FINAL REPORT

AAIU Synoptic Report No: 2003-019
AAIU File No: 2000/0033
Published: 21/12/2003

In accordance with the provisions of SI 205 of 1997, the Chief Inspector of Accidents, on 16 May 2000 appointed Mr Graham Liddy as the Investigator-in-Charge to carry out a Field Investigation into this occurrence and prepare a Synoptic Report.

Aircraft Type and Registration:	Socata-Aerospatiale Rallye 893E EI-BFM
No. and Type of Engines:	One Lycoming O-360
Aircraft Serial Number:	12958
Year of Manufacture:	1977
Date and Time (UTC):	15 May 2000, @ 18.30 hrs
Location:	Coonagh Airfield, Co Limerick
Type of Flight:	Private
Persons on Board:	Crew - 2 Passengers - 0
Injuries:	Crew - 0 Passengers - 0
Nature of Damage:	Aircraft was economic write-off
Commander's Licence:	PPL with Class 1 Instructors rating
Commander's Age:	57 years
Commander's Flying Experience:	1900 hours of which 30 were on type
Information Source:	AAIU Field Investigation and pilots' reports

SYNOPSIS

The aircraft experienced a reduction of power late on the take-off run and the take-off was abandoned. The aircraft overshot the end of the runway and came to rest on a public road. The aircraft suffered extensive damage. There were no injuries. It was determined that carburettor icing was the probable cause of the engine power reduction.

FINAL REPORT

1. FACTUAL INFORMATION

1.1 History of the Flight

The aircraft was operated by a local flying club at Coonagh Airfield. The club has a policy that members who are qualified pilots, but have not flown recently, must have a check flight, with an instructor, prior to resuming solo flying in club aircraft. The pilot-under-supervision had not flown for several weeks and therefore required a check flight. He arranged with the aircraft commander, a Class 1 instructor, to be checked on the evening of the accident. The pilot-under-supervision performed the pre-flight inspection of the aircraft. This was to be the first flight of the day for EI-BFM Both pilots then boarded the aircraft. After start-up the aircraft taxied to the start of Runway (RWY) 28. Here a full power check was performed and the carburettor heat was cycled. All engine indications were normal. The pilots assessed the crosswind at 8 kt. from 180º, almost at right angles to the runway. They decided to counteract the effects of the cross wind by applying left aileron, (into the direction of the cross wind) and by delaying rotation until a speed of 60 kt was attained.

Full power was applied and the take-off run commenced. At a point approximately 2/3 of the distance down the runway, an airspeed indication (ASI) of 60 kts was achieved and rotation was about to be initiated when the pilots experienced, as both stated in subsequent interviews, "*a sudden and inexplicable loss of power*". At this point the instructor took control. He noted that the engine RPM was below 2000 RPM and visibly dropping. He decided to abandon the take-off. The aircraft failed to stop on the remaining runway, departed the hard surface and continued along the extended runway centre-line, over a grassed area, for 62 metres. It pushed through a light wire fence, traversed a minor public road and came to rest, after impacting a stone wall, on the other side of this road.

The pilots were uninjured and vacated the aircraft. With the assistance of club members, the aircraft was removed to the club hangar without consultation with the AAIU. Shannon ATC and the AAIU were subsequently informed of the accident.

There was no visual witness to the accident. However, a member of the flying club was in the club building abeam the point on the runway where the power reduction occurred. He did not see the aircraft in the second half of the take-off run. However he did hear it clearly. He stated that the engine sound was normal, until the point where it reduced suddenly, just as the aircraft went by his location, which was 270 metres from the start of RWY 28.

1.2 Damage

The aircraft suffered substantial damage when it struck the stone wall. One blade of the propeller was bent rearwards and the nose undercarriage leg was sheared off. There was also damage to the engine cowlings, engine bulkhead and the wing leading edges. Because of its age, the aircraft was deemed to be an economic write-off.

The only other damage caused was to a section of the airfield boundary fence, which was demolished, and to the stone wall which suffered some displacement.

