NO. 93-021

BANTAM B22

ZK-JAS

13 KM SOUTH-EAST OF ROTORUA

12 DECEMBER 1993

ABSTRACT

The report explains the uncontrolled descent and collision with the ground of a Bantam B22 microlight aircraft ZK-JAS near the Rotorua Microlight Club airstrip at Mead Road, near Rotorua, on 12 December 1993. Safety issues included the hazard of reduced performance due to excess load, high density altitude, and sink encountered after take-off, and potential for stall onset during a turn at low airspeed.

TRANSPORT ACCIDENT INVESTIGATION COMMISSION

AIRCRAFT ACCIDENT REPORT NO. 93-021

Aircraft Type and Serial Number and Registration:	Micro Aviation (NZ) Limited Bantam B22, 0113 ZK-JAS
Number and Type of Engines:	1 Bombardier Rotax 582 LC
Year of Manufacture:	1992
Date and Time:	12 December 1993, 1506 hours*
Location:	Deerstalkers Range, Mead Road, (13 km south-east of Rotorua) Latitude: 38°14'S Longitude: 176°21'E
Type of Flight:	Private
Persons on Board:	Crew: 1 Passengers: 1
Injuries:	Crew: 1 Serious Passengers: 1 Fatal
Nature of Damage:	Substantial
Pilot in Command's Licence:	Microlight Aircraft Association of New Zealand 'Novice' Certificate
Pilot in Command's Age:	51
Pilot in Command's Total Flying Experience:	275 hours 113 on type
Information Sources:	Transport Accident Investigation Commission field investigation.
Investigator in Charge:	Mr D G Graham

*All times in this report are NZDT (UTC + 13 hours)

1. NARRATIVE

1.1 On Sunday, 12 December 1993, the pilot flew unaccompanied in his microlight aircraft ZK-JAS, from Taupo Aerodrome, where the aircraft was hangared, to the Rotorua Microlight Club airstrip situated on Mead Road near Lake Rotokakahi (Green Lake). The weather was fine and sunny with a light south- westerly providing a tailwind during the 40 minute flight. It was the pilot's first visit to the Rotorua Microlight Club but he was aware of the general location and had no difficulty finding the airstrip.

1.2 The airstrip was situated in an enclosed north/south valley at an elevation of 1200 feet amsl. Some of the surrounding hills were more than 2000 feet high. The airstrip had an essentially level smooth grass surface, 500 m long, and was oriented 155°M/355°M.

1.3 On arrival overhead the pilot observed a microlight aircraft taking off in a northerly direction, with another microlight waiting to depart in the same direction. He therefore made his approach and landing from the south. The landing was uneventful, but the pilot, who had not realised until arrival that the airstrip was located at the base of a valley system, recalled experiencing turbulence and "roller and rotor" effects during the approach.

1.4 After parking his aircraft, the pilot watched a Quicksilver MXII microlight which was operating in the circuit. During this time, the wind direction changed through 180° and as a consequence the Quicksilver MXII altered direction in the circuit and landed toward the south. From his observations of the circuits being flown the pilot of ZK-JAS assessed that, in the existing conditions, turbulence existed at both ends of the airstrip.

1.5 The pilot in command of the Quicksilver MXII was an experienced Instructor, who was also the President of the Rotorua Microlight Club. He had been carrying out circuit training with a student. As a result of the changing conditions, and sink encountered to the south of the airstrip, he decided to cut the lesson short, and subsequently landed after about 15 minutes flying.

1.6 The Instructor offered the pilot of ZK-JAS a cup of coffee, and some discussion followed concerning microlight operations in the valley. Conversation included reference to the conditions which the Instructor had just experienced. The pilot of ZK-JAS mentioned his own experience of a fairly high landing speed and turbulence encountered during the approach from the south.

1.7 An acquaintance from Rotorua, who had led an Aviation Tour to the USA in which the pilot of ZK-JAS had taken part, had arrived at the Microlight Club. He was an aviation enthusiast, and an active member of the Amateur Aircraft Constructors Association, having earlier built his own Varieze aircraft which he had flown for a number of years. He held a Commercial Pilot's Licence (Aeroplane) and had recorded a total flight time in excess of 700 hours, including 31 hours of helicopter flying experience.

1.8 On renewing acquaintance with the Tour Leader, who had expressed interest in the Bantam Microlight type, the pilot of ZK-JAS suggested that they should fly a circuit around the nearby lakes. The invitation was accepted and the passenger borrowed the Instructor pilot's helmet for the flight. The pilot of ZK-JAS had brought with him a container of additional fuel, and maps and documentation for the cross-country flight. After unloading these items he ensured that his passenger was comfortably seated and checked that the seatbelt was secured.

