Air Accident Investigation Unit Ireland

SYNOPTIC REPORT

ACCIDENT
REIMS CESSNA FRA150M, G-BDOW
Newcastle Airfield (EINC)
Co. Wicklow, Ireland
13 July 2012

An Roinn Iompair Turasóireachta agus Spóirt
Department of Transport, Tourism and Sport

FINAL REPORT

AAIU Report No: 2013-011
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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 S.I. 460 of 2009, the Chief Inspector of Air Accidents, on 13 July 2012, appointed Mr. Thomas Moloney as the Investigator-in-Charge to carry out an Investigation into this Accident and prepare a Report. The sole purpose of this Investigation is the prevention of aviation Accidents and Incidents. It is not the purpose of the Investigation to apportion blame or liability.

Aircraft Type and Registration:	REIMS CESSNA FRA150M, G-BDOW
No. and Type of Engines:	1 x Rolls-Royce Continental O-240-E
Aircraft Serial Number:	0296
Year of Manufacture:	1976
Date and Time (UTC[1]):	13 July 2012, 17.58 hrs approx
Location:	Adjacent to Newcastle Airfield (EINC) Co. Wicklow, Ireland
Type of Operation:	General Aviation
Persons on Board:	Crew – 1 Passenger – 1
Injuries:	None
Nature of Damage:	Substantial
Commander's Licence:	PPL(A) issued by UK CAA
Commander's Details:	Male, aged 30
Commander's Flying Experience:	400 hrs approx, of which 100 hrs approx were on type
Notification Source:	EINC Airfield Manager
Information Source:	AAIU Investigation. AAIU Report Form Submitted by Pilot

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[1] UTC: Co-ordinated Universal Time, which is used throughout the Report unless stated. Add one hour for local time.

SYNOPSIS

The aircraft carried out two short flights from EINC, as part of a pre-purchase evaluation. During the second flight, the Passenger noticed a momentary RPM drop and the Pilot decided to return to EINC for a landing. He carried out a normal left-hand downwind and base leg and turned onto finals for Runway (RWY) 36. On short finals at a height of approximately 150 feet, the engine stopped without warning and the aircraft descended rapidly, struck the airfield boundary fence and came to rest in a ditch. The two occupants were uninjured. The aircraft sustained substantial damage which was beyond economic repair. There was no fire.

1. FACTUAL INFORMATION

1.1 History of the Flight

The Pilot informed the Investigation that he was assessing the aircraft with a view to purchasing it for use in a flying school. Earlier in the afternoon of 13 July 2012 before flying G-BDOW he, along with a licenced avionic engineer, had examined the aircraft's documentation and had carried out a detailed visual inspection of the aircraft at EINC. He stated that this had included all of the pre-flight actions required by the Flight Manual, including the specified fuel checks.

The Pilot stated that, following a run-up during which everything was normal, he took off on RWY 36 with the avionics engineer as a passenger in the right seat. They performed a number of orbits overhead the airfield at a height of around 1,500 feet and carried out some avionic checks. The cloud-base was at about 2,000 ft. After a flight lasting about ten minutes, they returned to EINC and landed on RWY 36.

The Pilot shut down the engine and the engineer exited the aircraft, while the Pilot remained on-board. A friend of the Pilot, who also held a PPL, then boarded the aircraft and sat into the right seat. The aircraft taxied out, took off again from RWY 36 and climbed to a height of around 1,500 ft with the same profile as the initial flight. The Pilot told the Investigation that the flight included a single roll over the airfield. The Pilot stated that he had given control of the aircraft to the Passenger for a couple of minutes. During this time, the Passenger heard a momentary drop in RPM and brought it to the attention of the Pilot, who had not noticed it at all.

The Pilot took control of the aircraft and decided to return to EINC. He stated that he throttled back and applied carburettor heat for the descent. He stated that he was in no way concerned about the performance of the aircraft and therefore he carried out what was effectively a normal left hand downwind and base leg and turned onto approximately a one mile final for RWY 36. When on finals, he selected the flaps to their maximum setting of 40°.

The Pilot stated that as the aircraft was descending through a height of what he estimated to be 150 ft on short finals, he pushed in the carburettor heat control knob. He stated that at that precise moment the engine cut out without any warning.