1.3 Aircraft Maintenance History

The engine was overhauled in 1998 and was then installed in EI-BFM, in October 1998. The aircraft's first flight following the installation of this overhauled engine was on 27 September 1999. The Certificate of Airworthiness (C of A) was renewed on 8 February 2000. During maintenance for the renewal of the C of A, the propeller was removed, as it's service life was expired. A new replacement propeller, of the same type, was fitted. Total aircraft flight time at the C of A renewal was 2,117 hours. A 50-hour inspection was completed at 2,163 hours on 14 March 2000 and another 50-hour inspection was completed at 2,208 hours on 4 May 2000. All this maintenance was completed by the same maintenance organisation.

1.4 Tests

Initial examination of the engine revealed no obvious defects. In particular, the air passage to the carburettor was found to be free of obstruction. The fuel lines and filters were all serviceable and the fuel flow to the carburettor was ample to provide full engine power.

As the engine was undamaged in the accident, it was decided to conduct a test-run. The damaged propeller was replaced for this test. The aircraft's previous, and identical, time-expired propeller was fitted. The nose of the aircraft had to be propped up, due to the departed nose wheel. The aircraft was securely anchored. The engine started in the second attempt and ran without problem. At full throttle, an engine speed of 2,400 RPM was noted. Club instructors stated that this was the normal static full throttle engine RPM obtained on this aircraft. All other engine parameters were also satisfactory. After a run of 10 minutes the engine was stopped. After a few minutes it was again restarted, starting on the first attempt this time. Again all parameters were normal. Checks of magnetos and carburettor heat were satisfactory.

The engine was subsequently removed from the airframe and sent to an engine overhaul agency. It was dismantled and inspected. No defect, that could have caused a sudden and dramatic loss of power, was found. The carburettor was also inspected and found to be free of defects and contamination.

Fuel samples were taken from the engine fuel filter bowl and both wing fuel tanks. The fuel was tested and found to be Avgas 100LL and to be free of water. It did contain some sediment, which was consistent with the age of the aircraft and the effects of impact with the fence and stone wall. The volume and size of this sediment was not significant and would not account for an engine power loss.

1.5 Take-Off Performance

The Investigation calculated that the total weight of the aircraft at take-off was approximately 915 kg. Based on information in the Flight Manual for the Rallye 893,

the aircraft was capable of achieving a take-off speed of 53.5 kt in a take-off roll of 205 metres. However, as the aircraft was held down until 60 kt, the ground roll required would have been approximately 258 metres, assuming a zero head wind component.

1.6 Meteorological Information

The nearest Meteorological Station is at Shannon **A**irport, located 8 nm WNW of Coonagh airfield. This station recorded a wind of 180º/9 kt at 18.30 hrs, with visibility greater then 10 km, few clouds at 1,800 ft, broken cloud at 4000 ft and at 6,000 ft, a temperature of 15ºC, a dew point of 9º C, QHN 1009 and no significant weather.

The Dew Point and the Outside Air Temperature, as recorded at Shannon Airport, were plotted on the standard chart for determining the possibility of carburettor icing. [**Ref: IAA Aeronautical Information Circular (AIC) No. 11 of 1997: Induction System Icing on Piston Engines as Fitted to Aeroplanes, Helicopters and Airships]**. The result of this plot is shown in **Appendix A.**

1.7 Aerodrome Information

Coonagh airfield has a single tarmac runway RWY 28/10. It is 416 metres long, 10 metres wide and 17 ft above sea level. It is located near the Shannon estuary, a large body of water. The single hangar and clubhouse facilities are located near the end of RWY 28, to the left of the runway. A short taxiway links the runway to the hanger area. This taxiway meets the runway 71 metres before the end of the runway. There is a windsock located due north of the taxiway/runway intersection.

The boundary fence is located 62 metres beyond the end of RWY 28. A minor public road lies immediately beyond the fence. Beyond this road is a very small field. On either side of this field, approximately 30 metres either side of the runway centreline, are two houses, the construction of which post-dates the airfield.