1.9 Noting from the windsocks that the wind was from the south the pilot decided to take off into wind towards the head of the valley. The aircraft had been parked on the western edge of the airstrip adjacent to the microlight hangars and after an engine run-up and pre-take-off checks the pilot taxied out from the parking position, turned toward the south and took off.

1.10 The pilot's intention was to maintain the airstrip heading after take-off until sufficient height had been gained then make a left turn, in accordance with the procedure normally followed by microlight aircraft operating in the valley. No difficulty was experienced during the take-off and initial climb. However, as the flight progressed, the aircraft was drifted toward the left side of the valley and at the same time began to be "pushed down". Accordingly the pilot initiated a turn to the right. The engine was operating at full power and the pilot recalled making the turn "as flat as possible" banking, in his estimation, about 15° or 20° to the right. The pilot recalled no difficulty in maintaining height to this stage, but the aircraft was then suddenly and markedly "pushed down"

and continued to lose height despite the pilot's efforts to arrest its descent.

1.11 The change of heading to the right resulted in ZK-JAS descending across the valley towards an area of rough grass and scrub lying beyond a recently constructed shooting mound which lay at right angles to the aircraft's path. The pilot endeavoured to overfly the mound to reach the area of scrub but the aircraft sank rapidly, struck the ground and almost immediately impacted heavily against the raised forward edge of the shooting mound.

1.12 A consortium of Gun and Pistol Clubs were located in the valley south of the airstrip. Members of the Black Powder Shooters Club were engaged in shotgun competition shooting at the time. Microlight aircraft were regularly observed in the area but on this occasion the low height at which the aircraft was flying, and its slow speed, drew the attention of a number of members. Witness reports varied in regard to the precise flight path and the steepness of the turn to the right but indicated that, immediately following the turn, the aircraft descended rapidly, consistent with the pilot's recollection of events. The subsequent impact was observed by many of the Club members. A number ran to the scene, and Police, fire and ambulance services were alerted without delay. Two members with first aid qualifications rendered such practical assistance as they could, to the pilot and passenger.

1.13 Both occupants of ZK-JAS were wearing the automotive type lapbelts installed in the aircraft. The pilot was not wearing a helmet. The passenger wore a helmet. However, the combination of vertical impact forces and the longitudinal deceleration due to collision with the shooting mound resulted in injuries to the passenger which were unsurvivable. The pilot's injuries necessitated a period of 13 weeks in hospital.

1.14 The shooting mound formed part of the Deerstalkers Range which was an open expanse oriented in an easterly direction across the base of the valley, adjacent to, and south of the Black Powder Shooters Club. The mound was located transversely (190°M/010°M) at the 300 yard position. The lower front (easterly) edge comprised two layers of heavy planks laid horizontally and supported by substantial half-round posts. The mound itself was a 2 metre wide fill of earth, rocks, and concrete rubble behind the timber retaining wall, piled to an overall height of about 750 mm. Apart from the obstacle presented by the shooting mound the range had a rough, but reasonably level, grassy surface. Other rough, but similarly open areas, existed further up the valley.

1.15 The fibreglass nose-fairing and windshield assembly of ZK-JAS had shattered, and the tubular structure which supported the side by side seating to which the undercarriage and fuel tank were attached had collapsed. The forward lower structure and nosewheel assembly were severely deformed due to impact forces and parts were embedded in the shooting mound. The left main wheel and part of the undercarriage leg had broken off. It was necessary, during rescue efforts, for the whole aircraft to be lifted and moved several metres rearwards to extricate the pilot and passenger.

1.16 ZK-JAS was lying on a heading of 250°M, in front of the shooting mound. Both wings had sustained bending and twisting loads as a result of ground impact, and the fuselage support struts had been deformed. The empennage was undamaged. The integrity of all control runs was established. Flap setting 'as found' was approximately 15° flaps down. The pilot stated, however, that he had not selected any flap prior to the accident. A significant quantity of fuel had leaked from the fuel tank. Fuel was present in the fuel line and at the carburettors. No significant information was obtained from the instrumentation. The pilot had turned the ignition and other switches off at the time of the accident.

