CIVIL AVIATION AUTHORITY OF NEW ZEALAND

# AIRCRAFT ACCIDENT REPORT

## OCCURRENCE NUMBER 99/227

## AVIAMILANO FALCO F8L

## ZK-RNA

## NORTHERN HAURAKI GULF

## 6 FEBRUARY 1999

**Glossary of abbreviations used in this report:**

| | |
|---|---|
| CAA | Civil Aviation Authority |
| CO | Carbon monoxide |
| C of G | Centre of gravity |
| C of A | Certificate of Airworthiness |
| E | East |
| Ft | Feet |
| Kg | Kilogram(s) |
| lb | Pound(s) |
| m | Metre(s) |
| mg | Milligram |
| ml | Millilitre |
| nm | Nautical mile(s) |
| NZDT | New Zealand Daylight Time |
| S | South |
| UTC | Co-ordinated Universal Time |

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# AIRCRAFT ACCIDENT REPORT

## OCCURRENCE No. 99/227

| | |
|---|---|
| **Aircraft type, serial number and registration:** | Aviamilano Falco F8L, 104, ZK-RNA |
| **Number and type of engines:** | One - Lycoming O-320-B3C |
| **Year of manufacture:** | 1956 |
| **Date and time:** | 6 February 1999, 1616 hours* |
| **Location:** | Northern Hauraki Gulf |
| | Latitude: S 36° 20'<br>Longitude: E 175° 06' |
| **Type of flight:** | Private |
| **Persons on board:** | Crew: 1 |
| | Passenger: 1 |
| **Injuries:** | Crew: Fatal |
| | Passenger: Fatal |
| **Nature of damage:** | Aircraft destroyed |
| **Pilot-in-Command's licence** | Private Pilot Licence (Aeroplane) |
| **Pilot-in-Command's age** | 71 years |
| **Pilot-in-Command's total flying experience:** | 10,450 hours<br>Approximately 1100 hours on type. |
| **Information sources:** | CAA field investigation |
| **Investigator in Charge:** | Mr O J Stewart |

* Times are NZDT (UTC + 13 hours)

**Synopsis**

The Civil Aviation Authority was notified of the accident at 1618 hours on Saturday 6 February 1999. The Transport Accident Investigation Commission was also notified but declined to investigate. A CAA investigation was commenced the next day.

The pilot and passenger were on a scenic flight from Ardmore Aerodrome. Their intention was to over-fly the departing "Around Alone" race yachts, particularly the Italian entrant.

Upon arrival at the yacht's location southwest of Little Barrier Island, the aircraft made several low passes. On the last pass, the aircraft was seen to enter a turn, then suddenly roll and descend in a steep nose-down attitude into the sea.

Both occupants were fatally injured by the impact and the aircraft was destroyed.

# 1. Factual information

## 1.1 History of the flight

1.1.1 After the aircraft was refuelled, ZK-RNA departed from Ardmore Aerodrome at 1536 hours on 6 February 1999. The occupants, who had been associating with the skipper of an "Around Alone" race yacht during his stay in Auckland intended to over-fly the departing yacht fleet and to photograph and farewell them.

1.1.2 At approximately 1600 hours, the aircraft arrived overhead two of the "Around Alone" yachts, some six nm south-west of Little Barrier Island. The aircraft made several low passes over the Italian entrant, at a height estimated at 200-300 feet. The witness described the aircraft manoeuvres as a shallow descending approach and a shallow ascent once past the yacht. This was followed by another steep turn and shallow descending approach.

1.1.3 On the last pass, the aircraft was seen to commence a similar turn. The witness indicates that what he thought was going to be a similar routine turn, abruptly became a roll and the aircraft quickly dropped into a steep nose-down descent, impacting the sea surface almost inverted.

1.1.4 The accident occurred in daylight, at approximately 1616 hours, at a position approximately 6 nm south west of Little Barrier Island, in the outer reaches of the Hauraki Gulf. Grid reference 260-S09-388991.

## 1.2 Injuries to persons

| *Injuries* | *Crew* | *Passengers* | *Other* |
|---|---|---|---|
| Fatal | 1 | 1 | 0 |

## 1.3 Damage to aircraft

1.3.1 The aircraft was destroyed by the impact.

## 1.4 Other damage

1.4.1 Nil

## 1.5 Personnel information

1.5.1 The pilot held a New Zealand Lifetime Private Pilot Licence and a valid Class 2 medical certificate reissued in December 1998.

