FINAL REPORT

AAIU Report No: 2010-003
State File No: IRL00909076
Published: 29/04/10

In accordance with the provisions of SI 205 of 1997, the Chief Inspector of Air Accidents, on 17 August 2009, appointed Mr. Paul Farrell as the Investigator-in-Charge to carry out a Field 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:	Colomban Cri-Cri MC-15, G-CDNJ
No. and Type of Engines:	2 x JPX PUL-212
Aircraft Serial Number:	69
Year of Manufacture:	1991
Date and Time (UTC):	17 August 2009 @ 15.40 hrs
Location:	Coonagh Airfield (EICN), Co. Limerick
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 0
Injuries:	Crew - Nil Passengers - Nil
Nature of Damage:	Substantial
Commander's Licence:	ATPL issued by the UK Civil Aviation Authority (CAA)
Commander's Details:	Male, aged 34 years
Commander's Flying Experience:	6,214 hours, of which 1 hour was on type
Notification Source:	Duty Manager, Shannon Airport Air Traffic Control (ATC)
Information Source:	AAIU Accident Report Form submitted by Pilot, AAIU Field Inspection

SYNOPSIS

During circuit flying, just before levelling from a descent, the left engine stopped. The Pilot carried out a forced landing into a field adjacent to the airfield. The aircraft suffered substantial damage. The engine stoppage was probably due to carburettor icing. The Pilot was not injured.

1. FACTUAL INFORMATION

1.1 History of the Flight

In the days before the accident flight the aircraft had flown twice for about 15 minutes on each occasion. On the day of the accident the aircraft had flown for 15 minutes, shut down for about half an hour and had been refuelled.

The aircraft took off to fly left hand circuits to Runway (RWY) 28 at EICN. The aircraft had been operating up to 1,000 ft and was in a left descending turn to 500 ft in preparation for approach and landing. The Pilot's intention was to break off the approach at 500 ft for a downwind leg and a circuit to land. Just before levelling at 500 ft the left engine suddenly stopped.

The Pilot estimated his speed at the time the engine failed as 180 km/h. He wanted to reduce speed to 120 km/h (which he called Single Engine flying speed) and he selected Flap 12. He said this was the recommended Flight Manual procedure for single engine flight. He selected full power on the right engine and the aircraft banked to the left. This bank was not uncontrollable but the speed reduced very quickly to around 110 km/h and the Pilot felt he had to put the nose of the aircraft down; he said that due to his height above the ground lowering the aircraft nose limited his options.

Realising that he would be unable to complete his planned landing profile to EICN, the Pilot elected to carry out a forced landing into a field to his left, which was adjacent to EICN. He completed a curved approach to the field and then concentrated on keeping the wings level whilst holding off as long as possible. The aircraft impacted in a level attitude but the terrain was rough and soft, and the nosewheel dug in and fractured, then the right undercarriage dug in and fractured. The aircraft stopped quickly. The Pilot was unhurt and exited the aircraft unaided.

1.2 Damage to Aircraft

The aircraft suffered substantial damage, which included broken nose and right undercarriage legs, and extensive damage to the left wing tip, the right wing and flaperon, lower right hand side of the fuselage, the nose cone area and the right hand propeller. (**Photo No. 1**)

Photo No. 1: Aircraft as it came to rest following the accident

1.3 Aircraft Description

The Cri-Cri is a small, lightweight, single seat, twin-engined, home-built, aerobatic aircraft, which was built from plans. Construction materials are primarily wood and metal, with glued joints throughout the aircraft structure. The aircraft is 3.9 m long, has a wingspan of 4.9 m, wing area of 3.1 m^2 with an aspect ratio of 7.8. The empty equipped weight is 172 lbs, and Maximum Take-off Weight is 375 lbs. The aircraft is powered by two JPX PUL 212 (D and G) engines, each delivering 15 Horsepower at 6,000 rpm. Each engine drives a two blade composite propeller. Fuel is stored in a 23-litre tank, situated between the pilot's legs. Two main pins, four secondary pins and two rod ends (on opposite sides of the cabin), allow quick assembly and disassembly. The aircraft, disassembled, is transported on a purpose-built trailer.

1.4 Aircraft History and Certification

The aircraft was manufactured in 1991 and originally it was registered and operated in France. The logbooks record that the aircraft's last flight was on 27 September 2003, in France. In September 2004 the aircraft was sold to a new owner in the United Kingdom (UK).