1.17 The aircraft was fitted with a Warp Drive three-bladed propeller. Two of the carbon-fibre reinforced composite blades had broken off on impact. The third blade, the propeller hub, and reduction gearbox assembly were intact. The clamps incorporated in the propeller hub, which permitted ground adjustment of the blade pitch angles, were still holding each blade root firmly. Pitch setting was consistent for the three blades. (The propeller had been adjusted by the aircraft manufacturer at an earlier stage to provide the most effective climb/cruise combination.) No defect or anomaly was evident in regard to the engine, its accessories, or the coolant system.

1.18 The pilot had purchased the aircraft new and it had been registered to him as ZK-JAS in March 1992. The Permit to Fly had been first issued in May 1992 valid to 19 May 1993. On 15 May 1993 the pilot had flown ZK-JAS to the manufacturer's facility and the aircraft had been inspected for renewal of the Permit to Fly but the necessary documentation for renewal action had not been subsequently received by the Civil Aviation Authority. As a

consequence, at the time of the accident, the aircraft did not have a valid Permit to Fly. There was no evidence to suggest, however, that any defect or malfunction of the aircraft contributed to the accident. Witness information and the pilot's recollection of events, indicated that the engine was developing maximum power up to the occurrence of the accident.

1.19 The pilot had commenced flying training on the Cessna 172 aeroplane type in 1987 and had obtained his Private Pilot Licence (Aeroplane) a year later. Over the next three years he had flown Cessna 177 and 172 aircraft regularly. He had also flown the Piper PA18 and, briefly, the Cessna 337 type. His Type Rating Certificate included Group A, Group B, and Group F aircraft. He had last renewed his PPL(A) in 1989. The pilot had accumulated a total of 162 hours flying on conventional light aircraft up to June 1990, after which he had allowed his PPL(A) to lapse.

1.20 The pilot was first issued with a MAANZ Novice Pilot Certificate in April 1990. As the holder, at the time, of a current PPL(A) the pilot was entitled to have applied for, and obtained (subject to certain provisions) an Intermediate, or Advanced Pilot Certificate, but this action had not been taken. See 1.21. The holder of a Novice Pilot Certificate was not permitted by Civil Aviation Safety Order (CASO) 19 to carry a passenger, was required to be under the supervision of an instructor for all solo flying, and was also required to have specific authorisation from an instructor for any cross country flight. (Subject to meeting microlight requirements, and a demonstration of competency, the holder of an Intermediate or Advanced Certificate could be authorised by a MAANZ Instructor to carry a passenger, and the requirements in regard to supervised solo and cross-country flying were either not applicable or less restrictive in the case of the higher Certificates.)

1.21 The pilot's Novice Pilot Certificate had been renewed annually and was valid to 29 April 1994. The associated Medical Certificate was valid to the same date. In accordance with the requirement to be a member of MAANZ, the pilot had joined the Waikato Microlight Club. The pilot's application to the Club indicated his PPL experience and ratings. The pilot stated that a MAANZ instructor had told him that as a result of this experience he was entitled to carry passengers and make unrestricted solo and cross country flights, in effect exercising the privileges of the MAANZ Advanced Certificate.

1.22 The pilot had first flown ZK-JAS in June 1992. He had recorded two instructional flights totalling 3 hours as "Type Rating". After further consolidation flying he had flown the aircraft from the manufacturer's airstrip to his base at Taupo. Since that time he had flown ZK-JAS, exclusively, for a total of 113 hours. He had not flown any other microlight type. Much of his flying was solo, but he had also carried passengers on numerous occasions prior to the accident flight.

1.23 Within the last 90 days he had recorded 16 hours flying on ZK-JAS. Three hours had been flown within the last 28 days. No flying, other than the cross-country flight from Taupo to Rotorua, and the accident flight itself, had been carried out within the last seven days. The supervision and authorisation, appropriate to the holder of a Novice Pilot Certificate, was not being exercised at the time of the accident flight.

1.24 In an 'aftercast' of the weather, the Manager, Meteorological Standards, of the Meteorological Service of New Zealand, reported as follows:

> "On the day of the accident an intense anticyclone centred west of Auckland, and a lee trough on the east coast of North Island intensified during the afternoon as a result of diurnal heating. The airflow over North Island was generally moderate west to south west. Conditions were fine after the clearance of early morning cloud. During the afternoon Rotorua Tower reported west to north west winds between 12 and 15 knots with good visibility. There was one `octa' of cumulus cloud at 2000 feet with no precipitation. Tephigrams at Kaitaia and Paraparaumu showed a strong inversion at about 5000 feet. Surface heating would have led to strong convection in the afternoon below the inversion. Air above the inversion was stable so that convection was cut off very quickly."

