



AIRCRAFT ACCIDENT REPORT

No. 90-086

BANTAM B22

ZK-FOM

Near Claxby, South Eyre Road, Canterbury

9 June 1990

**Transport Accident Investigation Commission
Wellington • New Zealand**

AIRCRAFT:	Micro Aviation (N Z) Ltd B22 Bantam Microlight	OPERATOR:	J.A.M.B. Syndicate									
REGISTRATION:	ZK-FOM	PILOT:	Mr L G Hargraves									
PLACE OF ACCIDENT:	Near Claxby, South Eyre Road Canterbury	OTHER CREW:	Mr J G Leech									
DATE AND TIME:	9 June 1990 approx 1235 hrs	PASSENGERS:	Nil									
SYNOPSIS: The Duty Inspector of Air Accidents was advised of the accident at 14 50 hours on 9 June 1990. Mr D G Graham was appointed Inspector In Charge and an on-site investigation was commenced the same afternoon. The aircraft was flying into wind at about 250 feet above ground level and had made several turns when it was observed to bank very steeply to the left. It entered a steep spiral dive and shortly afterwards struck the ground. The instructor on board received fatal injuries on impact. A student pilot who occupied the left seat died at Christchurch Hospital later in the day from injuries sustained in the accident.												
1.1 HISTORY OF THE FLIGHT: See page 3.	1.2 INJURIES TO PERSONS: Crew: 2 Fatal	1.3 DAMAGE TO AIRCRAFT: The aircraft was substantially damaged	1.4 OTHER DAMAGE Minor surface damage to young wheat crop									
1.5 PERSONNEL INFORMATION: See page 5.												
			Flight Times									
			<table border="1"> <thead> <tr> <th></th> <th>Last 90 days</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>All Types</td> <td>19.2</td> <td>286</td> </tr> <tr> <td>On Type</td> <td>4.2</td> <td>4.7</td> </tr> </tbody> </table>		Last 90 days	Total	All Types	19.2	286	On Type	4.2	4.7
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All Types	19.2	286										
On Type	4.2	4.7										
1.6 AIRCRAFT INFORMATION: See page 7.												
1.7 METEOROLOGICAL INFORMATION: See page 8.		1.8 AIDS TO NAVIGATION: N/A	1.9 COMMUNICATIONS: N/A									
1.10 AERODROME INFORMATION: N/A	1.11 FLIGHT RECORDERS: N/A	1.12 WRECKAGE AND IMPACT INFORMATION: See page 9.										
1.13 MEDICAL AND PATHOLOGICAL INFORMATION: See page 10.		1.14 FIRE: Fire did not occur	1.15 SURVIVAL ASPECTS: See page 11.									
1.16 TESTS AND RESEARCH: N/A	1.17 ADDITIONAL INFORMATION: See page 12.	1.18 USEFUL OR EFFECTIVE INVESTIGATION TECHNIQUES: Nil										
2. ANALYSIS: See page 14.	3. FINDINGS: See page 17.											
4. SAFETY RECOMMENDATIONS: See Page 18.			5. REGULATORY: See Page 19.									

* All times in this report are NZST (UTC + 12 hours)

1. FACTUAL INFORMATION

1.1 *History of the flight*

1.1.1 On the day of the accident members of the syndicate which had recently purchased Bantam B22 ZK-FOM, and Mr Hargraves, the Chief Instructor of the Air New Zealand Microlight Club who had agreed to provide instruction on ZK-FOM that day, assembled at Claxby at about 0915 hours.

1.1.2 The aircraft had been flown the previous weekend and had remained during the week in its fully rigged state, stored with other microlight aircraft in an enclosed hangar at the privately owned property.

1.1.3 Following a detailed pre-flight inspection, Mr Hargraves carried out a solo take-off, circuit and landing in ZK-FOM to satisfy himself regarding the aircraft's operation and the local flight conditions. Mr Hargraves then departed with a syndicate member, Mr Leech, on a training flight which occupied some 15 to 20 minutes. This was the first occasion Mr Leech had flown in the aircraft and the flight was also his introductory training flight as a student pilot.

The flight evidently proceeded uneventfully and other syndicate members reported that Mr Leech, who had been eagerly anticipating the commencement of his flying training, thoroughly enjoyed the experience.

Mr Leech said that during this flight he was "just holding the stick and keeping the aircraft straight and level".

1.1.4 Mr Hargraves then carried out two further instructional flights with syndicate members who had already begun microlight training in a Quicksilver MXII type aircraft but intended to continue their training in ZK-FOM. The first flight occupied about 45 minutes and the second 55 minutes.

1.1.5 During both flights Mr Hargraves followed a similar routine, flying in the area to the west of Claxby, initially skirting Eyrewell Forest then operating over the open paddocks to the north of the forest before returning for circuit work near to Claxby itself. The flights involved general handling, straight and level flight, turns and some stalls as well as circuits.

1.1.6 The students reported that stalling demonstration and practice was carried out at a height of about 1000 feet above ground level (agl) and the other exercises, with the exception of the final circuits, were flown at least 800 feet agl. It was Mr Hargraves normal custom to conduct training flights at about this height or occasionally higher.