Inspection of the runway showed tyre marks starting 81 metres before the end of RWY 28, which is 335 metres from the start of the runway. These marks led to the ground marks made by EI-BMF as it departed the runway surface. Inspection of the ground in the over-run area indicated that braking performance would be poor in this area.

1.8 Reporting the Accident

The AAIU was not informed of this accident until the aircraft had moved into the hangar at Coonagh. When the aircraft was inspected in the hangar, the throttle and mixture controls were both in the fully retarded (closed) position.

1.9 Other Information

1.9.1 The Irish Aviation Authority (IAA) issued IAA Aeronautical Information Circular (AIC) No. 11 of 1997. to alert pilots of the hazard posed by carburettor icing. This was as a result of a previous safety recommendation made by the AAIU.

1.9.2 In their Safety Sence Leaflet 14, which is available on the UK CAA website, it is recommended that carburettor heat be selected for a short period before take-off, and returning to cold for the actual take-off.

2. ANALYSIS:

2.1 The evidence of the pilots, the aural witness, and the tyre marks on the runway indicate that the power reduction occurred at a point approximately 270 meters from the start of the take-off roll. This corresponds well with the ground roll of 258 meters calculated from the performance figures given in the aircraft's Flight Manual, for the operating weight of the aircraft. This indicated that the engine was delivering full power up to the point of the power reduction.

2.2 The engine performed flawlessly on the subsequent test runs. This demonstrates that there were no problems of a mechanical nature in the engine, and that the air supply, ignition system and fuel systems were performing correctly. The failure to start on the first attempt was to be expected, as the fuel lines and filters had been opened during the initial inspection of the engine.

2.3 The fuel was satisfactory, notwithstanding the presence of a small amount of sediment in the sample taken. The carburettor and filters were clear.

2.4 The plot of air temperature and dew point, based on the data available from nearby Shannon Airport, show that the ambient conditions were just on the edge of the zone where serious carburettor icing could be expected at any power setting. The fact that the carburettor heat had been exercised immediately before take-off would have reduced, but not have eliminated, the risk of carburettor icing on take-off. Because of the power loss associated with the use of carburettor heat, and the short length of the airstrip at Coonagh, the use of any degree of carburettor heat on the actual take-off run would not have been appropiate.

2.5 Engine misfiring, rough running and/or backfiring are often precursors of engine failure due to carburettor icing. Neither the pilots in the aircraft, nor the witness near the point where the power reduction occurred, reported any such indications prior to the power reduction.

2.6 Apart from the possibility of carburettor icing, no technical reason for the power reduction was discovered during the course of this investigation.

2.7 Many accident and incident investigations in Ireland and elsewhere have concluded that carburettor icing was the cause of accidents. A common thread in many of these investigations is that no defect was found in the engine and it ran perfectly

subsequently. Many pilots believe that carburettor icing is associated with low air temperatures and low power settings. It is not generally appreciated that:

- Serious carburettor icing can be expected, in conditions of high humidity, **at any power setting** up to 16º C

- Serious carburettor icing can be expected, in conditions of high humidity, **at low power settings** up to 33º C

- Higher levels of atmospheric humidity, as indicated by only a small difference between the air temperature and the dew point temperature, are highly conducive to serious carburettor icing, at typical Irish daytime temperatures.

2.8 In accessing the possibility of encountering carburettor icing, it is essential that pilots have access to information relating to the local Dew Point temperature, in addition to the local air temperature. Both these parameters are essential to use the chart contained in the IAA AIC.

2.9 The aircraft was removed from the accident site to a nearby hanger before the AAIU were notified of the event, and consequently before the aircraft was inspected by AAIU personnel. There is a remote possibility that significant evidence was lost as a result of this action.