1.25 The meteorological evidence, and witness observations indicated that it was very hot in the valley at the time of the accident. At Rotorua Aerodrome at 1500 hours the temperature was 22°C. Surface heating effects in the valley, and the proximity of the surrounding hills increased local temperatures, confirmed by measurement under similar weather conditions at the same time the following day. It was likely that, at the time of the accident, the equivalent density altitude (which took account of ambient temperature and pressure altitude) was approxi-

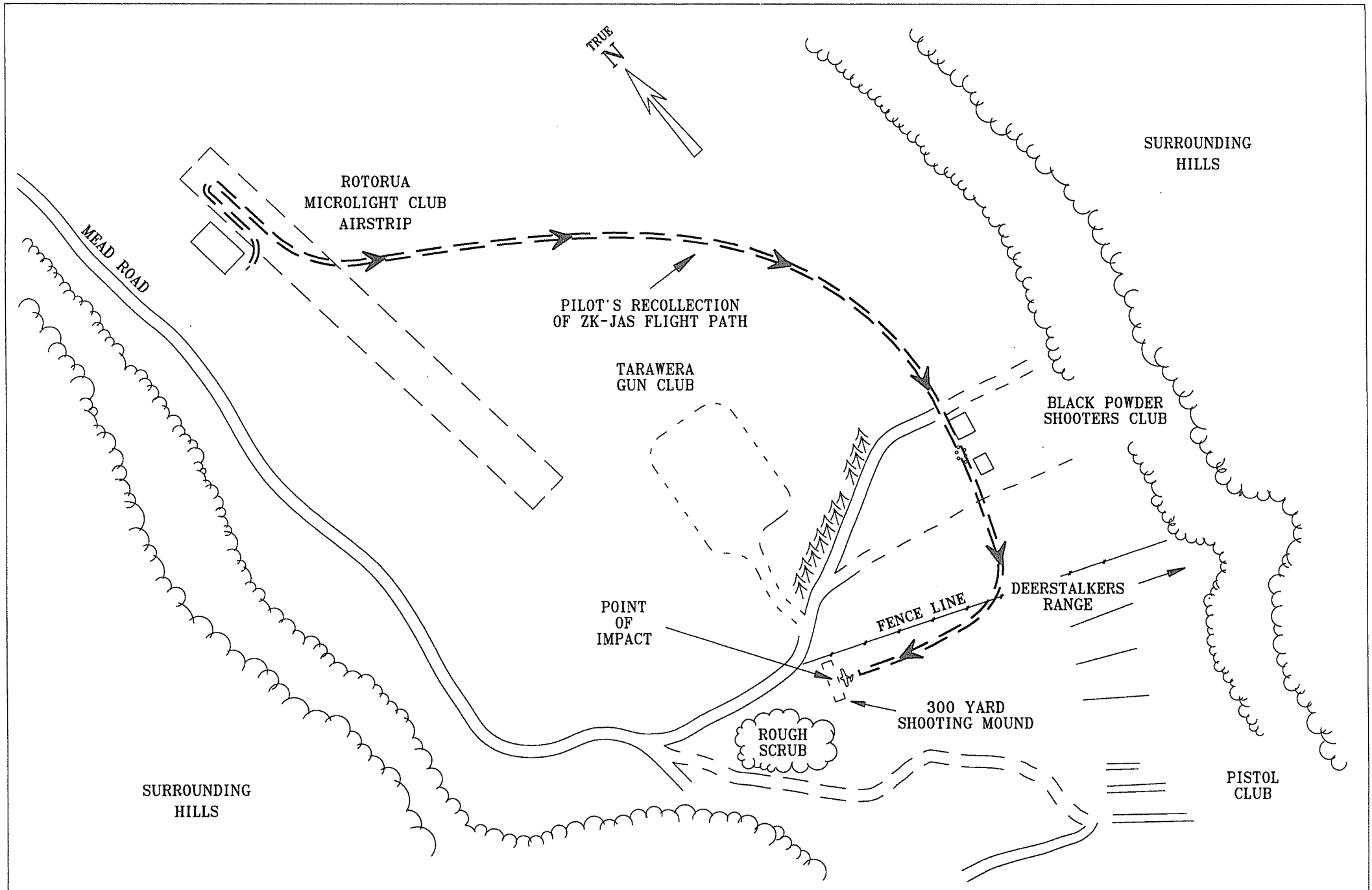

FIG 1 SKETCH OF APPROXIMATE FLIGHT PATH
BANTAM B22 ZK-JAS

mately 2500 feet.