1.1.7 The behaviour of the aircraft in the stalling exercises was straightforward with no evidence of any sudden or marked wingdrop. Recovery was effected without difficulty in each case. One student commented that the aircraft was headed into wind prior to the stalling practice and recalled "the second stall we did was a bit bumpy mainly because there was a lot of wind. The wind just blew up and it was gusting about slightly. It just dropped one wing slightly on the stall. Just power back and pull back on the stick. It just sort of hovered and then it fell. One wing went slightly. I don't remember which one. But it was very easy to recover and it responded very well to the recovery. I think I did three. The other two were very smooth."

1.1.8 The students recalled that during turning practice, Mr Hargraves drew attention to the necessity to maintain the airspeed at or above 40 mph. He monitored the indicated airspeed carefully and was quick to point out and require correction of any tendency for the airspeed to decrease below this value. On both flights the flaperon control was only used during take-off and landing.

1.1.9 During the morning's flying ZK-FOM performed satisfactorily in all respects. None of the syndicate members nor Mr Hargraves noted any abnormality or unusual characteristic in the operation of the aircraft or its engine. The sole "snag" encountered related to intermittent functioning of the "Hour Meter" which did not always record the time flown. An auxiliary instrument fuse was replaced in an attempt to correct this minor electrical fault.

1.1.10 Shortly after midday a break was taken for some light refreshment and ZK-FOM was refuelled to capacity with the required 2-stroke mixture. Mr Hargraves had a cup of coffee and a biscuit at this time and informed the group that he was "still feeling good" and was happy to carry on with the flight training.

He had been wearing sneakers during the earlier flights and mentioned that his feet were cold, so took the opportunity to change into flying boots before departure.

1.1.11 Mr Hargraves and Mr Leech took off from Claxby in ZK-FOM at about 1230 hours, although this time could not be established precisely. The take-off and climb out appeared normal. As this was only Mr Leech's second training session in the aircraft, it was assumed that the flight would continue for some 30 to 40 minutes, consolidating basic aircraft familiarisation and effects of controls, probably introducing straight and level and climbing and descending skills, with perhaps the demonstration of some turns. There had been no indication in prior conversation that this would be other than the case and observation of the aircraft's initial progress suggested that Mr Hargraves was following standard routine.

1.1.12 The driver and passenger of a car proceeding toward Oxford along South Eyre Road who had passed Claxby a short time earlier, observed a microlight aircraft flying in a south-westerly direction toward the Waimakiriri River. The aircraft, which proved to be ZK-FOM, was flying slowly, heading into the relatively strong wind, at a height of about 250 feet agl and was seen to carry out some turns. One turn was about 180° to the left followed by a 180° turn to the right. The aircraft then briefly flew south-west again before suddenly banking very steeply to the left. The driver of the car, who was a keen hang glider pilot, realised at this stage that the pilot was in difficulty. His first impression was that the aircraft had entered a wing-over type manoeuvre leading to a full roll and he described the angle of bank as almost vertical.

1.1.13 The witnesses lost sight of ZK-FOM as they passed a nearby stand of trees and next observed the aircraft at a low height spiralling to the ground in a steep nose down attitude. It struck the surface of a paddock and tumbled backwards before coming to rest. After locating the gates the witnesses drove as rapidly as possible through adjoining paddocks to the scene of the accident. It was evident that one occupant, Mr Hargraves, was already dead and the other, Mr Leech, was unconscious and severely injured. One of the witnesses

remained at the site attending to Mr Leech while the other drove to Claxby to seek further assistance.

1.1.14 Syndicate members immediately drove to the scene and an instructor on board a Robinson helicopter operating at Claxby was informed of the occurrence. The instructor and his student flew to the area, while the helicopter operator's base alerted the Rangiora ambulance. The rescuers successfully extricated Mr Leech from the wreckage and the ambulance was guided across the paddocks to the accident site, utilising directions relayed from the helicopter which was airborne overhead. The instructor on board the helicopter reported that he was advised of the accident at approximately 1315 hours.

1.1.15 Mr Leech was subsequently transferred by ambulance to Christchurch Hospital but died some two and a half hours after the accident as a result of the severe injuries he had received.

1.1.16 The accident occurred in daylight at an undetermined time, probably between 1230 hours and 1300 hours. The accident site was in a level open wheat paddock 15 km north-west of Christchurch Aerodrome at an elevation of about 330 feet amsl. The accident occurred approximately 3.5 km west of the grass airfield at Claxby, where the aircraft was shortly expected to return. National Grid Reference 607568 (NZMS260 Sheet M35 Christchurch). Latitude: 43°23.4'S Longitude: 172°23.4'E.

1.5 Personnel information

1.5.1 The pilot in command, Lindsay George Hargraves, 57, had been issued with a Student Pilot Licence – Aeroplane (SPL-A) in May 1983 and had commenced flying training in a Cessna 150 light aircraft in June 1983.

He had commenced flight training in a Quicksilver MXII microlight aircraft in January 1984 and had subsequently interspersed training in conventional fixed wing light aircraft with his microlight flying training.

1.5.2 Mr Hargraves was a member of the Air New Zealand (Sports and Social) Microlight Club. He successfully completed the required microlight training schedule and was issued with Microlight Aircraft Association of New Zealand (MAANZ) Intermediate Licence No. GPB/154/2 in September 1984.

He obtained Private Pilot Licence – Aeroplane, (PPL-A), number 80484 and a Type Rating Certificate for Group "A" aircraft, in June 1985.

