Air Accident Investigation Unit Ireland

FACTUAL REPORT

ACCIDENT

Reims Aviation SA, Cessna F172M, EI-DDC

Navan Airfield, Co. Meath

4 March 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.

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[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, the Chief Inspector of Air Accidents, on 4 March 2022, appointed Ray Jordan as the Investigator-in-Charge to carry out an Investigation into this Accident and prepare a Report.

Aircraft Type and Registration:	**Reims Aviation SA, Cessna F172M, EI-DDC**
No. and Type of Engines:	**1 x Lycoming 0-320-E2D**
Aircraft Serial Number:	**F17201082**
Year of Manufacture:	**1974**
Date and Time (UTC)[4]:	**4 March 2022 @ 09:40 hrs**
Location:	**Navan Airfield (EIHH), Co. Meath, Ireland**
Type of Operation:	**General Aviation**
Persons on Board:	**Crew – 1 Passengers – Nil**
Injuries:	**Crew – Nil**
Nature of Damage:	**Minor**
Commander's Licence:	**European Union Private Pilot Licence (PPL) Aeroplane (A) issued by the Irish Aviation Authority (IAA)**
Commander's Age:	**39 years**
Commander's Flying Experience:	**120 hours, of which 4 hours 25 minutes were on type**
Notification Source:	**Airfield Operator**
Information Source:	**AAIU Report Form submitted by 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 the same as UTC on the date of the accident.

SYNOPSIS

Shortly after becoming airborne from Runway 27 at Navan Airfield (EIHH), the Pilot noticed that his airspeed was lower than expected and decided to land again. The aircraft touched down and bounced before touching down again. The aircraft departed the runway and impacted a perimeter fence at the end of the runway and came to rest in an adjacent field. During the runway excursion, the aircraft sustained minor damage. The Pilot, who was the sole occupant of the aircraft, was uninjured. There was no fire.

NOTIFICATION AND RESPONSE

The airfield operator notified the AAIU of the accident by telephone. Three Inspectors of Air Accidents deployed to the site to commence an Investigation.

PREAMBLE

The Pilot commenced his Flight Training in September 2016 and most of his flying experience was on a Pierre Robin HR 200 aircraft. The Pilot initially booked a Pierre Robin HR 200 for a planned flight to Ireland West Airport (EIKN). However, due to a subsequent conflicting booking, he was advised that the HR 200 was no longer available and was offered a Cessna 172 instead. Although the Pilot was not as familiar with the Cessna 172, he had completed some training on it.

1. FACTUAL INFORMATION

1.1 History of the Flight

The Pilot arrived at EIHH at approximately 08:15 hrs with the intention of conducting a cross-country flight to EIKN. He filed a flight plan for a departure time of 09:30 hrs. The Pilot stated that the aircraft had been parked on a grass parking area and that he noticed there was frost on the wings. With the help of a flying instructor, the aircraft was started and taxied to the fuel pumps at the airfield, where both fuel tanks were filled. The aircraft was then parked in direct sunlight to facilitate melting of the frost. The Pilot took the opportunity to sit in the cockpit and review the aircraft's checklist. Although he had some experience of the aircraft type, he had not flown this particular aircraft before, and he informed the Investigation that he was *'unfamiliar with the aircraft'*.

The Pilot stated that when he was satisfied that no more frost was present on the wings and tail of the aircraft, he rang Shannon Air Traffic Service to revise his flight plan for a departure time of 09:45 hrs. The Pilot, who was seated in the left seat, started the aircraft and taxied to hold short of Runway (RWY) 27, as he was number two for departure behind a Robin HR 200 aircraft. When the Robin HR 200 aircraft had departed, the Pilot taxied the aircraft on the grass taxiway located between RWY 27 and another runway (RWY 25) at the airfield and lined up on RWY 27 for take-off. The Pilot said that prior to departure, he conducted power and pre-take-off checks.

The Pilot reported that he advanced the throttle for take-off and as the airspeed increased, the aircraft eventually became airborne, but he felt that it was struggling to stay aloft, so he lowered the nose to *'get into ground effect'*[5]. The Pilot noticed that his airspeed was indicating only 40 knots and decided to land again. The Pilot stated that he *'pulled the throttle and put the plane back on the ground'.* The aircraft touched down and bounced before touching down again. The Pilot braked hard and the aircraft veered to the right and impacted with a perimeter fence at the end of the runway. The aircraft then slewed left before coming to rest in an adjacent field, on a magnetic heading of 180° (**Photo No. 1**). The Pilot who was the sole occupant of the aircraft, was uninjured. There was no fire.