The Pilot stated that the aircraft was too low and descended too rapidly for him to take any action other than a shallow turn to the left to avoid a mechanical digger which was parked close to the airfield boundary. The aircraft struck a timber fence abutting a road along the southern boundary of the airfield, turned through an angle of approximately 90° on impacting the ground and came to rest in a water-filled ditch at a nose-down angle of approximately 30° (**Photo No. 1)**. The two occupants, who were wearing seat belts and shoulder harnesses, were not injured in the accident and they exited unaided through their respective doors into the ditch, where they both sustained scratches from briars. The aircraft was substantially damaged in the accident. There was no fire.

Photo No. 1: Final Position of G-BDOW

1.2 Interviews

The Investigation carried out interviews with the Pilot, his Passenger and another pilot who was the last person to fly G-BDOW before the day of the accident.

1.2.1 Interviews with the Pilot

The Pilot was interviewed by the Investigation on the evening of the accident and again some time after the accident. He also submitted an AAIU Pilot Report Form.

In the interview conducted in the immediate aftermath of the accident, the Pilot stressed that he had not noticed any abnormality with the aircraft right up to the moment that the engine stopped.

He stated that it was the Passenger who had remarked on a momentary RPM drop or misfire while he (the Passenger) was handling the aircraft overhead EINC, and they had made an immediate decision to return to EINC to land. In any case, the flight was coming to its intended conclusion at that time.

He stated that, while overhead the field the engine was running at cruise power in the range 2,300 to 2,400 RPM. After the decision to return to EINC was made, he throttled back to about 1,500 RPM and then pulled out the carburettor heat knob because he was descending at low power. He made a *"fairly rapid descent"* and the engine was at *"fairly low revs all the way in from then"*.

The Pilot described how his normal procedure when landing was *"on very short finals….to knock off the carb heat in case of a go-around". The "engine stoppage was to the millisecond co-incident"* with when he pushed the carburettor heat knob back in.

The Pilot stated that there had been plenty of fuel in the aircraft before the flights and that he definitely had not run out of fuel.

In the later interview with the Pilot, he stated that prior to flying he had dipped the tanks with a graduated dipstick that was in the aircraft. He said that there was the best part of two hours fuel on the aircraft. He had converted the fuel quantity measured on the dipstick to endurance using data from the Flight Manual. Neither he nor his colleagues had put any fuel into the aircraft before the flights. He stated that, after the accident, the fire brigade had dispensed foam all over the aircraft and into the ditch because of the smell of fuel at the accident site. He was aware that the FRA150M carries a relatively large quantity of unusable fuel. He stated categorically that *"there was absolutely enough fuel for the flights that we did".*

The Pilot confirmed that, as far as he could recall, after making the decision to return to land at EINC he had throttled back for the descent and then pulled out the carburettor heat knob. He also said that during the descent, exercising the throttle did not occur. He pointed out that during the descent, the engine was not at idle power but was operating at around 1,500 RPM and that, while this might not have the same carburettor heating effectiveness as at cruise RPM, he would not expect any carburettor icing problems to be encountered in those conditions. He had set the flaps to 40°, their maximum setting, when the aircraft was on final approach.

The Pilot confirmed that he usually but not always turned off carburettor heat on short finals. He accepted that the FRA150M Flight Manual stated that, for a normal landing, carburettor heat is set to cold (turned off) after landing.

He had not done a weather check, or specifically checked the temperature/dewpoint conditions prior to the flights.

The Pilot stated that his initial flying training had been done on the Cessna 150 and that he had, by the time of the accident, achieved approximately 100 hours on type. He had also flown a wide variety of other single engine piston types in his 400 hours total flying time.

The Pilot provided the Investigation with a copy of his PPL(A) which was issued by the UK CAA in 2010 with a five year validity. He held a Single Engine Piston (Land) rating valid until December 2012 and a Class 2 Medical valid until 2015.

1.2.2 Interview with the Passenger

The Passenger was interviewed by the Investigation on the evening of the accident. He confirmed that he held a PPL and that he was invited to fly as a passenger on a pre-purchase evaluation flight by the Pilot with whom he was friendly. He stated that he occupied the right hand seat.