1.5.3 In November 1985, Mr Hargraves undertook and passed the flight test authorising him to act as an instructor in microlight aircraft. He continued to fly various light aircraft as a private pilot, while instructing on the Quicksilver MXII microlight. He also carried out brief flights in several other types of microlight aircraft.

1.5.4 Mr Hargraves regularly renewed his PPL-A and his microlight qualifications. In April 1988 he was issued with MAANZ Approved Testing Officer Certificate No. 154/6. His experience and qualifications were appropriate for the position he held as Chief Instructor of the Air New Zealand Microlight Club.

His PPL-A expired in July 1988 and was not renewed after this date. He last flew a conventional fixed wing light aircraft on 2 March 1988.

1.5.5 The last entry recorded in Mr Hargraves' Pilot's Logbook was dated 4 June 1990.

Including time flown in Bantam B22 ZK-FOM on the day of the accident, Mr Hargraves' flight experience was summarised as follows:

Total Hours flown on conventional light aircraft 115.2 hours
(54.4 hours dual instruction and 60.8 hours
as pilot in command)

Aircraft types flown: Cessna 150, Piper PA38, Piper PA28-151
and 181
(A 30 minute dual flight had also been
carried out in a DH82A aircraft in
February 1985)

Total hours flown on microlight aircraft 170.9
hours flown on Quicksilver MXII type 164.5
hours flown on Bantam B22 type 4.7

1.5.6 Within the last 90 days Mr Hargraves had flown 19.2 hours, of which 14.6 were on the Quicksilver MXII. Within the last seven days he had flown approximately 5.5 hours, including the accident flight. (4.2 hours on the B22 ZK-FOM, 0.4 on the Gemini and 0.9 hours on the MXII.)

1.5.7 With the exception of a 30 minute familiarisation flight in a Bantam B22 on 27 November 1986, Mr Hargraves had not flown this type until 2 June 1990, a week before the accident, when ZK-FOM had first been assembled at Claxby. His logbook recorded a flight in ZK-FOM of 50 minutes' duration on this date, entered as "Familiarisation with type".

1.5.8 On 4 June 1990, Mr Hargraves had carried out two instructional flights in ZK-FOM, of approximately 25 and 30 minutes' duration, both flights introducing "effects of controls" to two members of the syndicate which owned the aircraft.

1.5.9 The next occasion on which he flew ZK-FOM was 9 June 1990, the day of the accident.

1.5.10 Mr George John Leech, 25, occupied the left seat of ZK-FOM on the accident flight.

He was a member of the JAMB syndicate which had arranged the purchase and operation of the aircraft. The day of the accident was the first occasion he had seen ZK-FOM and his first opportunity to commence flight training on the aircraft, as he had been away the previous weekend.

1.5.11 It was Mr Leech's intention, during the ensuing week, to take the necessary action to join the Air New Zealand Microlight Club, as the other syndicate members had done. He also intended to apply for membership of MAANZ and to submit the appropriate medical declaration.

1.5.12 Mr Leech had no previous flying experience and the flights in ZK-FOM on the day of the accident constituted his first experience as a pilot under instruction. However he was accustomed to building and flying radio-equipped model aircraft and was familiar with the basic principles of flight.

1.6 Aircraft information

1.6.1 Microlight Bantam B22, serial number 0062, was constructed by Micro Aviation (NZ) Limited in 1987. It was registered as Class II (2 seat microlight aircraft) ZK-FOM.

1.6.2 ZK-FOM was first test flown on 18 September 1987 and was found "to perform satisfactorily in all normal flight manoeuvres". A Permit to Fly was issued on this date. The aircraft, which was initially retained in the ownership of the manufacturer, was flown regularly and received periodic maintenance as required.

1.6.3 The aircraft was powered by a Rotax 503 series two-stroke engine, serial number 3641033, fitted with a 3 bladed "Ultra" propeller. In April 1988, after 113 hours in service, the engine was rebuilt with a new crankcase, crankshaft, conrods and pistons. A 4 bladed "Ultra" propeller and a new reduction gearbox was installed at this time. In addition, the airframe was upgraded by the manufacturer to the latest B22 specifications. This included re-positioning the wings, lowering the engine thrustline and installation of longer tailboom struts. (One result of these modifications to the type was to reduce a previous tendency for a marked wing drop to develop when the aircraft was stalled).

1.6.4 ZK-FOM was purchased by a private owner but was flown infrequently during the remainder of 1988 and 1989.

1.6.5 The latest Permit to Fly had been issued on 1 June 1989 and remained valid until 31 May 1990.

1.6.6 The JAMB syndicate purchased ZK-FOM in May 1990 and arranged for its transportation by road from the manufacturer's premises near Hamilton, where it had been stored, to Christchurch. The manufacturer inspected the aircraft and incorporated some further improvements (replacing the two cage hanger tubes and modifying the windscreen assembly) before it was dismantled and prepared as a freight load. It had accumulated 141 hours total flying time at this stage.

1.6.7 The aircraft arrived on 1 June 1990 and was taken to the hangar at Claxby. An inspection for renewal of the Permit to Fly was carried out by an authorised inspector in conjunction with the assembly of ZK-FOM the following day. An engine ground run was made and the aircraft was considered satisfactory for flight.

1.6.8 Subsequent test flights on the same day, 2 June 1990, confirmed that ZK-FOM performed and handled in the expected manner in all respects.