Photo No. 1: Final position of EI-DDC

1.2 Interview with the Pilot

The Pilot stated that as part of the power checks conducted prior to take-off, carburettor heat was applied for about *'six or seven seconds'* but no drop in rpm[6] was noticed. The Pilot also said that when full cold was selected, an increase in rpm was not observed which the Pilot thought was a *'bit odd but decided to proceed'.* When asked about the operation of the throttle friction nut as part of the pre take-off checks, the Pilot informed the Investigation that it was not used.

The Pilot informed the Investigation that his normal take-off technique when departing from RWY 27 was to hold the aircraft on the brakes, pull the control yoke fully back, apply full power and then release the brakes. The Pilot stated that he pushed in the throttle for take-off with his right hand which he then placed on the control yoke leaving the throttle unguarded and without any application of the friction nut.

[5]**Ground Effect:** The positive influence on the lifting characteristics of the horizontal surfaces of an aircraft when it is close to the ground.
[6]**RPM:** Engine revolutions per minute.

The Pilot stated that the aircraft eventually became airborne but was struggling to stay aloft. He said that he then heard a radio transmission on the airfield frequency but could not recall exactly what was said but it was *'something about carb heat or throttle'.* At approximately the same time as the Pilot heard the radio transmission, he noticed that his airspeed was indicating only 40 knots but could not recall hearing the stall warning aural alert. He decided to land again and closed the throttle. Ground scarring and ground tracks indicate the aircraft bounced then touched down again (**Photo No. 2**)**.** The Pilot stated that he *'stood on the brakes but it wasn't enough and* [the aircraft] *went through the fence'.* The Pilot recalled that the grass was wet, which in his opinion adversely affected the aircraft's stopping capability. The Pilot said that the aircraft impacted with the fence and then slewed to the left, tipping onto its right wingtip before righting itself again. The Pilot noted a lack of familiarity with the aircraft, and a different cockpit layout to the Robin HR 200 aircraft with which he was more familiar.

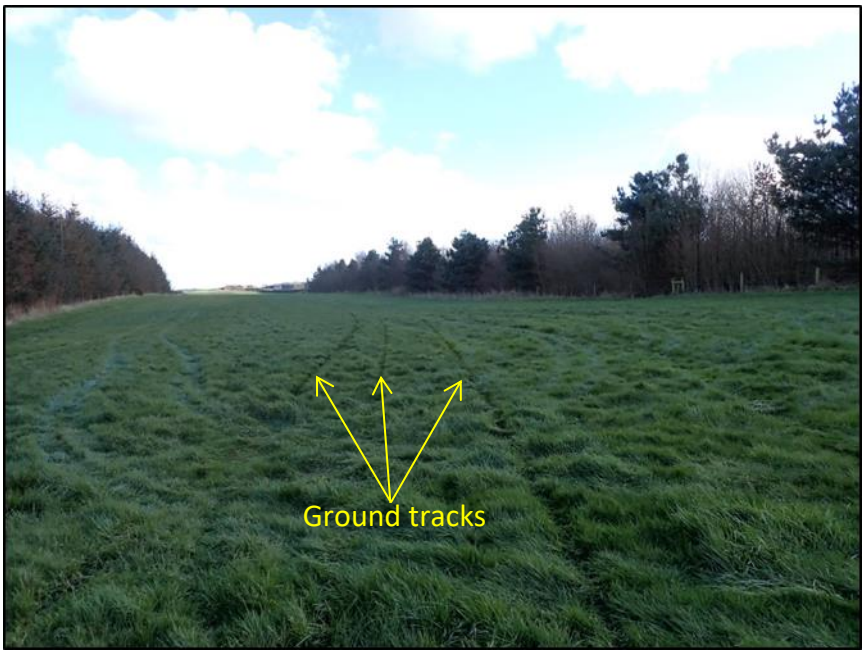

Photo No. 2: Ground tracks on RWY 27 (looking in the opposite direction to flight)

1.3 Witnesses

The Investigation interviewed two individuals who witnessed the event. The first witness, who was a qualified pilot, was in the club house (**Figure No. 1**) and observed the aircraft, stating that *'it was airborne far too early; the* [aircraft] *was hanging on the verge of the stall'.* This witness made the radio transmission described by the Pilot in his interview.