He recalled that, while flying orbits overhead EINC, he heard a momentary reduction in RPM which the Pilot did not notice. When asked which of them was flying the aircraft at that time, the Passenger stated that it was the Pilot who was flying and that he had not seen the Pilot's hand moving the throttle when the RPM reduction occurred. He didn't see any movement of the RPM dial but he had not been looking at it at the time. After that, the engine ran fine again. They decided to return to EINC and land. At what he estimated to be a height of about 100 ft on the final approach, the engine died. The nose of the aircraft went down and he saw the ground coming up to meet them. The aircraft hit a fence and he was *"stunned for a second or two"*. He released his harness, opened his door and dived out of the aircraft into the water because he saw steam which he initially thought was smoke and he wanted to get clear of the aircraft. He recalled that after that, he came around the left hand side of the aircraft and he saw that the Master switch was off. When asked if he had been handling the aircraft during the flight he said, *"Maybe for a minute or two"*.

1.2.3 Interview with pilot who had flown G-BDOW previously

The Investigation interviewed the pilot who had flown G-BDOW at EINC on 11 July 2012, two days before the accident. The Investigation understands that this was the flight which immediately preceded the two flights on 13 July 2012. This pilot had purchased a share in the aircraft in early July 2012.

He had previously flown in the aircraft on 26 June 2012 with another co-owner for about 30 minutes. On that occasion, they had found that operating the carburettor heat knob had no effect on engine RPM and was thus defective. That defect had been repaired on 30 June and on 11 July he flew G-BDOW again with a passenger. They flew in the EINC area and towards Wicklow town for about 25 minutes. The weather was gusty with rotors off the hills and he had curtailed the flight and returned to EINC.

Prior to the flight on 11 July, he dipped the tanks and found that the right-hand tank was approximately one quarter full, with the left tank being a little less than that. He also stated that the fuel gauges were both reading about ¼ full. He had not refuelled G-BDOW after the flight. He stated to the Investigation that on 11 July, the aircraft was flying perfectly.

1.3 Damage to Aircraft

The aircraft sustained substantial damage in the accident and was beyond economic repair. The fact that the forward fuselage ended up in a ditch is likely to have partially cushioned the impact. The nose landing gear leg was pushed rearwards and upwards into an almost horizontal position. The lower arms of the engine bearers, which were attached to this leg, were fractured.

The main landing gear legs were also pushed rearwards and upwards, which resulted in substantial buckling of the fuselage underneath and to the rear of the cabin area. The outer section of the port wing sustained severe deformation of the leading edge while the starboard wing was pushed rearwards from the wing root outwards, which in turn led to the aircraft roof above the cabin area being pushed upwards and deformed.

1.4 Aircraft Information

1.4.1 General

The Reims Cessna FRA150M is a single-engined high-wing two-seat monoplane, with a non-retractable tricycle type landing gear. The 'F' in the aircraft designation indicates that it was manufactured in France by Reims Aviation, while the 'R' indicates that a Rolls-Royce Continental O-240-E 130HP[2] engine was installed. The 'A' in the aircraft type designation indicates that the aircraft had an aerobatic capability.

In the FRA150M, fuel is supplied to the engine from two tanks, one in each wing. From these tanks, fuel flows by gravity through a fuel shutoff valve and fuel strainer (also known as a gascolator) to the carburettor. **Table No. 1**, which is reproduced from the Flight Manual, shows the fuel quantity data for the type.

TANKS	USABLE FUEL ALL FLIGHT CONDITIONS	UNUSABLE FUEL	TOTAL FUEL VOLUME
TWO, STANDARD WING 49 Litres each (13 US Gal)	22.5 US Gal 85 litres	3.5 US Gal 13 litres	26.0 US Gal 98 litres

Table No. 1: FRA150M Fuel Quantity Data

The Flight Manual contains fuel consumption data in a Table entitled *"Cruise Performance"*. The Table states that, at an altitude of 2,500 ft, the fuel consumption is 28.0 litres/hour at 2,650 engine RPM; 23.5 at 2,500; 18.9 at 2,300; and 15.5 at 2,100. The Flight Manual cautions that, while the data in the table will be useful in flight planning, it does not take into account the effects of wind, navigational errors, pilot technique, run-up, climb, etc.