1.6.9 The specifications for the Bantam B22 defined a maximum all up weight of 356 kg. ZK-FOM had been refuelled to capacity prior to the accident flight. The weight of ZK-FOM was estimated to be approximately 340 kg at the time of the accident.

1.6.10 The specifications did not include any information relating to Centre of Gravity limitations, but the Bantam B22 was an accepted microlight type. On the accident flight it was not carrying any abnormally disposed, or additional load, which might have adversely affected its proven handling characteristics.

1.6.11 ZK-FOM was fitted with an electric fuel pump and associated 12 volt motorcycle type battery. The fuel pump was selected by an ON/OFF switch mounted on the instrument panel. The battery also supplied power to a rotating anti-collision beacon. The beacon was inoperative at the time of the accident.

1.6.12 The aircraft was not equipped with any form of radio transceiver.

1.6.13 The Permit to Fly for ZK-FOM had expired eight days prior to the accident. The required inspection had been completed but administrative action to obtain the new Permit to Fly was still in process, in association with the change of ownership arrangements, when the accident intervened.

1.6.14 ZK-FOM was not equipped with a ballistic parachute (designed to be operated in the event of structural failure or similar emergency to enable the aircraft to descend safely to the ground).

1.7 Meteorological information

1.7.1 On the day of the accident an anticyclone was centred to the south-west of South Island and a southerly airstream flowed onto the east coast. The weather at the time of the accident was cloudy with broken cloud at about 4000 feet above ground level. During the afternoon there were some light showers with patches of cloud down to 1500 or 2000 feet, but the visibility generally remained good.

1.7.2 The meteorological conditions at Christchurch Aerodrome (15 km to the south-east of the accident site) at 1200 hours were recorded as follows:

Surface wind:	230°T/10 knots
Visibility:	90 km
Past weather:	Recent showers
Cloud:	2 octas cumulus at 3500 feet 7 octas strato cumulus at 4000 feet
Temperature:	8°C
Dew Point:	2°C
QNH:	1034.5 hPa

The surface wind became more southerly during the afternoon. The upper winds recorded at Christchurch Aerodrome at 1100 hours were as follows:

1000 feet	235°T/13 Knots
2000 feet	210°T/19 Knots
3000 feet	205°T/21 Knots
4000 feet	195°T/21 Knots

1.7.3 The General Manager of the New Zealand Meteorological Service in an “aftercast” of the meteorological situation made the following comments:

“The general weather conditions at the site of the crash would have been similar to those at Christchurch Airport. However the accident site is about 1.5 km north of Eyrewell State Forest and this would have had some effect on the wind flow. The winds being south-westerly places the site in the lee of the forest. The passage of the airstream over the

forest would have increased the turbulence within it. It is estimated that at 200 feet near the crash site the mean wind speed would have been about 12 knots with gusts possibly reaching 20 knots compared to 17 knots up-wind of the forest.

The temperature at the surface would have been about 8 degrees Celsius and at about 1000 feet 7 degrees.”

1.7.4 The two witnesses to the accident, one of whom was an experienced hang glider pilot, described the local weather as follows:

“The wind was pretty strong from the south-west. It was a cold, gusty wind of about 10 to 15 knots. It was quite gusty. There was no rain at the time.”

1.7.5 The helicopter instructor who had been flying at Claxby during the morning and who flew to the accident site shortly after being alerted concerning the occurrence, stated that the wind was from the south-west and estimated its strength as 15 to 20 knots. He recalled some drizzle in the area.

1.12 Wreckage and impact information

1.12.1 The aircraft was lying in the northern corner of a wheat paddock in a 30° nose-down attitude with the fuselage on a heading of about 190°M. When rescuers first reached the scene the tailboom, which had broken just behind the hang cage rear attachment, was aligned with the trailing edge of the left wing.

1.12.2 The fibreglass fuselage nose-fairing and windshield had shattered and the tubular structure of the hang cage which supported the side by side seating to which the undercarriage and fuel tank were attached, had been disrupted on impact.

1.12.3 The ground was firm, moist, stony soil, with the wheat crop 100 to 150 mm high.

1.12.4 The accident site was 1 km south of South Eyre Road and 3.5 km west of the grass aerodrome at Claxby (from where the flight had commenced and where the aircraft was to return).

1.12.5 The surrounding terrain comprised numerous large open level paddocks, some bounded by trees and dykes, but almost all suitable for an emergency or precautionary landing in an aircraft such as ZK-FOM.

1.12.6 The outboard section of the left wing was bent downward and the outer leading edge was covered with soil. The tubular leading edge spar had been bent rearwards and had fractured about 200 mm inboard of the forward strut attachment.

1.12.7 Ground scars matching the damage to the left wing were evident 12 m south-west of the wreckage, and the impact of the engine and fuselage nose fairing had produced two adjacent craters 200 to 300 mm deep. One almost intact propeller blade remained attached to the propeller hub. Portions of the three other blades were recovered in the vicinity of the engine crater and up to 16 m beyond. The damage to the blades suggested that the propeller was rotating at impact but the extent of power being produced by the engine was not determined.

1.12.8 The ground marks, distribution of the wreckage and the extent of damage was consistent with impact in a steep spiral descent to the left. Following initial impact on the left wing the aircraft had "cartwheeled" and subsequently bounced rearwards before coming to rest.

1.12.9 All components of the aircraft were accounted for at the accident site. There was no evidence of a bird-strike, or pre-impact contact of the airframe or propeller with any other object.