The second witness, also a qualified pilot, was located near some farm buildings. This witness informed the Investigation that he *'heard the aircraft developing full power ready for take-off'.* The witness then walked to an access point at the edge of RWY 27 because it took a little bit longer than usual for the aircraft to come into view.

This second witness stated that the aircraft passed him with a pronounced nose high attitude and at a reduced engine rpm. The witness estimated the height achieved by the aircraft during the flight was between 30 and 40 feet above ground before it touched down, became airborne and touched down again prior to impact with the perimeter fence.

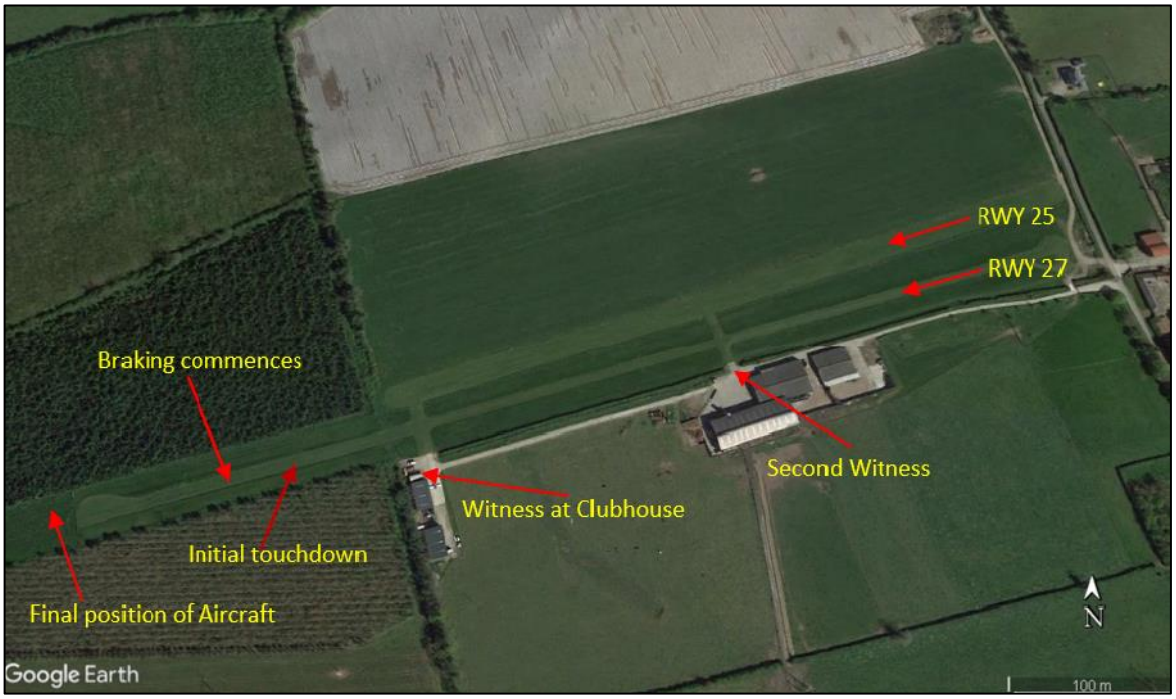

Figure No. 1: Witness locations

1.4 Injuries to Persons

No injuries were reported to the Investigation.

1.5 Aircraft Information

The Cessna F172M is an all metal, high-wing aircraft, with a wingspan of 10.97 m. It is powered by a Lycoming 0-320-E2D normally aspirated piston engine, driving a two-blade McCauley fixed-pitch, metal propeller. The aircraft/engine is equipped with a carburettor heat system to remove carburettor ice. The single throttle control, located below the main instrument panel and accessible from either pilot's seat, has a friction nut to prevent inadvertent throttle movement due to vibration. The aircraft is also equipped with dual control yokes.

The Pierre Robin HR 200 aircraft type is a low-wing aircraft and is equipped with stick type dual controls. A throttle is located to the left of each control stick. For take-off on this aircraft type, a pilot, sitting in the left seat would normally have their right hand on the control stick and their left hand on the throttle whereas on the Cessna 172, a pilot sitting in the left seat would normally place their right hand on the throttle and left hand on the control yoke.