On 13 May 2005, the UK CAA allocated the registration G-CDNJ to the aircraft, pending receipt of further documentation of de-registration. On 6 June 2005 the French regulatory authority, Direction Générale de l'Aviation Civile (DGAC), de-registered the aircraft and on 17 June 2005 the CAA issued a Certificate of Registration, G-CDNJ/R1. A cover letter with the certificate drew the new owner's attention to the fact that the aircraft must be "*fully maintained and operated in line with the requirements of the Certificate of Airworthiness or Permit to Fly*". In the case of this aircraft the applicable authorisation was a Permit to Fly.

On 13 September 2004, the then owner entered into correspondence with the Popular Flying Association (PFA), the UK based agency with the authority to issue, monitor, and administer Certificates of Validity. These Certificates of Validity, renewable annually, are an integral component of the CAA (UK) Permit to Fly scheme. Permits to Fly remain valid, from date of issue until revoked, provided the aircraft has a current Certificate of Validity.

On 6 October 2004, the PFA sent the owner a letter outlining the PFA's 16-step process for registration of an amateur built aircraft originating outside the UK. On 8 February 2006, the owner applied to the PFA for a Permit to Fly, and submitted a comprehensive set of supporting documentation. On 10 March 2006, the PFA reverted to the owner with nine points on which clarification or correction was required. On 24 May 2006, an Imported Aircraft Inspection was carried out (by a PFA Inspector) on G-CDNJ. On 12 June 2006, the owner replied to the PFA addressing each of the nine points that had been raised.

On 12 June 2008, ownership of the aircraft was transferred from the UK owner to an Irish based consortium. At this time no Certificate of Validity had been issued by the PFA and one of their concerns (regarding a fuel cock) had not been addressed to their satisfaction. The contact person for the consortium (a microlight inspector and Private Pilot Licence holder) contacted the PFA by telephone and on 13 August 2008, he emailed the PFA setting out his understanding of the extant situation. On 13 November 2008, the PFA wrote to the contact person pointing out that he was based in Ireland and that their Permit to Fly was invalid outside the UK. The contact person advised the PFA that the intention was to base the aircraft in Newtownards which is in UK airspace, and that if he "*was going to base it in the south of Ireland he would not have spent the last five months e-mailing*" the PFA.

On 3 February 2009, the contact person e-mailed the PFA attaching drawings of new fuel taps, confirming that the aircraft's electronic ignition system was already approved on another Cri-Cri operating on a UK Permit to Fly, advising that he had identified a suitable test pilot who would conduct "*test flights in Newtownards and was also assisting in sorting out licensing issues with the CAA*". At that time the contact person indicated that a PFA inspector was due to carry out an inspection of the aircraft in early March 2009.

The contact person told the Investigation that in March 2009 the consortium decided to discontinue contacts with the PFA and instead pursue an Irish Permit to Fly through the Society of Amateur Aircraft Constructors (SAAC). The contact person said that he submitted an application and supporting paperwork to SAAC in March 2009. The normal procedure is that SAAC, when satisfied with the application engage with the Irish Aviation Authority (IAA) and recommend granting of a Permit to Fly. On 10 July 2009, the contact person had a chance conversation with an IAA inspector followed by a telephone conversation with another IAA inspector. He learned that contrary to his understanding, the paperwork recommending the granting of a Permit to Fly had not been lodged (by SAAC) with the IAA. The contact person stated that he contacted SAAC and expressed his displeasure/frustration and that he understood that the matter would be addressed promptly by SAAC.

SAAC, in response to the Draft Report, told the Investigation that the only paperwork received was what was considered a general enquiry. The general enquiry was considered at committee level and the bearer of the enquiry was advised that a formal application should be made on the prescribed SAAC form. SAAC further pointed out to the Investigation that they would have been unable to recommend the granting of a Permit to Fly at that stage because the aircraft was still registered in the UK, it was not on the SAAC approved aircraft list and no permit application paperwork had been received by SAAC.

However, on the day of the accident the matter had not been resolved and the aircraft did not have a valid Permit to Fly.

When interviewed by the Investigation the contact person stated, on two separate occasions, that maintenance records had not been kept for work done on the aircraft since it was imported. He characterised this work as "*stickers and paint*". Asked about the fact that the aircraft had not flown since 2003, the contact person said that the UK owner had run the engines once a week and that since taking ownership; the contact person had run the engines once a month at his house. No records of these engine runs were found amongst the documentation provided to Investigation at the time of the accident. However, in response to the Draft Report the contact person stated that "*they are in existence and kept securely including photographic evidence*", and also said "*but they were never entered in the official aircraft logbooks*". The contact person told the Investigation that the aircraft manuals prescribe engine runs of 5 hours duration, and that these were carried out in February. No records of these engine runs were found amongst the documentation provided to the Investigation at the time of the accident.