1.12.10 The aileron and elevator, flaperon and elevator trimmer control circuits were still connected, but both rudder cables had failed due to overload in the impact sequence. The differing positions at which the left and right cable had failed provided an indication of the displacement of the rudder pedals and suggested that right rudder was applied when impact occurred. Witness marks on the flaperon stirrup and fuselage tube suggested that the flaperons were "up" at the time of ground impact. It was not practicable to determine the pre-impact setting of the elevator trimmer.

1.12.11 The single, centrally mounted, control column was properly secured and moved freely.

1.12.12 The centre cable connected to the throttle cross-tube had failed in overload approximately 30 mm from its swaged attachment thimble. Fuel was present in the in-line fuel filter between the fuel tank and the engine. The fuel tank had ruptured on impact with substantial leakage, but some residual fuel remained in the tank.

1.12.13 The front and rear attachments of both wings were intact, as were the upper and lower attachments of the four wing struts. The rear strut on the right wing had fractured approximately mid span at the clamp which supported the jury strut. The fracture had occurred where the clamp bracket was pop-riveted to the strut. The strut was bowed and the failure at the clamp was consistent with overload due to ground impact. There was no evidence of internal or external corrosion which might have pre-disposed the strut to fail. Removal of the matching clamp from the rear strut of the left wing disclosed no evidence of corrosion or other weakness in this area.

1.12.14 The engine switch was in the "ON" position. The selection of the fuel pump switch could not be determined. The altimeter subscale was set at 30.57 ins. There was no reading on the instrument itself. The airspeed indicator read 14 mph and the cylinder head temperature gauge indicated 450°. The tachometer had been destroyed. The "Hour Meter" indicated 148.0. The previous recorded "Hour Meter" reading was 147.3.

1.13 Medical and pathological information

1.13.1 Prior to the issue of a licence validity certificate for Mr Hargraves', Private Pilot Licence (which lapsed in July 1988), the medical assessment had included special investigations concerning a possible heart complaint. After the lapse of his PPL, Mr Hargraves held a MAANZ Medical Certificate completed by his doctor. This Certificate was valid to 19 May 1991.

1.13.2 Specific reference was made at autopsy to any evidence that would demonstrate that Mr Hargraves was attempting to manipulate the aircraft's

controls at the time of impact. No pathological evidence to confirm that Mr Hargraves was manipulating the controls could be found, thus the possibility of pilot medical incapacitation could not be excluded.

1.13.3 Significant narrowing of the coronary arteries to the heart and mild narrowing of the carotid arteries to the brain by arterial atheroma were discovered at Mr Hargraves' autopsy. Atherosclerosis of arteries is known to predispose to thrombosis and complete occlusion causing either myocardial infarction (heart attack) or cerebrovascular accident (stroke). Additionally severe narrowing of coronary arteries by atheroma may reduce the blood supply so that myocardial ischaemia (inadequacy of blood supply) occurs. Myocardial ischaemia may be non-symptomatic or cause angina (chest pain) or arrhythmia (disturbances of the heart rhythm) causing faintness or collapse.

There was no evidence of myocardial infarction but there was evidence that some minor changes of ischaemia had occurred.

1.13.4 Mr Hargraves was noted to have high blood pressure, abnormal blood lipids and an abnormal electrocardiogram in 1983. His high blood pressure was subsequently treated. Specialist examination by a cardiologist and further tests were undertaken in 1983 and 1986 to exclude ischaemia. These tests were limited by technical problems and while apparently negative did not conclusively exclude myocardial ischaemia.

1.13.5 Many individuals aged 40 and over in the general population, including among them many pilots, will have significant narrowing of their coronary arteries by atheroma. In the majority of cases there will be no symptoms and no limitations on performance. However symptoms and sudden collapse or death may occur to such individuals without any premonitory indications that coronary circulation is inadequate. The possibility of the sudden onset of symptoms due to ischaemia could not be excluded in the case of Mr Hargraves.

1.13.6 Pilot medical incapacitation may have occurred due to myocardial ischaemia associated with chest pain or disturbance of heart rhythm prior to the accident. An estimate of the probability of such an occurrence ranged from low to moderate.

1.13.7 Toxicological analysis disclosed no relevant indications in the case of either Mr Hargreaves or Mr Leech. Post-mortem examination revealed no evidence of any pre-existing disease or disability which could have affected Mr Leech during the flight.

1.15 Survival aspects

1.15.1 The occupants were both wearing their automotive type "tongue & buckle" lapbelts. The belt assemblies and their anchorages had remained intact but the structure to which they were attached was severely disrupted.

1.15.2 The instructor and student both wore motor cycle type "full-face" safety helmets with visors and warm clothing appropriate for the conditions. The instructor was wearing overalls, gloves and flying boots at the time of the accident.

1.15.3 Rescuers reached the scene within minutes of the accident and the student was transferred to hospital by ambulance with a minimum of delay. However his injuries were such that he died a short time later.

1.15.4 The aircraft structure afforded little protection and the steep angle of impact following a spiral descent from a height of some 250 feet rendered survival of either occupant unlikely.

1.16 Tests and research

1.16.1 Inspection and subsequent testing of the engine and gearbox assembly revealed no indication of any abnormality or malfunction.