1.6 Damage to Aircraft

The right wingtip fairing was cracked, and mud and grass were present (**Photo No. 3**). A section of the wing's leading edge adjacent to the wing tip was deformed. Scratch marks were observed on one propeller blade and on the engine exhaust pipe (**Photo No. 4**). Wire from the perimeter fence had become entangled around the nose and left main landing gear with impact damage and scuff marks visible on the propeller spinner (**Photo No. 5**).

Photo No. 3 (left) and **Photo No. 4** (right)**:** Damage to right wing tip and propeller blade

Photo No. 5: Damage to the propeller spinner

1.7 Personnel Information

The Pilot held a European Union PPL(A) issued by the IAA. The non-expiring licence was issued on 29 March 2021. The Pilot held a Single Engine Piston (Land) class rating which was valid until 31 March 2023. The Pilot held a Class 2 Medical Certificate which was valid until 10 January 2024. The Pilot's last flight in a Robin HR 200 was on 17 January 2022 and the most recent flight in a Cessna 172 was on 23 November 2021. The Pilot informed the Investigation that he was right-handed.

Total all types:	120 hours 15 minutes
Total on type:	4 hours 25 minutes
Total on type P1:	4 hours 25 minutes
Last 90 days:	7 hours 20 minutes
Last 28 days:	Nil
Last 24 hours:	Nil

Table No. 1: Pilot's Flying Experience

1.8 Meteorological Information

Met Éireann, the Irish Meteorological Service, Aviation Services Division provided the Investigation with an aftercast of the estimated meteorological conditions at the time and location of the accident (**Table No. 2**).

Meteorological Situation:	A light to moderate north-westerly airflow covers Ireland, generated by a ridge of high pressure extending from the Azores.
Surface Wind: **Wind at 2,000 feet (ft):**	North-west 5-8 knots (kt). North-north-west 15-20 kt.
Visibility:	35 km.
Weather:	Dry and sunny.
Cloud:	No significant cloud.
Surface Temperature/Dew Point:	3/1 degrees Celsius.
Mean Sea Level (MSL) Pressure:	1024 hPa [hectopascals].
Freezing Level:	2,500 ft.

Table No. 2: Aftercast of meteorological conditions

1.9 Airfield Information

Navan Airfield (EIHH) is a private airfield located 3 nautical miles north-east of Navan town, which is in Co. Meath, Ireland. It has two adjacent grass runways designated 09/27 and 07/25. RWY 27 is 700 metres in length with a slight downhill slope**.** The airfield has an elevation of approximately 250 feet above mean sea level.

1.10 Ground Tests

Following the accident, the aircraft was recovered to a hard stand. A functional check of the carburettor heat and its associated linkages was performed, and it was found to operate correctly.

With the engine running, the throttle was advanced to the maximum setting, and the throttle friction nut was loosened. The throttle was observed to move back with an associated drop in engine power of approximately 100 rpm. The throttle was then advanced again to its maximum setting and the throttle friction nut was tightened. No reduction in rpm or movement of the throttle was observed.

1.11 Ground Effect

Based on Thom, 1997[7], when an aircraft is flying close to the ground, the surface interferes with the airflow around the wings restricting it in a number of ways. A nearby surface:

- Restricts the upwash and downwash
- Restricts the formation of wingtip vortices

By reducing the upwash in front of the wing and downwash behind the wing, the ground surface acts like a cushion, causing the wing to develop more lift.

Wingtip vortices behind the trailing edge are a major cause of induced drag[8] so when a nearby surface restricts their formation, the induced drag will be less and therefore the total drag on the aircraft will be less. An aircraft operating with reduced power may be able to maintain flying speed while in ground effect; however, once out of ground effect this may not be possible. When an aircraft climbs to a height above the ground, equivalent to approximately one wingspan, an aircraft is effectively out of ground effect (**Figure No. 2**) and if the aircraft is at a high angle of attack, induced drag will also be high. If an aircraft becomes airborne at too low a speed, it may be unable to climb further due to a combination of reducing ground effect and high induced drag.

Because the Cessna 172 is a high-wing aircraft, the downwash generated by the wings can act on the tail of the aircraft. Therefore, when the aircraft climbs out of ground effect, in addition to the decrease in lift and increase in induced drag as the downwash increases, the effect of the downwash on the horizontal stabiliser becomes progressively stronger. This can cause a downward load on the horizontal stabiliser and a nose-up pitching moment.

