<b>Weather:</b>	Cloudy with patchy rain and drizzle.
<b>Cloud:</b>	Overcast with cloud bases between 1,000-1,500 ft.
<b>Surface Temperature/Dew Point:</b>	9/7 degrees Celsius.
<b>Mean Sea Level (MSL) Pressure:</b>	1,028 Hectopascals (hPa).
<b>Freezing Level:</b>	8,000 ft.

**Table No. 1:** Estimated weather conditions in the Birr area at the time of the occurrence

## FINAL REPORT

## 1.7 Piston Engine Icing

### 1.7.1 Previous AAIU Investigations

The AAIU has published numerous reports relating to accidents and serious incidents that identified carburettor icing as a probable cause.

### 1.7.2 Guidance Material

The UK Civil Aviation Authority (CAA) published Safety Sense Leaflet (SSL) No. 14 on 'PISTON ENGINE ICING'. It provides guidance to pilots on icing in the induction and fuel system of aircraft with piston engines. It states the following in relation to carburettor icing:

*'The most common type of piston engine icing is carburettor icing, often referred to as 'carb icing'. It affects aircraft in which the fuel and air mixture is delivered to the engine via a carburettor.*

[...]

*Within the venturi, the fuel atomisation and associated pressure reduction has a significant cooling effect. The temperature inside the carburettor can be as much as 35°C less than the ambient. Water vapour present in the induction air may therefore condense and turn to ice.*

*The ice will constrict the venturi and throttle valve, reducing the amount of fuel-air mixture flowing to the engine. The mixture will also tend to become richer. Power is often lost gradually, going unnoticed until a large amount of ice is present.*

*Engines with a fuel injection system eliminate carburettor icing. The fuel is delivered under high pressure and closer to the heat of the engine, either at some point in the inlet manifolds or directly to individual cylinders.'*

The Safety Sense Leaflet further states in its section on engine power checks prior to take-off, the following:

*'Select carburettor heat fully on during the engine power checks, for at least 15 seconds. Check that there is a significant power decrease when the heat is selected (typically 75–100 rpm or 3-5" of manifold pressure), and that power is regained when it is selected off. If the power returns to a higher value than before, ice was likely present and further checks should be carried out until the ice has cleared. Depending on the design of an alternate air system, procedures for checking correct operation may vary. Follow AFM guidance.*

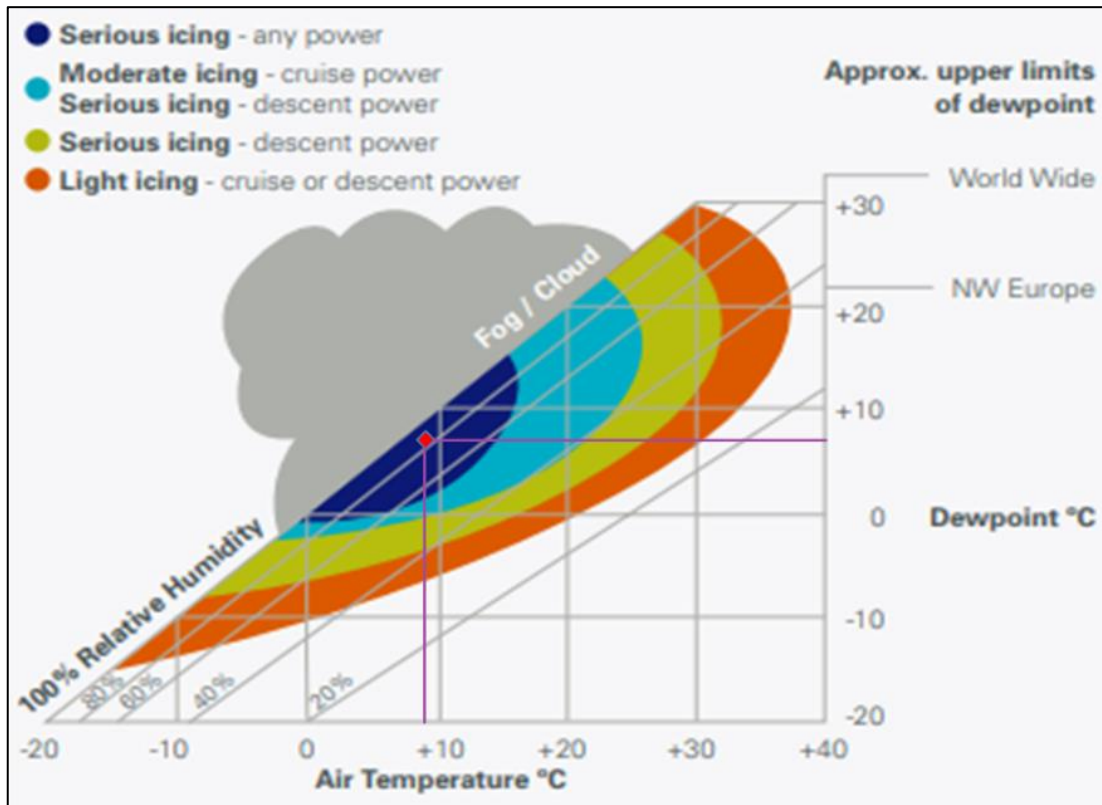
[...]