1.5.2 He also held an Italian pilot's licence first issued in 1958. Records indicate the licence had been issued to category 3 (commercial) standard and included both glider and powered aircraft instructor ratings, an instrument rating and glider tow rating. The pilot had also held an experimental test pilot rating.

1.5.3 The pilot's 10,450 hours flight time had been obtained in a wide variety of aircraft, from DH82 (Tiger Moth) through to Learjet. He had performed prototype testing on the Falco F8L for the designer as well as the Partenavia P68 light twin-engined aircraft. He was well known and respected within the international aviation community through his many air racing successes.

## 1.6 Aircraft information

1.6.1 ZK-RNA was built as a two-seat side-by-side low wing light-touring monoplane of conventional wooden construction, with retractable undercarriage. It was built in Italy in 1956 and was powered by a Lycoming O-320-B3C 160 horsepower engine, which had a Hartzel HC-A2XL-1 constant-speed propeller fitted.

1.6.2 The aircraft was imported into New Zealand in 1983 but remained on the Italian Civil Register until 1985. At that time evaluation of the aircraft indicated that the aircraft did not conform to a recognised type design. The aircraft was originally manufactured as a Series 1 type, but had been modified to include a substantial number of the Series 4 refinements. There was no supporting documentation for these modifications from the State of Manufacture authorities, the Rigistro Aeronautio Italiano (RAI). A lengthy process was then embarked upon to determine the status of the aircraft.

1.6.3 Calculation indicated that the aircraft could not be flown within the certificated C of G limits for the type. Correspondence with the designer allowed for extension of the centre of gravity limits and flight-testing was undertaken to determine the aircraft's flight characteristics within these new limits. The test flying indicated satisfactory performance.

1.6.4 The last recorded aircraft weighing in Italy, dated 7 August1975, showed the aircraft weighing 508 kg (1117 lb) and centre of gravity position of 1.672 m aft of the datum. The C of G limits were stated as 1.74 to 1.90 m aft of the datum. The aircraft was weighed on 21 December 1983 in New Zealand with a weight recorded as 1306 lb (593.6 kg) and centre of gravity at 60.55 inches (1.69 m) aft of the datum. The CAA aircraft file for ZK-RNA provided insufficient detail to explain the weight difference between the 1975 weight and 1983 weight.

1.6.5 Due to the lengthy process required to determine the status of the aircraft, a terminating Certificate of Airworthiness in the Restricted Category for Private Operations was issued in December 1985 and a number of extensions to the validity period were given whilst that determination took place.

1.6.6 Assessment of the status of the aircraft, its modifications and the weight and balance data was completed on 21 November 1990. A full C of A was issued in the Restricted Category to expire in September of 1992. The CA 2146 Flight Manual form was amended to reflect the new centre of gravity limits. An approved amended Flight Manual was issued by the Air Transport Division of the Ministry of Transport in January 1991. A non-terminating C of A was issued on 23 December 1992.

1.6.7 A review of the aircraft documentation and logbooks, after the January 1999 accident, together with enquiries made as to its general condition, indicates that at the time of the accident, the aircraft had been maintained as required. However, the Annual Review of Airworthiness, required by the Civil Aviation Rule 91.619, had not been completed. This requirement is intended to separate the ongoing inspection and maintenance of the aircraft from the periodical review of the aircraft's conformity and condition. The Annual Review of Airworthiness, required by Part 91, requires a statement made by a CAA authorised person, that the aircraft's maintenance history has been reviewed against its maintenance programme. This includes the Airworthiness Limitations Section of the manufacturer's maintenance manual and any Airworthiness Directive listing published by the CAA. The review will also include a check for conformity against the aircraft's type certificate and a check that no unapproved modifications are installed.

1.6.8 At the time of the accident, the pilot had owned the aircraft for approximately 40 years.

1.6.9 The aircraft had completed 1198 hours total time in service and the engine 1010 hours total time in service. The propeller had operated 211 hours since complete overhaul and approximately 2 years calendar time and 24 operating hours since its last calendar inspection.

1.6.10 At the time of the accident, the aircraft had flown 8½ hours since its last inspection.

1.6.11 Witnesses indicate that the aircraft was fuelled with Avgas prior to departure, however the quantity of fuel uplifted could not be determined and consequently the aircraft C of G could not be calculated.

1.6.12 Several comments were received during the investigation from people who had flown in the aircraft, indicating that the cockpit of the aircraft always had a strong smell of petrol, as the rear fuel tank vented into the cockpit area. This appears to be due to the design of the canopy, which covered over the rear fuel tank vent. Enquiries indicate that most older Falco’s also had the smell of petrol in the cockpit, due to the design of the venting system. This was changed in later models.