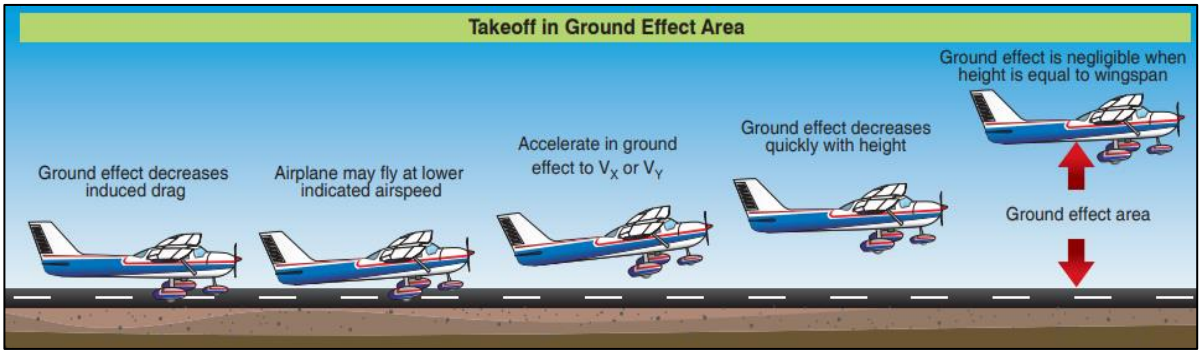

Figure No. 2: Take off in ground effect (FAA Airplane Flying Handbook)

[7] **Thom, T. (1997):** The Air Pilot's Manual, The Aeroplane-Technical. Shrewsbury: Airlife Publishing Ltd.
[8] **Induced Drag:** A consequence of lift and is produced by the passage of an aerofoil through the air.

1.12 Carburettor Icing

1.12.1 Types of Icing

The UK Civil Aviation Authority (CAA) in their Safety Sense Leaflet (No. 14) on *'Piston Engine Icing'* states that there are three main types of induction system icing: Carburettor Icing, Fuel Icing, and Impact Icing.

The Safety Sense leaflet outlines the following:

> *'a) Carburettor Icing*
> *The most common, earliest to show, and the most serious, is carburettor (carb) icing caused by a combination of the sudden temperature drop due to fuel vaporisation and pressure reduction as the mixture passes through the carburettor venturi and past the throttle valve.*
>
> *If the temperature drop brings the air below its dew point, condensation results, and if the drop brings the mixture temperature below freezing, the condensed water will form ice on the surfaces of the carburettor. This ice gradually blocks the venturi, which upsets the fuel/air ratio causing a progressive, smooth loss of power.'*
>
> […]

The Safety Sense Leaflet in its section on '*Pilot Procedures'* further states:

> *'d) Ground Power Checks*
>
> *Select carburettor hot air fully ON for at least 15 seconds. Check that there is a significant power decrease when hot air is selected (typically 75-100 rpm or 3-5" of manifold pressure) and that power is regained (but to a level no higher than before) when cold air is re-selected. If the power returns to a higher value, ice was present and further checks should be carried until the ice has cleared.'*

1.12.2 Guidance on the use of Carburettor Heat

The aircraft's Pilot Operating Handbook in its *'Before Take Off'* procedure includes:

> *'(9) Carburetor* [sic] *Heat – Check operation.'*

A laminated checklist that was located in the cockpit included a section on *'Power Checks'.* It states the following:

- *Brakes* *On*
- *Lookout* *Clear Behind, Check Temp and Pressure Gauges in Green*
- *Power* *Set 1700 RPM*
- *Carb Heat* *Check RPM. On 30secs, Off*
- *Magneto Check* *Right. Max. Drop 125, Left Max Drop 125, Diff. 75 RPM*
- *Oil Temp/Press* *Check in Green*
- *Suction Gauge* *Check in Green*
- *Ammeter* *Charging*
- *Throttle* *Check Idle RPM 700-800 (EI-DDC) then Set 1000 RPM*

1.12.3 Carburettor Icing Chart

Numerous charts have been produced indicating the probability of carburettor ice forming, depending on a variety of factors including temperature, dew point, relative humidity, and power settings. The following chart (**Figure No. 3**) was produced by the Australian Government's Civil Aviation Safety Authority (*CASA*). This chart uses the '*dew point depression'*, which is the ambient temperature minus the dew point. The estimated meteorological condition for Navan Airfield on the day of the accident gave a temperature of 3ºC and a dew point of 1ºC giving a dew point depression of 2ºC which would give a probability of serious icing at any power setting.