1.26 The most recent specifications for the Bantam B22 type defined a maximum all-up weight of 375 kg. The all up weight of ZK-JAS at the time of the accident flight could not be established precisely. However, weighing of the aircraft's component parts after the accident and comparison with known weights of other B22 aircraft indicated that ZK-JAS, which had some optional items installed, had an empty weight of more than 170 kg. It was fitted with a standard 50 litre fuel tank. The quantity of fuel on board was not determined but in the pilot's recollection was about "half a tank". Using a combined weight of 194 kg for the pilot and passenger, the available evidence suggested that with the passenger on board, the operating weight of ZK-JAS was above the defined maximum all-up weight.

1.27 The specification sheet supplied with ZK-JAS gave a representative empty weight for the aircraft type of 148 kg. The pilot relied upon this information in terms of loading his aircraft. He had assessed the passenger's weight as approximately 80 kg. Thus, allowing 25 kg for the fuel on board, and including his own weight as 100 kg, his estimations resulted in a total below the latest defined maximum all-up weight limit.

1.28 About 400 m of airstrip length was available from the position at which ZK-JAS commenced take-off. The accident site was located approximately 350 m beyond the southern end of the airstrip, some 10° left of the extended centre-line. A paddock with scattered trees and gorse, and a line of macrocarpas some 20 feet high lay between the airstrip and the open ground of the Black Powder Shooters Club and the Deerstalkers Range. (See Sketch Diagram Fig 1)

1.29 The pilot recalled no difficulty in becoming airborne and making an initial climb. However, once out of ground effect, the performance of the heavily laden microlight aircraft would have been adversely affected by the hot conditions and resulting high density altitude. While the pilot succeeded in maintaining height during the early portion of the flight, the available performance margin was at best relatively limited. In the circumstances an encounter with any significant localised sink or convective turbulence was likely to have exceeded the capability of the aircraft to maintain height despite the use of full power. The initiation of a turn in such conditions held potential for a further reduction in performance margin and an ensuing rapid loss of height. At a low height the pilot would have had little opportunity to recover control of the aircraft before it struck the ground.

1.30 The pilot and passenger both had a background of experience in flying conventional light aircraft, which have generally proved forgiving in regard to a modest overload and the ability to operate satisfactorily in a varying range of conditions. In addition, the pilot was accustomed to flying his microlight regularly, with and without passengers, and as a relatively new aircraft, maintained in good order, the performance of ZK-JAS was likely to have engendered considerable confidence in its capabilities.

1.31 The accident circumstances however emphasised the continual necessity for weight and performance limitations to be carefully considered and caution to be exercised in regard to prevailing conditions before embarking upon any flight.

1.32 The collision of the aircraft at the conclusion of its final descent with the substantial obstruction formed by the shooting mound was an added factor which increased considerably the severity of injuries sustained in this accident.

2. FINDINGS

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

2.2 The pilot held a valid MAANZ Novice Pilot Certificate. This certificate did not permit the pilot to carry a passenger.

2.3 The pilot was under the erroneous impression that because he had held a Private Pilot Licence (Aeroplane) he was entitled to exercise the privileges of a MAANZ Advanced Pilot Certificate and to carry passengers.

2.4 The pilot's experience entitled him to have applied for, and obtained, a MAANZ Intermediate or Advanced Pilot Certificate, and, subject to the required flight test, an authorisation to carry a passenger.

2.5 The passenger held a Commercial Pilot Licence (Aeroplane) and had current aviation experience.

2.6 The topography of the valley in which the Rotorua Microlight Club airstrip was situated rendered the region vulnerable to turbulence and/or areas of 'sink' under certain conditions.

2.7 The pilot of ZK-JAS on landing, and an Instructor pilot operating a different microlight type in the circuit, had experienced turbulence and sink to the south of the airstrip prior to the accident flight.

2.8 The Instructor pilot had terminated the training flight in which he was engaged, as a result of the varying conditions and 'sink' he had encountered.

2.9 The confined nature of the valley just to the south of the airstrip produced high local temperatures in sunny conditions.

2.10 The airstrip density altitude at the time of the accident was probably about 2500 feet.

2.11 The available evidence suggested that the weight of ZK-JAS on the accident flight was above the defined maximum all-up weight.

2.12 The performance capability of ZK-JAS was degraded due to the effect of the aircraft's weight and the high density altitude.