Due to the lack of a Permit to Fly, and in the absence of any maintenance records a release for flight could not be given for the aircraft for flight. Both the contact person and the Pilot confirmed that the aircraft had not been released for flight.

1.5 Aircraft Inspection

As the Investigator-in-Charge (IIC) was at a distance from the accident site and due to security concerns and fading evening light, the Investigation gave permission for the Pilot of the aircraft to conduct a detailed photographic survey of the accident site and then remove the wreckage to a secure location. On the day following the accident the Investigation inspected the wreckage. It was noted that there was some foreign matter on the bottom of the fuel tank and both the Pilot and the contact person told the Investigation that apart from straining the fuel as it was added to the tank no measures (such as tank sampling) were used to assure fuel quality. The in-line fuel filters were visually examined and no contamination was evident. The fuel used for the aircraft was Mogas from an installation at EICN. The fuel was mixed with a proprietary, fully synthetic, two-stroke lubricating oil, in proportions specified in the Flight Manual (2.5% to 3%). The contact person informed the Investigation that the Mogas had not been tested for alcohol.

The Investigation verified that fuel was reaching both engines. The spark plugs from both engines were examined and though the failed engine's plug exhibited some minor discolouration it was not considered significant. The Investigation then requested the contact person to try to start the left (failed) engine. A locally manufactured pull-cord was used and though the engine fired on the first attempt, it failed to start. The contact person expressed the opinion that this was due to the absence of a choking cowl that is normally used for starting. The air inlet was half obscured to provide an improvised choke and a second starting attempt was made; the engine started and ran satisfactorily.

The contact person told the Investigation that he had previously observed moisture accumulation/condensation (often as an emulsified white-ish deposit) on the carburettors during low power ground runs. He expressed the view that the aircraft was prone to carburettor icing but that the manuals contained little information on icing; he thought this was probably because the aircraft had no carburettor ice detection or management provisions (e.g. carburettor heat). He further stated that he believed carburettor icing had caused this accident. The Pilot, in his accident report form, also expressed the view that the accident was due to carburettor icing.

1.6 Meteorology

Met Éireann provided the following aftercast for Coonagh at the time of the accident.

Meteorological Situation:	*The Coonagh area lay under the influence of a weak ridge of high pressure. However, the atmosphere was unstable in its lower layers (up to approx. 760 hPa) allowing some light showers to develop.*	
Wind	***Surface:***	*Approx 240° at 10Kts. (Note: the wind direction could have temporarily veered to 260 degrees as a weak showery trough passed through the area at approximately this time- see attached RADAR image)*
	2,000 feet:	*270° at 15Kts*
Visibility:	*10+km*	
Weather:	*Light showers were likely*	

Cloud: *SCT 2000ft BKN 5000ft*

Surface Temp/Dew Pt: *18°C/13°C*

MSL Pressure: *1,015hPa*

Freezing Level: *Circa 11,000FT*

1.7 Mogas Guidance

The aircraft was being operated on Mogas, which is an approved fuel according to the Aircraft Flight Manual. IAA Aeronautical Notice (AN) A16, Issue 6, dated 23/08/01, "*Use of motor gasoline (MOGAS) in certain light aircraft*", permits the use of leaded or unleaded Mogas in certain light aircraft. AN A16 also prescribes checks and procedures to be followed when using Mogas, including fuel specification, alcohol testing, use of fresh supplies only and water checking of fuel if the aircraft has been standing for more than 24 hours. When asked if the fuel had been tested for alcohol, the contact person seemed unaware of the requirement and stated to the Investigation that it had not been checked for alcohol. In response to the Draft Report, the contact person stated, "*there may have been a misunderstanding or lack of communication on my part as I am aware of the need to test for ethanol in Mogas. The fuel is tested for alcohol upon delivery to the Bowser at Coonagh*". The contact person also told the Investigation that the aircraft design did not incorporate water-sampling drain points in the fuel tank or system, so water sampling was not carried out.

AN A16 contains advice that particular attention should be paid to carburettor heat, including "*making sure during pre-take-off checks that a good RPM drop is obtained when hot air is selected*" and "*intermittent selection of hot air in flight whether or not the obvious symptoms of loss of power are experienced*".