1.6.13 Whilst not required, the aircraft was not fitted with the manufacturer-recommended stall strips on the wing leading edge. These strips are fitted to the wing to cause the inboard section of the wing to stall first, allowing the pilot to maintain lateral control with aileron and obtain stall onset warning through aerodynamic buffet, generated by the stall strips.

## 1.7 Meteorological information

1.7.1 There was good visibility on the day, with an east-northeast wind of approximately 20 knots. The sea state was very rough with a swell estimated at two metres.

## 1.8 Aids to navigation

1.8.1 Not applicable

## 1.9 Communications

1.9.1 Not applicable.

## 1.10 Aerodrome Information

1.10.1 Not applicable

## 1.11 Flight Recorders

1.11.1 Not applicable

## 1.12 Wreckage and impact information

1.12.1 The aircraft was reported to have struck the surface of the sea at a fairly high speed, in a steep nose-down, almost inverted attitude. The aircraft fragmented at impact with the light wooden construction allowing a considerable portion of the aircraft to float on the surface. The heavy components such as engine, propeller, landing gear and instrument panel sank to the sea floor.

1.12.2 The only witness to the accident did not see any smoke or fire from the aircraft, nor did he see any indication of structural failure or separation of any items from the aircraft prior to impact.

1.12.3 The witness, who was approximately half a mile from the impact point, reported that the engine sounded normal at all times up to the point of impact.

1.12.4 Rescue services recovered approximately one third of the aircraft on the surface after arriving at the scene some forty minutes after the initial 'Mayday' call was received from the Italian "Around Alone" entrant.

1.12.5 During subsequent weeks, a further third of the aircraft's wooden structure was recovered from about a one mile stretch of Omaha Beach. Beaches north and south of Omaha were checked for debris but none was found at these locations. No reports of debris at any other locations were received.

1.12.6 The recovered debris was transferred to a hangar where the aircraft was partially reconstructed. Whilst the entire aircraft was not recovered, inspection of the retrieved items (which included representative parts from nearly all of the aircraft) did not suggest any structural failure or in-flight break-up. All glue joints were in sound condition and the wood itself appeared in good condition. There was no evidence of rot or weakness, nor were there any fractures or failures, other than from overload at impact. There was no evidence of fire on any item.

1.12.7 All the extremities of the aircraft were recovered, except for the port aileron and flap and the nose section. It is suspected that the aileron and flap were still attached to the heavy components on the seabed.

1.12.8 The rear fuel tank was recovered at the scene by the rescue services and was found to have a considerable quantity of fuel still inside. Due to the risk of fire on board the rescue vessel, the fuel was emptied into the sea.

1.12.9 Subsequent seabed searches for the aircraft wreckage by the Royal New Zealand Navy, using side scanning sonar and a remote operated vehicle, were unsuccessful.

## 1.13 Medical and pathological information

1.13.1 Post mortem examination of the occupants concluded that death was due to multiple injuries consistent with a high-energy, 'nose-dive' impact.

1.13.2 Toxicological tests disclosed higher than normal levels of CO in both the pilot and the passenger. The pilot's blood was 11% saturated with CO and his passenger's blood 7 % saturated with CO.

1.13.3 Toxicological tests also disclosed blood alcohol levels of 30 milligrams per 100 millilitres for the pilot and 5 milligrams per 100 millilitres for the passenger.

## 1.14 Fire

1.14.1 The witness did not observe any signs of fire prior to impact and recovered pieces of wreckage did not exhibit any signs of fire.

## 1.15 Survival aspects

1.15.1 The accident was not survivable owing to the high decelerative forces involved.

## 1.16 Tests and research

1.16.1 The vehicle used for the trip to the airport by the pilot and his passenger was tested for CO levels inside using a Drägar Multi Gas detector. No evidence of CO was found. After the internal test, the detector was used to sample gas directly from the car exhaust pipe. The detector immediately registered a full scale CO detection level.

## 1.17 Organisational and management information

1.17.1 Not applicable

## 1.18 Additional information

1.18.1 Not applicable

## 1.19 Useful or effective investigation techniques

1.19.1 Nil

## 2. Analysis

2.1 The only witness to the accident indicated that the aircraft was making controlled passes over the yacht. This would be in keeping with the intention to photograph and video the yacht from the aircraft.

2.2 The pilot had carried out steep turns to return to the witness's position aboard the yacht. The witness did not see any cause for concern during these manoeuvres. Given the experience of the pilot and his experience with the aircraft, these steep turns should have been well within his capabilities.