[2] HP: Horsepower

The fuel outlet from each tank is close to the centre of the tank (when viewed from fore to aft).

With respect to carburettor heat, the Flight Manual states that, *"Before landing"*, full heat should be applied before closing the throttle. In case of a *"Balked landing"*, the sequence is *"Throttle – full open"* and then *"Carburettor heat – Cold"*. After a normal landing, the sequence is *"Wing Flaps – Up"* and then *"Carburettor heat – Cold"*.

1.4.2 Ownership of G-BDOW

G-BDOW had been based in the UK for many years and on the date of the accident, its registered owner was a company in the UK.

The Investigation learned that G-BDOW had been sold by the registered owner to a UK aircraft broker on 29 March 2012, on which date it was ferried from Cranfield England, its previous base, to the broker's premises. This was its first flight since 24 February 2012. The broker informed the Investigation that, shortly afterwards, he agreed to sell the aircraft on to a buyer in Ireland and the aircraft was delivered to him at Haverfordwest, Wales on 6 April 2012 from where it was ferried to EINC, its subsequent base. Partial payment for the aircraft was received by the broker from a different party than the original intended buyer, who appeared to have pulled out of the purchase. The broker informed the Investigation that the total flying time between G-BDOW's departure from Cranfield and arrival in Haverfordwest was 2 hours 55 minutes during which the aircraft *"performed very well without any glitches."*

At the time of the accident, two persons in Ireland co-owned G-BDOW while the UK broker also retained a financial interest in it, for which he was awaiting payment. The Pilot who was flying G-BDOW when the accident occurred had proposed to buy the aircraft outright from the co-owners and the broker.

The accident led to legal dispute between the various interested parties, the principal issues being whether the Pilot had the owners' permission to fly G-BDOW and the aircraft's insurance status.

1.4.3 Aircraft Documentation

On the day following the accident, the Investigation took possession of documentation related to G-BDOW at EINC. This included the Flight Manual, an Aircraft Checklist, Aircraft and Engine Logbooks and Aircraft Technical Logs. Entries in the aircraft documentation ceased on the 24 February 2012, i.e. when the aircraft was still based in the UK. Despite numerous requests for further information regarding the aircraft's activities while based at EINC including flights, engine runs, maintenance actions and fuel uplifts, these were not made available to the Investigation and it appears that such records do not exist. The only exception to this was a Certificate of Release to Service (CRS) issued by a Licenced Engineer on the 30 June 2012 certifying the repair and re-routing of the carburettor heat cable. One of the co-owners assured the Investigation that this was the only significant maintenance activity carried out on G-BDOW after it arrived in EINC.

The last maintenance entry in the Log Books was for a 50 hour inspection carried out in Cranfield on 16/17 February 2012 at 6,342.6 airframe hours and 1,447.4 engine hours. The log book records ceased on the 24 February 2012 at 6,343.6 airframe hours and 1,448.4 engine hrs. The documentation stated that the next Scheduled Maintenance Inspection due was a 50 Hour/Annual Inspection due at 6,392.6 airframe hours or on 16 August 2012. Due to the lack of records after February 2012, it was not possible to determine the airframe or engine hours on the day of the accident.

The tachometer incorporated an hour-meter which read 7,329.6 hours at the time of the accident. The CRS for the 50 hour inspection carried out on the 16/17 February 2012 had the text *"Tach 7381."* hand-written alongside the typed entry 6,392.6 hours for the next Scheduled Maintenance Inspection. However, the maintenance organisation which had issued that CRS went out of business shortly afterwards and it was not possible to determine the precise meaning or intent of the hand-written entry.

The documentation for G-BDOW included a Certificate of Airworthiness issued by the UK CAA on 22 April 2008 and also a UK CAA Airworthiness Review Certificate which was issued on the 8 August 2011 and had a date of expiry of 3 August 2012.

1.5 Technical Examination

The AAIU Inspector on Call (IOC) arrived at EINC approximately one hour after the accident had occurred. By that time, there was a smell of fuel from the ditch and the Fire Service had dispensed a considerable quantity of foam onto the forward area of the aircraft and into the ditch (**Photo No. 2)**. The IOC supervised the recovery of G-BDOW from the accident site and its transfer to a hangar on the airfield. Subsequently the aircraft was moved to the AAIU wreckage facility in Gormanston for examination.