1.16.2 Examination of the aircraft's cable operated control systems and airframe structure at the accident site disclosed no evidence of pre-impact defect or failure. Later disassembly of the wing structure and examination of the spars and ribs and further detailed inspection of the fuselage and tailplane structure revealed no indication to suggest that any in-flight failure had occurred.

1.16.3 An accident involving a Bantam B22 aircraft occurred in January 1990 in which the pilot and passenger both survived but sustained serious injury. (Accident Ref: 90-011).

At about 100 feet agl the aircraft's left wing dropped and the aircraft descended out of control to collide with the ground. The investigation concluded that a westerly wind shear above a lower layer of calm air may have contributed to a loss of airspeed and control.

1.16.4 The circumstances of that accident and the nature of the resulting ground impact bore a distinct similarity to the accident involving ZK-FOM. In the latter case, however, the aircraft descended from a height of some 250 feet with consequently greater impact forces.

1.17 Additional information

1.17.1 The microlight pilot training schedule of the Air New Zealand (Sports and Social) Microlight Club listed the following sequence of training tasks (reproduced in part only):

- A/C Familiarisation/Explanation of controls
- Taxiing
- Effects of Controls
- Straight and Level
- Climbing and Descending
- Turning (Medium, Climbing and Descending)
- Stalling (Power Off)
- Circuit rejoin
- Take-off, circuit and landing

It was Mr Hargraves' practice as an instructor to follow the sequence of exercises as outlined in this schedule.

1.17.2 No intercom system was installed in ZK-FOM and airflow and engine noise was such that in-flight communication between the occupants, who wore full face safety helmets with visors, was limited to hand signals or similar non-verbal indication.

1.17.3 Mr Hargraves' instructional technique generally involved a pre-flight briefing and discussion of proposed exercises followed by in-flight demonstration and hand-over to the student who would then attempt to fly the

demonstrated exercise(s). In terms of communication, for example, in regard to airspeed control, it was Mr Hargraves' practice to monitor the airspeed indicator and draw the student's attention to any deviation from desired values by pointing to the instrument. If the student did not take appropriate action to correct a given situation, Mr Hargraves would normally take over the controls promptly.

1.17.4 Another instructor member of the Air New Zealand Microlight Club held engineering qualifications and was authorised to conduct Permit to Fly inspections on microlight aircraft. He had supervised the assembly of ZK-FOM after it had been transported to Christchurch and was satisfied that the aircraft was structurally sound and correctly rigged. This instructor test flew ZK-FOM during the weekend prior to the accident and also flew together with Mr Hargraves to assess the handling characteristics at close to maximum all-up weight. He noted no unusual handling tendencies and commented that it was easy to enter and maintain balanced turns. He and Mr Hargraves carried out a number of stalls and experienced no problem in the recovery. On one occasion he noted a tendency to drop the left wing, but recovered without difficulty. He recalled the indicated airspeed at the stall as about 32 mph with the flaperon control in the "UP" position.

1.17.5 The instructor stated that Mr Hargraves flew ZK-FOM competently. He adopted a cautious attitude in his handling of the aircraft, reflecting his lack of experience on the type.

1.17.6 Between 1000 and 1030 hours on the morning of the accident several persons at a property located about 5 km north-east of Claxby watched a microlight aircraft flying in their vicinity. The aircraft which they identified as a Bantam B22 had two persons on board and carried out three medium to steep turns before departing in the direction of Claxby.

The observers, who owned and operated microlight aircraft themselves, gained the impression that the turns were not balanced and generally lacked smoothness and coordination. The engine sounded normal throughout, but one observer commented that the aircraft's pitch attitude varied to an unusual extent during the manoeuvres.

It was concluded that the aircraft was ZK-FOM. The manner in which the aircraft was being flown probably reflected the training nature of the flight but also may have indicated that Mr Hargraves was still developing familiarity with the aircraft's handling characteristics.

1.17.7 Information re Quicksilver MX Microlight

Notes issued by the manufacturer of the Eipper Quicksilver MX microlight aircraft contained the following information in relation to the aircraft's stall characteristics and recommended procedures prior to practising stalls (reproduced in part only):

(a) **Stall Speeds-Vs1**

Stall speeds change with angle of bank, gross weight, and power configuration. As the angle of bank increases stall speed increases. When making steep turns maintain more airspeed in relation to angle of bank. This is usually accomplished with a more low attitude or extra power or a combination of both.

Gross weight can change stall speeds and characteristics. The MX has a very gentle stall and slow stall airspeed so extra weight increases stall speed and stall characteristics. Less gross weight will lower stall speed and stall characteristics.

Maintaining power will lower stall speed and increase the angle of attack. The MX will experience a slight descent with power in a stall attitude. When in doubt of stall conditions push the control stick forward. This lowers the nose and aircraft will recover airspeed. Normal flight conditions can then be resumed.

At gross weight the power-off stall speed (V_{S1}) of the MX is 24 mph.

NOTE: The Quicksilver MX will not spin due to the dihedral and washout in the main wing.

(b) **Stalls**

Stalls should be practiced in an area away from other air traffic and at an altitude that generally permits stall recovery at least 200 feet above the ground. During stall practice, as well as in other manoeuvres, the area must be “cleared” of other airplanes. Make clearing turns a part of each manoeuvre, by first making two medium banked 90° turns in opposite directions. The object of these clearing turns is to look over the entire area, especially at your flight altitude, to assure yourself there are no other airplanes in the area. If there are airplanes nearby, wait until they are well clear before performing the manoeuvre.