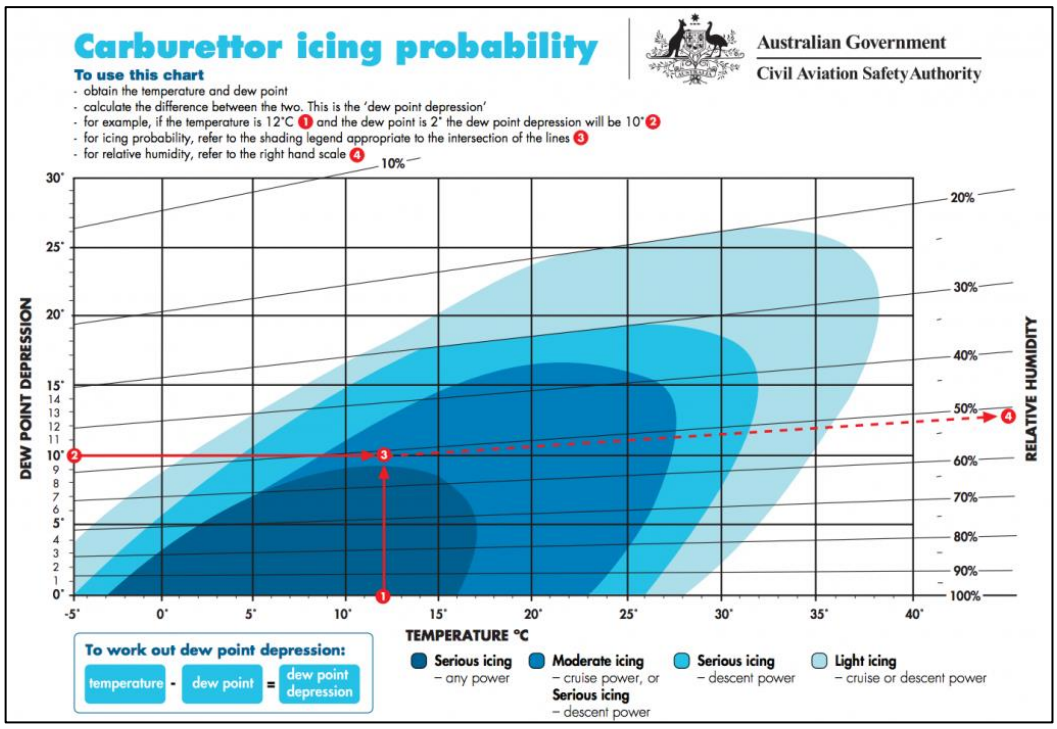

Figure No. 3: Icing chart (*CASA*)

2. AAIU COMMENT

The Pilot was appropriately licensed for the flight and the aircraft's airworthiness certification was valid.

The Pilot had limited flying experience on the aircraft type. During the take-off the Pilot had both hands on the control yoke and the throttle friction lock had not been applied. Therefore, the Investigation considers it likely that, as the aircraft continued its take-off run, the throttle began to creep back due to the effects of vibration. The Investigation notes that the environmental conditions on the day were conducive to the formation of carburettor icing which may have had an adverse effect on engine performance.

Due to the take-off technique being used, the aircraft became airborne at a low airspeed and likely at a reduced power setting. As the aircraft gained altitude it began to transition out of ground effect at a pronounced nose-up attitude, which likely increased the induced drag resulting in the aircraft being unable to sustain stable flight. The Pilot decided to land again, as further increasing the angle of attack in an attempt to climb away could have resulted in a stall. However, the position of the initial touchdown point coupled with the bounce, and reduced braking action made it impossible to avoid impact with the perimeter fence.

This occurrence highlights the importance of familiarity with the specific features and handling characteristics of the aircraft type being operated. The occurrence also highlights the importance of attaining the correct airspeed on take-off, to avoid degraded aircraft performance and an inability to climb away safely. Regarding the operation of the throttle, usual practice is to keep a hand on the throttle during all critical phases of flight to ensure power required has been set correctly, maintained, and in the event of a rejected take-off, power can be reduced expeditiously, reducing ground roll, and mitigating the potential for a runway excursion.

- 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

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