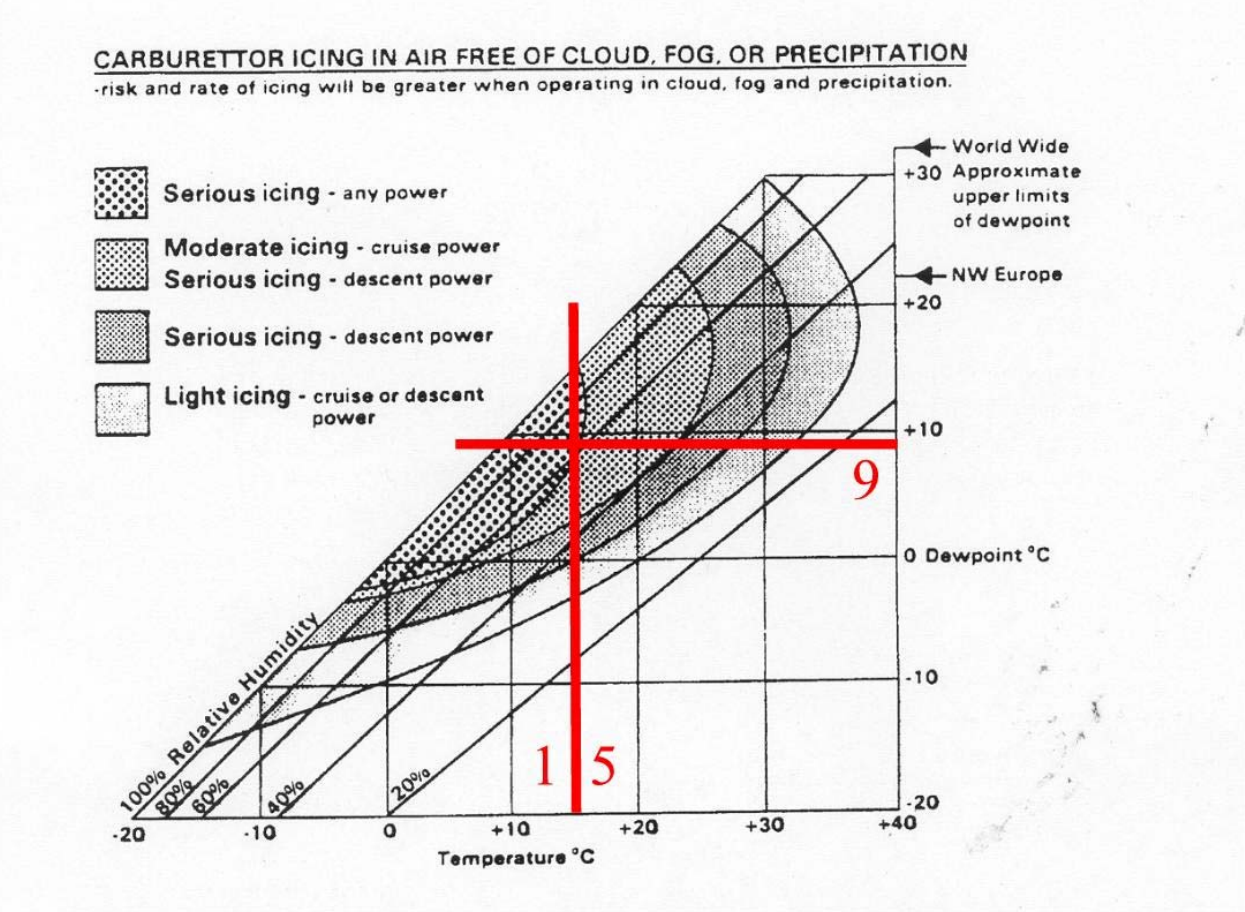
3. CONCLUSIONS

3.1 Carburettor icing is the only possible cause of this accident that is consistent with the information provided by the pilots.

4. SAFETY RECOMMENDATIONS

4.1 The operators of airfields with piston-engined aircraft operating from short runways, such as Coonagh, should consider the installation of equipment to measure both temperature and dew point, so that an accurate prediction as to the likelihood of carburettor icing can be made by pilots. (**SR 33 of 2003**)

Appendix A



Extract from IAA Aeronautical Information Circular (AIC) No. 11 of 1997, with the local data for this accident superimposed