2.3 The witness did not see any smoke or fire from the aircraft prior to impact. Complete recovery of the wreckage was not possible but there was no indication of fire or smoke found on any of the component parts recovered. As there were raised CO levels in both the pilot and passenger, a source of smoke or an onboard fire could not be completely ruled out.

2.4 Examination of the recovered wreckage suggests that the structural integrity of the aircraft was sound. However because a significant portion of the aircraft remained unaccounted for, structural failure could not be ruled out. Of the extremities recovered, there is no evidence of control surface flutter or failure prior to impact.

2.5 The possibility of an aircraft control malfunction could not be eliminated as none of the cockpit controls or control linkage systems of the aircraft were recovered.

2.6 The possibility of engine or propeller failure is unlikely but this similarly could not be confirmed.

2.7 Carbon monoxide saturation levels in non-smokers can average 1-2%. The levels were elevated in both the pilot and his passenger at 11% and 7% respectively. These levels are indicative of an exposure to carbon monoxide. The car used for their transport to the aerodrome tested negatively for CO contamination.

2.8 Possible sources of CO in the aircraft were either a fire, which is highly unlikely, or exhaust fumes from the engine. Since the aircraft did not have a cabin heater fitted, it is possible that the CO may have come from a leaking exhaust gasket. The aircraft was fitted with exhaust stubs, without the refinements or complexities of a muffling system. Not having a muffler system removed a prime source of possible CO contamination, which can occur through cracking, or burning of pipes and mufflers, often hidden by covers and shrouds. The leaking fumes may have entered the cockpit through small cracks or holes in the firewall or the nose landing gear bay area. Fumes may also have been drawn into the cockpit between the canopy and the fuselage, as a result of normal aerodynamic airflow. The last recorded repair on the exhaust system was carried out in December 1992.

2.9 Expert opinion indicates that the effects of CO saturation levels found in the two occupants can vary considerably from person to person. There is no reliable predictor to allow determination of just what effect the levels of CO may have had, if any, on the pilot and his passenger.

2.10 The family of the deceased was surprised at the levels of alcohol (30mg/100ml in the pilot and 5 mg/100ml in the passenger) found in the blood samples taken for toxicology. The family indicated that the pilot and his passenger were non-drinkers. Investigation of the couple's recent activities failed to disclose where the alcohol might have come from. Expert opinion is that the blood alcohol levels are not attributable to post-mortem changes.

2.11 Research has demonstrated that 30mg/100ml (or 0.03%) blood alcohol can cause some impairment of pilot related tasks. Studies on the effects of alcohol on the performance of those tasks shows that impairment can occur with blood alcohol concentrations of 0.025%. In-flight evaluation of pilots with quite low blood concentrations of alcohol has suggested significant degradation of performance.

2.12 The effects of overexposure to petrol fumes are discussed in the Material Safety Data Sheets produced by the respective petrol manufacturers. The effects may include eye irritation, respiratory irritation, dizziness, nausea, skin irritation or loss of consciousness. It appears that the aircraft had a history of petrol fumes in the cockpit and other similarly aged Falco's have been reported as having a similar cockpit environment.

2.13 Records indicate that the aircraft did not have stall strips fitted. The manufacturer recommended fitment of the strips, but they were not required to be fitted. It is possible that the aircraft stalled during the final steep turn, despite the experience of the pilot. The cumulative effects of CO, alcohol and petrol fumes on the pilot, combined with the lack of pre-stall buffet, may have combined to cause the aircraft to flick into a spin at an altitude from which recovery was not possible.

# 3. Conclusions

3.1 The pilot was appropriately qualified and experienced for the flight.

3.2 No pre-accident medical incapacitation was detected in either the pilot or his passenger.

3.3 The aircraft had a valid Certificate of Airworthiness and had been maintained in accordance with relevant requirements, with the exception of the Annual Review of Airworthiness.

3.4 There was no evidence in the wreckage inspected of any pre-accident aircraft defects that would have contributed to the accident.

3.5 The possibility of smoke or fire as the source of blood CO saturation levels could not be discounted, though this is unlikely.

3.6 The possibility of an engine or propeller failure is highly unlikely, based on the witness account.

3.5 The possibility of a control system malfunction could not be discounted.

3.6 The possibility of loss of control of the aircraft by the pilot, through the single or cumulative effects of CO, alcohol and petrol fumes could not be discounted.

3.7 In the absence of sufficient physical evidence in the form of the unrecovered sections of the aircraft, the cause of the accident could not be determined.

Michael G Hunt
Assistant Director Safety Investigation and Analysis 15 November 1999