As a stall is approached there are other cues that inform you the airplane is slowing. For example, the tone and intensity of the slipstream noise.

Stall warnings are 1 to 2 mph before the stall. The warning indications are buffeting at a high angle of attack. One of the purposes of stall practice is to recognise the indications applicable to your airplane.

1.17.8 The Quicksilver MXII microlight employed a control system arrangement in which the control “stick” operated the elevator when moved fore and aft and the rudder when moved from side to side, with foot operated wing spoilers.

This system contrasted with the conventional “3-axis” controls of the Bantam B22 in which fore and aft “stick” provided pitch control but sideways movement operated the flaperons (combined flap and aileron surfaces) and foot pedals operated the rudder.

2. ANALYSIS

2.1 Mr Hargraves was appropriately qualified to conduct instructional flights in Bantam B22 microlight ZK-FOM and on the morning of the accident had successfully completed three such flights.

Following a short lunchtime refreshment break Mr Hargraves had expressed his readiness to continue the flight training programme.

Mr Hargraves and Mr Leech, the student pilot on board, were both reported to have been in good spirits when they took off in ZK-FOM on the accident flight. Mr Hargraves had, however, mentioned that his feet were getting cold during the morning's flying and accordingly had put on warmer footwear prior to the flight. This was not unexpected given the cool conditions which prevailed and the sequence of flights Mr Hargraves had carried out.

2.2 Mr Hargraves had flown ZK-FOM for the first time during the previous weekend and at the time of the accident had accumulated some 4.7 total hours flying on the type. During the morning he had completed four flights in ZK-FOM for a total of approximately 2.2 hours before departure on the accident flight. He was evidently satisfied with the performance of the aircraft and had given no indication of concern in regard to its flight characteristics. An instructor who had flown ZK-FOM with Mr Hargraves a week earlier, reported that his initial handling of the aircraft had been cautious, as could be expected in converting to a new type.

2.3 The precise time of take-off was not determined nor was it practicable to establish exactly when the accident occurred. The duration of the flight was therefore not known. The last recorded reading on the "Hour Meter" compared with the reading at the accident site suggested an elapsed time of 0.7 (42 minutes) if the "Hour Meter" had functioned correctly throughout the flight. Syndicate members however considered the probable flight time to have been of the order of 25 to 30 minutes.

2.4 There was no indication that the aircraft's departure from Claxby was other than normal. There were no reported sightings to confirm the area in which ZK-FOM was operated, the operating height, or any in-flight manoeuvres carried out, until the aircraft was observed (by the occupants of the vehicle proceeding along South Eyre Road) very shortly before the accident.

2.5 The witnesses description of events provided significant information relating to the circumstances and nature of the accident.

When first observed the aircraft appeared to be operating normally, but was flying slowly and was at a relatively low height.

2.6 In the prevailing conditions a low groundspeed was consistent with the aircraft's into wind heading and did not necessarily imply that ZK-FOM was being flown at a reduced airspeed. This possibility could not be entirely dismissed, however, given the conditions, which were likely to have produced at least some turbulence and gustiness at the aircraft's operating height.

The observed manoeuvring of the aircraft also held potential for airspeed to decrease, especially if ZK-FOM was being handled at the time by the pilot under instruction.

2.7 The witnesses estimated ZK-FOM to be flying at about 250 feet agl. While the exact height could not be confirmed, the witnesses estimate was based on hang gliding experience and reference to the height of nearby trees. The short time scale of the aircraft's final descent supported their estimate of the aircraft's operating height.

2.8 No conclusive evidence was established to explain the operation of ZK-FOM at a height well below that at which Mr Hargraves was accustomed to fly during a training flight.

Factors influencing a descent to a lower operating height at this stage, however, may have included the likelihood that the lesson was almost completed as the aircraft neared Claxby, and/or the advantage of less wind and warmer temperature at a lower height. There was also the possibility that Mr Hargraves may have intended to demonstrate a circuit or landing approach in one of the many suitable paddocks, prior to making a final landing at Claxby itself.

2.9 ZK-FOM was seen to carry out a turn to the left and one to the right, and briefly return to straight and level flight before the observed "almost vertical" bank to the left occurred. This suggested that prior to a sudden drop of the left wing leading to a spiral descent from which the aircraft was not recovered, ZK-FOM was capable of being controlled. Which of the two occupants may have been handling the aircraft at the time of the accident could not be determined.

2.10 Examination of the wreckage revealed no evidence to suggest a pre-impact failure or malfunction of the aircraft's control systems or airframe structure. The witness observations, the nature and extent of damage, and the disposition of the wreckage were however consistent with an in-flight loss of control.

2.11 In the absence of evidence to indicate structural or mechanical failure, various scenarios were considered in an attempt to account for a loss of control of ZK-FOM in the circumstances as observed. These included the possibility of in-flight incapacitation of the Instructor, an inadvertent stall during a practice turn, or an unexpected wing drop during a stall demonstration.

2.12 The possibility could not be completely eliminated that the right and left turns carried out before the accident were "clearing" turns prior to a demonstration by the Instructor of an approach to a stall, or a stall itself, and the demonstration resulted in an unexpected and severe wing drop to the left. It was unlikely, however, that Mr Hargraves would have chosen to demonstrate any stalling manoeuvres to Mr Leech at this early stage of training, nor was it likely, even if such a demonstration had been made, that it would have been carried out at a low height.