*If any significant time has elapsed between conducting engine power checks and take-off, reselect carburettor heat on for around 15 seconds, immediately before take-off. This will clear any build up that may have occurred while the engine has been sitting at a low power setting. In conditions conducive to serious carburettor icing, it may be necessary to run the engine to a high power setting several times, to clear any ice and confirm that take-off power will be available.'*



### 1.7.3 Carburettor Icing Charts

As stated in previous investigations conducted by the AAIU, numerous charts have been produced indicating the probability of carburettor ice forming. **Figure No. 2** is extracted from SSL No. 14 and has been annotated by the Investigation using the meteorological conditions on the day of the occurrence. When the temperature of 9°C and dew point of 7°C are plotted, the chart indicates that there is a probability of serious icing in the carburettor at any power setting.



**Figure No. 2:** Carburettor icing chart (modified)

Safety Sense Leaflets (SSLs) are available to view on the CAA website. The IAA website in its section on General Aviation, Safety Information, provides a link to the CAA SSLs.

### 1.8 Airfield Information

EIBR is a licensed airfield located approximately one nautical mile south of Birr town in Co. Offaly, Ireland. It has one grass runway designated 18/36 with a take-off run available of 570 metres. The airfield has an elevation of approximately 250 feet above mean sea level.

During the site survey of the airfield, the Investigation located the approximate position where the brakes were applied on EI-GWU (**Figure No. 1**).

## FINAL REPORT

## 1.9 Personnel Information

The Instructor held a European Union CPL(A) issued by the IAA. The non-expiring licence was issued on 30 September 2019. The Instructor held a Class 1 Medical Certificate, which was valid until 27 October 2023 and a Flight Instructor Certificate for Single Engine Piston (Land), which was valid until 30 September 2024.

The Pilot held a European Union Private Pilot Licence (PPL) issued by the IAA. The non-expiring licence was issued on 27 August 2019. The Pilot held a Class 2 Medical Certificate, which was valid until 4 April 2027 and a Single Engine Piston (Land) class rating, which was valid until 31 August 2023.

The Pilot's and Instructor's flying experience are outlined in **Table No. 2** and **Table No. 3** respectively.

<b>Total all types:</b>	187 hours
<b>Total on type:</b>	Nil
<b>Total on type P1:</b>	Nil
<b>Last 90 days:</b>	5 hours 30 minutes
<b>Last 28 days:</b>	2 hours 10 minutes
<b>Last 24 hours:</b>	Nil

**Table No. 2:** Pilot's Flying Experience

<b>Total all types:</b>	296 hours
<b>Total on type:</b>	131 hours
<b>Total on type P1:</b>	76 hours
<b>Last 90 days:</b>	15 hours
<b>Last 28 days:</b>	7 hours
<b>Last 24 hours:</b>	Nil

**Table No.3:** Instructor's Flying Experience

## 2. AAIU COMMENT

Subsequent to the occurrence, a ground run of the engine was performed by an aircraft maintenance engineer who stated that the engine performed normally with no observed anomalies. The Investigation notes that the environmental conditions on the day, as is the case with most days in Ireland, were conducive to the formation of carburettor ice which will cause a reduction in engine power. Available guidance material states that carburettor heat should be selected 'on' during engine power checks for at least 15 seconds. When the selector is returned to the cold position, a new higher rpm, without any associated throttle movement, is an indication of the presence of ice. In conditions conducive to serious icing, it may be necessary to run the engine to a high power setting several times with the carburettor heat selected to hot in order to clear any ice that may have accumulated. Good practice is to reselect carburettor heat on for at least 15 seconds immediately before take-off if any significant time has elapsed between conducting power checks and commencing take-off.



In a photograph taken shortly after the occurrence, the Investigation notes that the flaps were in the extended position. Section 3 of the POH for the aircraft states that in the event of an engine failure during the take-off run, the flaps should be retracted which increases weight on wheels and improves braking effectiveness. Whilst EI-GWU did not experience a total engine failure, the Investigation considers the actions as described in Section 3 of the POH to be appropriate when abandoning a take-off.

According to the Pilot, the aircraft impacted the boundary hedge at '*running speed*'. The Instructor stated that he was wearing his seat belt but not his shoulder harness. The nature of the damage sustained by the aircraft suggests that it was in a relatively low energy state at impact; however, this may not always be the case. The wearing of all available harnesses by pilots and passengers could mitigate the risk of serious injury.

- 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.**

Produced by the Air Accident Investigation Unit

AAIU Reports are available on the Unit website at [www.aaiu.ie](http://www.aaiu.ie)



**An Roinn Iompair**  
Department of Transport

Air Accident Investigation Unit,  
Department of Transport,  
Leeson Lane,  
Dublin 2,  
D02TR60,  
Ireland.

Telephone:

+353 1 804 1538 (24x7)

Email:

[info@aaiu.ie](mailto:info@aaiu.ie)

X (formerly Twitter):

@AAIU\_Ireland