Photo No. 2: G-BDOW in Ditch

During the recovery of the wreckage, a quantity of fuel spilled into the ditch from the forward inboard area of the starboard wing where it had separated from the fuselage. This was due to the damage sustained in the impact, as the wing had been pushed back, compromising the fuel system. Because of the nature of the terrain around the accident site, it was not possible to collect the majority of this fuel. However, sufficient was collected to enable analysis at a laboratory.

On the morning following the accident, the Investigation confirmed that the throttle, mixture and carburettor heat controls were connected and properly attached. The three controls were exercised and all three functioned correctly. The engine was found to be turning without hindrance. The carburettor was then removed from the aircraft. It was found that there was a small quantity of fuel in the bowl (**Photo No. 3)**. There was also fuel in the pipe leading to the carburettor and the gascolator was full of fuel.

Subsequently, the Investigation carried out an examination of the engine in Gormanston. Again, the engine turned over without difficulty. The two magneto drive trains were both found to rotate correctly with no stiff spots. The eight spark plugs were removed and all were found to be in good condition and were a uniform light grey colour. When the engine was turned over, both magnetos were found to be producing sparks at the plugs. A boroscope check of the cylinders was carried out. No evidence of mechanical damage was seen. The plugs were replaced and, when the engine was turned over, compression was confirmed and some residual material was blown out of the exhaust pipe.

The “finger filter” in the fuel inlet to the carburettor was found to be clean and in good condition. The ignition timing was checked and was found to be correct. The muffler was inspected and the gas path was found to be clear.

Photo No. 3: Carburettor Following Dis-Assembly

The fuel sample taken from G-BDOW at EINC was sent for analysis at a laboratory in Dublin. The results showed that the fuel was AVGAS and no anomalies were identified.

1.6 Meteorological Information

Following the accident, the Investigation requested a weather report from the Aviation Services Division of Met Éireann. The report stated that at the time of the accident, an unstable northeasterly flow covered the area subsequent to an occluded front pushing away southwards. There were showers present in the vicinity of EINC, generally light in intensity. The surface temperature and dew point were 15/11°C. The report concluded, *"The humidity profile suggests there was a moderate to severe carburettor icing risk depending on the power of the aircraft at the time."*

1.7 Survival Aspects

1.7.1 Aircraft Harnesses

As the FRA150M is certified for aerobatics, both seats are equipped with seat belts and shoulder harnesses as standard.

1.7.2 Emergency Service Response

Note: All times in this Section are local time, i.e. UTC + 1 hour.

Shortly after the accident, it was brought to the attention of the Investigation that *"there was a significant delay in the mobilisation of the Wicklow Fire and Rescue Service to the aircraft accident at Newcastle Airfield."*

The Department of Communications, Energy and Natural Resources has a contract in place with a commercial telecommunications company to provide emergency call answering services (ECAS), i.e. to answer and process calls made to the emergency numbers 112 and 999. It is ECAS procedure to put calls through to the first Emergency Service (ES) requested by a caller.

The Investigation was informed by the ECAS service provider that the first relevant call was received at 18.59:44 hrs. ECAS informed the Investigation that, *"The caller advised of an aircraft crash in Newcastle airport, Co. Wicklow. The caller was quite distressed and difficult to understand. The operator thought the caller requested an ambulance however the caller had requested 'everything'. When the operator confirmed Ambulance as the Emergency Service requested the caller agreed. This call was connected to National Ambulance Service (NAS) Command and Control Townsend Street. . The caller advised the Ambulance service an ES was not needed as it was an emergency landing".*

ECAS received another call from the same mobile telephone at 19.01:33 hrs. ECAS advised the Investigation that, *"The caller requested the Ambulance service. The call was connected to the NAS Command and Control Townsend Street. The caller confirmed the address and advised an emergency landing had taken place and an Ambulance was needed as a precautionary measure as everyone was walking."*