2.13 In view of the medical evidence, the possibility existed that Mr Hargraves suffered an in-flight incapacitation and may have collapsed or otherwise have been rendered incapable of maintaining control of ZK-FOM, or of monitoring Mr Leech's handling of the aircraft.

While this probability was estimated as "low to moderate", if such an event had occurred, whether at a higher altitude, or at the height of ZK-FOM when first observed, Mr Leech would have been faced with the difficulty of descending the aircraft, retaining adequate control, and carrying out an emergency landing. With minimal flying experience and the additional hazard that control movement might be restricted or otherwise hindered by the Instructor's incapacitation, the successful outcome of such an attempt would be less than likely. An emergency of this nature could well have resulted in a stall and complete loss of control of the aircraft. On the other hand, the apparently normal flight of the aircraft

when first seen, and the turns to left and right observed before the accident, tended to diminish the likelihood that incapacitation of the Instructor was an initiating factor.

2.14 Loss of control accidents involving microlight aircraft, including the Bantam B22 type, have occurred when these aircraft have been operated in turbulent or gusty conditions, and/or have been subject to inappropriate control inputs. Although incapacitation could not be dismissed as a possible cause of the accident to ZK-FOM, potential for a sudden “wing-drop” also existed if the aircraft had been manoeuvred in an uncoordinated manner at a low airspeed, or otherwise mishandled during a practice turn. Gustiness in the prevailing conditions on the day of the accident increased the potential for an inadvertent stall.

2.15 Most of Mr Hargraves’ microlight flying was on the Quicksilver MXII type which had very docile stall characteristics, including a stall speed significantly lower than the Bantam B22. Mr Hargraves had, however, quickly gained familiarity and confidence in the Bantam B22 and despite the cautious attitude adopted during his earlier flying in ZK-FOM, the possibility could not be discounted that at the time of the accident he may have temporarily relaxed his vigilance or intervened too late while the aircraft was being manoeuvred to prevent a loss of control, given the higher stall speed and greater sensitivity of the Bantam B22 to the development of a wingdrop stall.

2.16 Whether such factors as fatigue, or the cold conditions, contributed to the accident could not be established. Nor was it practicable to determine whether control inputs such as deliberate or instinctive application of “opposite” aileron by either the student or Instructor in an attempt to level the wings of ZK-FOM, compounded any attempt at recovery from a steeply banked attitude. An input of right aileron to “pick-up” the left wing of ZK-FOM was likely to have aggravated an already critical situation if the airspeed was low, but nevertheless would have been a natural reaction for a student pilot of Mr Leech’s limited experience.

2.17 In Mr Hargraves’ case, the unconventional control system employed in the Quicksilver MXII (in which sideways movement of the “stick” applied rudder) and his familiarity with the operation of that type of aircraft may have also been relevant in regard to his control response in an emergency situation. Having held a PPL-A however, he did have a background of earlier experience in aircraft fitted with conventional controls and familiarity with their handling characteristics both in normal flight and during the approach to the stall, as well as at the stall itself.

2.18 In the event, the circumstances suggested that once control had been lost, whether or not correct recovery action was attempted, the height available was insufficient for recovery to be effected before the aircraft struck the ground.

3. FINDINGS

3.1 The pilot in command held an Approved Testing Officer Certificate and was authorised to act as an Instructor in microlight aircraft.

3.2 He was in current practice but had commenced flying Bantam B22 ZK-FOM only a week prior to the accident.

3.3 The aircraft's Permit to Fly had expired. This was not a contributory factor in the accident.

3.4 The weight of the aircraft was below the maximum authorised.

3.5 No evidence was found to indicate that a pre-impact structural or systems failure, or mechanical malfunction, contributed to the accident.

3.6 Fresh south-westerly conditions resulted in cool temperatures and the probability of some gustiness and turbulence at the time of the accident flight.

3.7 The pilot in command suffered from a medical condition that could have resulted in in-flight incapacitation.

3.8 The aircraft was under control and apparently operating normally before rolling very steeply to the left.

3.9 The aircraft's attitude and subsequent spiral descent was consistent with loss of control following a "wing-drop" stall.

3.10 The height at which the aircraft was operating precluded recovery before the aircraft struck the ground.

4. SAFETY RECOMMENDATIONS

4.1 The following recommendations were made to the Director of Civil Aviation Safety, Air Transport Division:

That more attention be paid to cardiovascular risk factors in asymptomatic individuals, in order to identify individuals with significant vascular disease, before the risk of pilot incapacitation becomes excessive and

That individuals with risk factors for cardiovascular disease in particular be followed up on a regular basis according to age and

That Exercise ECG's may only be submitted to the PMO if they are recorded after the patient has discontinued antihypertensive medication for an appropriate period, so that a true maximal heart rate test can be achieved and

That copies of all exercise ECG tracings should be submitted to the PMO and not simply a report.

5. REGULATORY

5.1 The legal personal representatives of the pilot in command and the pilot under instruction were invited to comment on a draft of the above report.

5.2 As a result of representations received the report was amended and amplified to clarify some of the points raised.

5.3 The representations made to the undersigned are not to be taken as an admission of liability on the part of the parties concerned and their statements are without prejudice to their right to act in any way they may consider fit in any proceedings or action which may be based on the events to which this report refers.

19 May 1992

M F DUNPHY
Chief Commissioner