Transport Canada (TC) produced TP 10737: "*The use of automobile gasoline (Mogas) in aviation*" (1993). The UK CAA produced "*Safetysense Leaflet 4 Use of Mogas*" (January 2009), and the UK Light Aircraft Association (LAA, formerly the PFA), produced "*Operating Information – Unleaded Mogas*" (May 2009). UK CAA's Generic Concessions 2, 3, 4 and 5, published in CAP 747, address the use of MOGAS in UK registered aircraft. These documents contain similar information to AN A16. In addition the documents provide detailed information for the scientific basis of the increased susceptibility of Mogas to vapour locking and carburettor icing, compared to Avgas. The documents highlight that Mogas has a greater volatility than Avgas. This greater volatility means that Mogas has a higher latent heat of vaporisation than Avgas and consequently when it is vaporised in a carburettor, Mogas will absorb more heat from the mixing air thereby inducing a greater temperature drop. The LAA document cites tests that showed that under the same ambient conditions "*carburettor throat temperatures of a Lycoming O-360 were typically 7° C lower with winter grade Mogas than Avgas. The result is that when using Mogas, carburettor icing will occur under higher temperature conditions and lower humidity than for Avgas*".

TC produced an indicative chart ("*TP 2700 – Carburettor Icing Conditions*") that provides guidance to pilots. The chart plots carburettor icing risk and power setting against air temperature and dew point. The chart is widely known and referred to in General Aviation. TC describes the chart as a "*rough guide to conditions conducive to carburettor icing*". The chart is based on Avgas, and TC says that for Mogas "*the risk areas would be larger*". It is impossible to be more specific due to the variability of Mogas volatility.

However TC notes "*In severe cases, ice may form at OATs*[1] *up to 20° C higher than with Avgas*". **Figure No. 1** shows a version of this (Avgas) chart, with the temperature and dew point for the accident flight plotted.

Besides AN A16, there are four other Mogas related documents on the IAA website. These are General Aviation Safety Notice - Motor Gasoline Fuels (MOGAS), Piston Engine Icing (UK CAA), Airworthiness Advisory Memorandum 01/2001and AIC 11/93. These documents contain salient information on the properties and behaviour of Mogas.

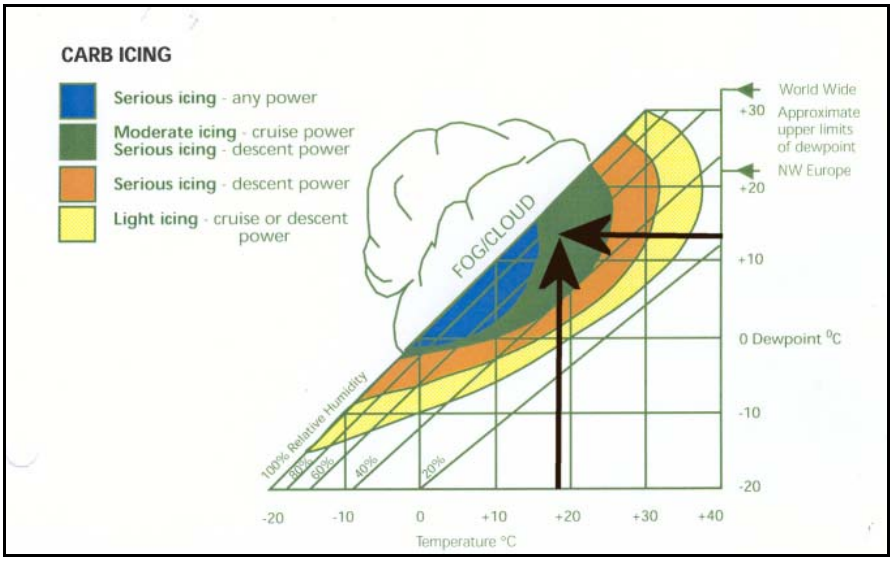

Figure No. 1: AVGAS carburettor icing chart for accident flight

1.8 Notification

The first contact the AAIU had regarding this accident was an enquiry from a local press reporter. The AAIU contacted Shannon ATC to enquire if they knew about the accident. The Duty Manager advised that all his aircraft were accounted for. He said that he would contact EICN to enquire about their operations. It should be noted that EICN operates in an area of Class G airspace (within the Shannon Control Zone) known as the Coonagh Fillet, within which flight up to 1,000 ft is allowed without reference to Shannon ATC. The Duty Manager was told by a person who answered the Coonagh Airfield phone that there had been "*no accident; an aircraft just approached low over the road*". The Duty Manager then contacted the fire service to be told that there had indeed been an accident and that emergency services were attending the scene. The AAIU then contacted an instructor at EICN, who happened to be the accident Pilot, and he provided the AAIU with the accident details.