The next relevant call received by ECAS was at 19.27:53 hrs from a different mobile number. ECAS advised the Investigation that, *"The caller requested 'Garda and Fire Brigade' in Wicklow. The call was connected to Wicklow Gardaí and the caller was advised to tell the Garda he also needed a Fire Brigade. The caller advised the Garda that his name was [ ] from Newcastle Airfield, he advised he had put a call in 20 mins ago as there was a plane down and is buried in a ditch, two lads had been taken in an ambulance and he needed support. He advised he needed a Garda car as there was gas leaking".*

Another call was received by ECAS at 19.32:25 hrs from An Garda Síochána requesting the Fire Service in Wicklow. An Garda Síochána advised they had *"received a report of a light aircraft crash at Newcastle aircraft field"*. The ES Operator (Fire Service) advised *"we already have the lads on route"*.

The Investigation sought information from the Dublin Fire Brigade (DFB) East Region Control Centre (ERCC) regarding the response to the accident. ERCC is responsible for the receipt of emergency fire calls and mobilisation of fire appliances for DFB and all fire authorities in Leinster, including County Wicklow. ERCC is located in Dublin city centre and is co-located with the NAS Command and Control. ERCC informed the Investigation that *"There are protocols and procedures for the transfer of incidents and resources and both agencies cover different geographic areas for the provision of emergency ambulance services."*

DFB ERCC documentation provided to the Investigation showed that the first recorded notification about the air accident at EINC was at 19.24:54 hrs when a Sub Officer at Greystones Fire Station, who had been contacted directly by an acquaintance at the accident site, alerted ERCC. Thereafter ERCC mobilised fire fighting appliances from Greystones and Bray to attend at the accident site. The first such appliance arrived on scene at 19.46:02 hrs.

NAS stated to the Investigation that they had verbally informed DFB about the incident at 19.05 hrs. There is no record of such notification in DFB documentation.

1.8 Other Information

1.8.1 Carburettor Icing

Carburettor icing is caused by the temperature drop due to fuel vaporisation and reduction in pressure at a carburettor venturi. The temperature reduction may be as much as 20° to 30°C and results in moisture in the induction air forming ice. The ice gradually builds up, constricting the venturi and, by upsetting the fuel/air ratio, causes a progressive decrease in engine power. Engines with a conventional float type carburettor are susceptible to this condition.

Carburettor icing is prevented by heating the induction air in an exhaust gas heat exchanger before it reaches the carburettor. This is usually achieved by use of a manually operated carburettor heat control knob, which when selected to "HOT", bypasses the normal intake filter and takes the induction air from a heated source. It is important to select the HOT position in time to prevent the formation of ice, because if the selection is delayed, the use of hot air may be too late to melt the ice before the engine stops.

There is a large amount of literature available on-line and elsewhere concerning carburettor icing, including an Aeronautical Information Circular (AIC) issued by the Irish Aviation Authority (IAA), AIC NR 11/97, which is available at:
http://www.iaa.ie/safe_reg/iaip/Frame1.htm

This AIC states at Section 5.9.1 regarding aircraft descent, *"As reduced throttle openings are much more conducive to the formation of carburettor icing, the HOT position should be selected before the throttle is closed for the descent or an auto-rotation, i.e. before the exhaust temperature starts to fall. Maintain the HOT selection during prolonged periods of flight at reduced throttle settings, e.g. during long descents at low power, and increase engine power to cruise settings at intervals of approximately 500 ft so as to increase exhaust temperatures in order to melt any ice which has formed."*

1.8.2 Allegations Made to the Investigation

During the Investigation, several allegations and counter-allegations were made to the Investigation by parties to the aircraft and the accident. The most relevant of these was a claim that the engine had been removed from and re-installed in G-BDOW at EINC in the weeks leading up to the accident. It was alleged that this was to facilitate a welding repair to the engine bearer arms. The Investigation made contact with the principal co-owner and with three other persons whose names arose in connection with this alleged activity.

The co-owner stated categorically that an engine removal had not taken place, as did one of the other persons. Another of the persons whose name arose in connection with the alleged work stated that, while he had tightened up a loose engine bearer arm, to his knowledge the engine was not removed from the aircraft while it was at EINC. No record of this tightening was found in the aircraft documentation. The third person stated that he had never been in EINC and that while he often carried out welding jobs on bearer arms, he had no knowledge or records of doing such work for G-BDOW.