2.13 No malfunction of the airframe, engine, or control systems contributed to the accident.

2.14 A combination of degraded performance, sink encountered to the south of the airstrip, and further reduction in performance margins during a subsequent turn to the right resulted in the aircraft descending rapidly.

2.15 The pilot was unable to arrest the descent before the aircraft struck the ground.

2.16 The accident was unsurvivable for the passenger due to the severity of the ensuing impact with the shooting mound.

3. SAFETY RECOMMENDATION

3.1 It was recommended to the Microlight Aircraft Association of New Zealand:

> As a result of the circumstances of this accident that MAANZ publicise the need for pilots to be aware of density altitude considerations when operating on hot days and/or at high altitude (056/94).

The President of the Microlight Aircraft Association of New Zealand indicated that:

> *"The circumstances of the accident had been promulgated soon after the occurrence, and pilots' attention drawn to the hazards of operating in hot conditions, or at high altitude. Other safety issues involved in the accident had also been emphasised."*

The content of the Safety Recommendation was therefore deemed to have been satisfied.

24 August 1994

M F Dunphy
Chief Commissioner

ABBREVIATIONS COMMONLY USED IN TAIC REPORTS

AD	Airworthiness Directive
ADF	Automatic direction-finding equipment
agl	Above ground level
AI	Attitude indicator
AIC	Aeronautical Information Circular
AIP	Aeronatical Information Publication
amsl	Above mean sea level
ASI	Airspeed indicator
ATA	Actual time of arrival
ATC	Air Traffic Control
ATD	Actual time of departure
ATPL (A or H)	Airline Transport Pilot Licence (Aeroplane or Helicopter)
AUW	All-up weight
C	Celsius
CAA	Civil Aviation Authority
CASO	Civil Aviation Safety Order
CFI	Chief Flying Instructor
CPL (A or H)	Commercial Pilot Licence (Aeroplane or Helicopter)
DME	Distance measuring equipment
E	East
ELT	Emergency location transmitter
ERC	En route chart
ETA	Estimated time of arrival
ETD	Estimated time of departure
F	Fahrenheit
FAA	Federal Aviation Administration (United States)
FL	Flight level
g	Acceleration due to gravity
GPS	Global Positioning System
HF	High frequency
hPa	Hectopascals
IAS	Indicated airspeed
IGE	In ground effect
IFR	Instrument Flight Rules
ILS	Instrument landing system
IMC	Instrument meteorological conditions
ins Hg	Inches of mercury
kHz	Kilohertz
KIAS	Knots indicated airspeed
kt	Knot(s)
LF	Low frequency
LLZ	Localiser
M	Mach number (e.g. M1.2)
M	Magnetic

MAANZ	Microlight Aircraft Association of New Zealand
MAP	Manifold absolute pressure (measured in inches of mercury)
MAUW	Maximum all-up weight
METAR	Aviation routine weather report (in aeronautical meteorological code)
MF	Medium frequency
MHz	Megahertz
mph	Miles per hour
N	North
NDB	Non-directional radio beacon
NOTAM	Notice to Airmen
nm	Nautical mile
NZAACA	New Zealand Amateur Aircraft Constructors Association
NZGA	New Zealand Gliding Association
NZHGPA	New Zealand Hang Gliding and Paragliding Association
NZMS	New Zealand Mapping Service map series number
NZDT	New Zealand daylight time (UTC + 13 hours)
NZST	New Zealand standard time (UTC + 12 hours)
NTSB	National Transportation Safety Board (United States)
OGE	Out of ground effect
PAR	Precision approach radar
PIC	Pilot in command
PPL (A or H)	Private Pilot Licence (Aeroplane or Helicopter)
psi	Pounds per square inch
QFE	An altimeter subscale setting to obtain height above aerodrome
QNH	An altimeter subscale setting to obtain elevation above mean sea level
RNZAC	Royal New Zealand Aero Club
RNZAF	Royal New Zealand Air Force
rpm	Revolutions per minute
RTF	Radio telephone or radio telephony
S	South
SAR	Search and Rescue
SSR	Secondary surveillance radar
T	True
TACAN	Tactical Air Navigation aid
TAF	Terminal aerodrome forecast
TAS	True airspeed
UHF	Ultra high frequency
UTC	Coordinated Universal Time
VASIS	Visual approach slope indicator system
VFG	Visual Flight Guide
VFR	Visual flight rules
VHF	Very high frequency
VMC	Visual meteorological conditions
VOR	VHF omnidirectional radio range
VORTAC	VOR and TACAN combined
VTC	Visual terminal chart
W	West