1.9 Flight Manual & Single Engine Flight Procedures

It is noted that the Flight Manual that the Pilot was using showed all indicated speeds in miles per hour (mph). The aircraft instrumentation, however, displays the indicated airspeed in kilometres per hour (km/h). The km/h equivalent speeds were written beside each mph entry in the Flight Manual.

[1] OAT is an acronym stands for Outside Air Temperature

The Pilot advised the Investigation that the Flight Manual prescribed procedure for Single Engine flying was speed 120 km/h, flap 12. The Flight Manual states at, "*4.3 Engine failure: If an engine fails keep the cruising configuration if the indicated airspeed Vi is over 70 mph*". 113 km/h was handwritten beside the 70 mph entry.

Under the heading "*Makeshift landing*" the Flight Manual states "*if both engines are irremediably out of order ... Highest lift to drag ratio : flaps at 12º configuration and Vi = 70 mph*".

120 km/h (75 mph) is given under Section *5.4 Maximum rates of climb*, as the indicated airspeed corresponding to the maximum rate of climb.

2. ANALYSIS

2.1 Fuel

Despite the presence of some foreign matter in the bottom of the fuel tank, the facts that examination of the in-line filters revealed no contamination and the engine started and ran easily on the day following the accident, suggest that the foreign matter was not a factor in the accident. For an Avgas operated aircraft the prevailing conditions (temperature and dew point) were conducive to the formation of moderate carburettor icing at cruise power and serious carburettor icing at descent power. Factoring for the use of Mogas suggests that there was a serious risk of carburettor icing at any power setting. Evidence of carburettor icing is perishable and carburettor icing is usually diagnosed by exclusion i.e. by ruling out other potential causes such as mechanical failure. In this case, the fact that the failed engine started and ran on the day after the accident, indicates that the aircraft had sufficient fuel and a viable ignition system; allied to the prevailing temperature and dew point (**Figure No. 1**), this suggests a diagnosis of carburettor icing, particularly when cognisance is taken of TC's warning in relation to the (Avgas) chart, that "*the risk areas would be larger*" for Mogas.

2.2 Engine Failure Procedures

The technique that the Pilot adopted in response to the engine failure was not the prescribed technique for a single engine failure. His procedure used a flap setting for highest lift to drag ratio (from the 2 engine failure procedure) and the airspeed from the maximum rate of climb procedure with both engines operative. In addition, the Pilot had limited familiarity with the aircraft type and a short time frame for effective action after the engine failure.

There is very little information in the Flight Manual about single engine flight and consequently it is not possible to ascertain with confidence the adverse impacts of the Pilot's actions on the single engine performance. However, it is noted that the speeds in question (120 km/h vs. 113 km/h) are certainly within the margin of variation due to gusts that would occur in normal flight.

3. CONCLUSIONS

(a) Findings

1. The aircraft did not have a valid Permit to Fly.

2. The aircraft did not have a valid maintenance release.

3. The aircraft was not fitted with a carburettor heat system.

4. The failed engine started and ran without difficulty on the day after the accident.

5. The aircraft had been noted to exhibit carburettor icing pre-cursor symptoms (moisture and condensation accumulation) during ground runs.

6. The engine failure was probably due to carburettor icing.

7. The use of Mogas as a fuel rendered the aircraft more likely to experience carburettor icing.

8. The standard carburettor icing indicative chart is not valid for Mogas; the indicated risk areas are larger for Mogas.

9. AN A16 could be construed to state that aircraft without carburettor heat provisions should not be operated using Mogas.

10. When Shannon ATC personnel rang EICN to enquire about a reported accident they were given incorrect information.

(b) Probable Cause

The aircraft experienced carburettor icing leading to failure of the left engine that resulted in a forced landing during which the aircraft was substantially damaged.

(c) Contributory Cause

1. The use of Mogas rendered the aircraft more susceptible to carburettor icing.

2. The lack of a carburettor heat system

4. SAFETY RECOMMENDATIONS

This Investigation does not sustain any safety recommendations

- END -