The Investigation examined the bearer arms. No evidence of a recent welding repair was noted.

2. ANALYSIS

2.1 General

G-BDOW suffered a sudden loss of power due to engine stoppage on short finals to RWY 36 at EINC. The engine stoppage was totally unexpected by the Pilot, who was carrying out a normal approach to land at the airfield. The low height of the aircraft and the maximum flap setting of 40° meant that the situation was unrecoverable and the aircraft struck the airfield boundary fence and came to rest nose-down in a water-filled ditch. It was fortunate that the aircraft was fitted with shoulder harnesses which restrained the two occupants in their seats during the impact, and they were uninjured.

Other than a single CRS issued for a repair to the carburettor heat cable carried out on 30 June 2012, the aircraft and engine log books contained no entries after 24 February 2012, when the aircraft was still based in the U.K.

The Investigation was unable to obtain any documented records of flying hours, engine runs, maintenance actions (other than a single CRS) or refuelling while the aircraft was based in EINC between 6 April 2012 and the date of the accident. It is unlikely that such records exist.

Therefore it cannot be stated definitively that the aircraft was airworthy when the accident occurred as, for example, there were no records confirming that the hours for the next airframe inspection due at 6,392.6 airframe hours had not been exceeded.

2.2 Engine Stoppage

Following the accident, the engine was examined by the Investigation at the AAIU's Gormanston facility. No mechanical issues were found with the engine, which turned over without hindrance and compression was confirmed. The throttle, mixture and carburettor heat controls were all found to be installed and functioning correctly.

The Investigation considered the possibility that the aircraft had run out of usable fuel when on short finals. The pilot who had flown G-BDOW two days before the accident stated that, when he had dipped the tanks prior to his flight, both tanks were about one quarter full. Given that the total fuel capacity of the tanks is 98 litres, this would mean that the tanks contained approximately 25 litres, of which 13 were unusable. If an average fuel consumption figure of 22 litres/hr is assumed, this would mean that the endurance of G-BDOW prior to the flight on 11 July was in the order of 33 minutes. That flight was reported to have lasted 25 minutes and thus only a small quantity of usable fuel would have remained thereafter.

The Pilot who was flying at the time of the accident stated that neither he nor his colleagues had refuelled the aircraft prior to the two flights on 13 July. However, he categorically stated to the Investigation that he had dipped the tanks and that there was the best part of two hours fuel on the aircraft. Given that there is no evidence of the aircraft being refuelled between the flights of the 11 and 13 July, the Investigation is unable to resolve the two statements.

When the carburettor was disassembled, it was found that only a small quantity of fuel remained inside the bowl. The gascolator, which is at the lowest point of the fuel system, was full of fuel and there was some fuel remaining in the fuel line between the gascolator and the carburettor.

The fuel outlet is close to the centre of each fuel tank (when viewed from fore to aft). Thus, the nose-down attitude encountered at a 40° flap setting could be a factor in uncovering the outlet when approaching minimum usable fuel remaining in the tanks.

An undetermined quantity of fuel spilled from the aircraft into the ditch following the accident and while the aircraft was being lifted from the ditch. However, the FRA150M holds 13 litres of unusable fuel, which is a considerable proportion of the total fuel capacity.

In the circumstances, the Investigation was unable to eliminate the possibility that the engine stoppage was due to fuel starvation.

2.3 Carburettor Icing

In light of the Pilot's assertion to the Investigation that the aircraft had "*absolutely enough fuel*" for the two flights on 13 July 2013, the Investigation considered other possibilities for the engine stoppage. Met Éireann's weather report for EINC at the time of the accident stated that the humidity profile suggested there was a moderate to severe carburettor icing risk depending on the power of the aircraft at the time. The Pilot's recall of the events prior to the accident was that he had throttled back to descent power prior to selecting carburettor heat. Thereafter, he did not adjust the power again prior to the engine stoppage.

The Flight Manual requires that full carburettor heat is applied before closing the throttle. This is so that heated air is available before the exhaust temperature starts to fall after power has been reduced. Good practice, such as set out in IAA AIC NR 11/97, is that during a prolonged descent at low power, engine power is increased to cruise settings at intervals of approximately 500 ft so as to increase exhaust temperatures in order to melt any ice which has formed.

It is possible that, given the humidity profile of the day, which was conducive to carburettor icing, the initial RPM drop noticed by the Passenger was the first symptom of the formation of ice. The fact that the Pilot then reduced engine power prior to the application of carburettor heat, combined with the reduced effectiveness of carburettor heat throughout the descent due to the continuous low power setting, is likely to have exacerbated an icing situation. The Investigation considers that it is possible that carburettor ice caused the engine stoppage.

2.4 Emergency Response

NAS informed the Investigation that they had verbally informed the DFB of the accident at 19.05 hrs (local time). DFB ERCC documentation shows that the earliest recorded notification received by DFB ERCC was approximately 25 minutes after the initial 999 call from the accident site, which was made at 18.59:44 hrs (local time). As a result, the first fire appliance arrived at the site approximately 46 minutes after the initial call whereas an ambulance had arrived about 20 minutes before that.

The AAIU has published a document entitled "Guidance for An Garda Síochána and the Emergency Services in the aftermath of an Aircraft Accident". It is available at http://www.aaiu.ie/sites/default/files/attachments/Guidance%20Doc%20for%20Emergency%20Services.pdf.

In Section 8 Fire Fighting the document states, "*It is vital that the fire is extinguished as soon as possible and, as soon as all has been done to save life and minimise injury, that the wreckage should be disturbed as little as possible. It is important that the Fire Service does not allow the post-impact fire to burn itself out as this will cause unnecessary damage to the wreckage and will destroy evidence.*"

Fortunately in this case, there was no post-accident fire. However, there is always a considerable risk of such a fire especially in cases where fuel leaks from wreckage which then may be set alight by an ignition source such as hot engine parts or disrupted electrical wiring. The Investigation considers it critical that the Fire Service, and indeed all the relevant emergency services including An Garda Síochána and the Ambulance Service, should always be alerted immediately when an air accident is reported to the Emergency Services.

Therefore, a Safety Recommendation is issued to the Department of Communications, Energy and Natural Resources to the effect that the Department should engage with the Emergency Call Answering Service service provider and the emergency services to consider putting procedures in place which ensure that emergency calls related to air accidents are notified immediately to all of the emergency services.

3. CONCLUSIONS

(a) Findings

1. The Pilot was carrying out a pre-purchase assessment flight of G-BDOW.

2. The Pilot held a valid PPL with single-engine piston rating.

3. No technical records were available for the aircraft after 24 February 2012, with the exception of a single CRS for work completed on the carburettor heat cable.

4. Although an Airworthiness Review Certificate with a date of expiry of 3 August 2012 was issued for G-BDOW, it was not possible to definitively assess the airworthiness status of the aircraft due to the absence of recent records.

5. Evidence from the pilot who last flew G-BDOW prior to the date of the accident suggests that a small quantity of usable fuel remained in the aircraft after his flight.

6. There is no evidence that the aircraft was refuelled after that flight. It was not refuelled by the participants in the accident flight before their two short flights.

7. The Pilot in Command at the time of the accident stated categorically that he had dipped the tanks prior to flight and that there was sufficient fuel for his flights.

8. The carburettor bowl contained only a small quantity of fuel on examination.

9. There was a moderate to severe carburettor icing risk at the time of the accident, which was dependent on the power setting of the aircraft.

10. The use of carburettor heat by the Pilot during the final stages of the flight was not in accordance with Flight Manual procedures or best practice.

11. The first recorded notification of the accident at Dublin Fire Brigade East Region Control Centre was not until approximately 25 minutes after the first 999 call was made to the Emergency Services.

(b) Probable Cause

Engine stoppage at low height for undetermined reasons, but most likely due to either fuel starvation or carburettor icing.

4. SAFETY RECOMMENDATIONS

No.	It is Recommended that:	Recommendation Ref.
1.	The Department of Communications, Energy and Natural Resources should engage with the Emergency Call Answering Service service provider and the emergency services to consider putting procedures in place which ensure that emergency calls related to air accidents are notified immediately to all of the emergency services.	IRLD2013019

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- 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.

Produced by the Air Accident Investigation Unit

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