NO. 94-012

MICRO AVIATION BANTAM B22

ZK-TKP

8 NM EAST OF HUNTLY

10 APRIL 1994

ABSTRACT

On 10 April 1994, Bantam ZK-TKP suffered an in-flight structural failure of the right wing. Control of the aircraft was lost, and the two occupants died in the ensuing impact.

TRANSPORT ACCIDENT INVESTIGATION COMMISSION

AIRCRAFT ACCIDENT REPORT NO 94-012

Aircraft Type, Serial Number and Registration:	Micro Aviation Bantam B22, 0053, ZK-TKP
Number and Type of Engines:	1 Bombardier Rotax 532
Year of Manufacture:	1986
Date and Time:	10 April 1994, 1515 hours*
Location:	Orini, 8 nm east of Huntly Latitude: 37° 33' S Longitude: 175° 20' E
Type of Flight:	Private
Persons on Board:	Crew: 1 Passengers: 1
Injuries:	Crew: 1 Fatal Passengers: 1 Fatal
Nature of Damage:	Destroyed
Pilot-in-Command's Licence:	Advanced Microlight Pilot Certificate
Pilot-in-Command's Age:	46
Pilot-in-Command's Total Flying Experience:	Over 250 hours, mostly on type
Information Sources:	Transport Accident Investigation Commission field investigation
Investigator in Charge:	Mr A J Buckingham

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

1. NARRATIVE

1.1 On 10 April 1994, the owner-pilot of ZK-TKP took a friend on a local familiarisation flight. The pilot operated the aircraft from his farm property, and was known to be keen on introducing friends and acquaintances to microlight flying.

1.2 He held a MAANZ (Microlight Aircraft Association of New Zealand) Advanced Pilot Certificate and Microlight Flying Instructor Certificate, although both his MAANZ membership and Medical Certificate had expired. The expiry of the latter two items rendered the Pilot Certificate invalid.

1.3 At about 1515 hours, the aircraft was seen by witnesses to be flying in the vicinity of the pilot's farm at an altitude estimated as no higher than 500 feet above ground level. The aircraft had made several flights earlier in the day, all apparently without incident. On the accident flight, during an apparent "wingover" manoeuvre, the outboard end of the right wing suddenly failed upwards.

1.4 The aircraft entered a steep spiral descent and impacted in a near-vertical attitude in open pastureland. Both occupants died as a result of impact forces.

1.5 On-site examination of the wreckage confirmed the witness observations of the failure of the right wing; both spar tubes had failed just outboard of the lift strut attachment points. The full-span flaperon, hinged on the trailing edge spar tube, had bent upward through an angle of approximately 120° before breaking, the break coinciding with the break in the spar tube. This, combined with the loss of a significant amount of wing area, would have rendered the aircraft uncontrollable.

1.6 The right wing had suffered further breaks in the spar tubes on impact, but the left wing was comparatively undamaged. The fuselage showed evidence of a longitudinal impact, and the "pod" where the occupants sat had been destroyed. All extremities of the aircraft were present, and pre-impact control continuity was established. The flaperons were found to be in the full down position. One witness had heard the engine noise cease while the aircraft was in its final dive, and it is possible that the pilot selected flap and closed the throttle in an attempt to minimise the speed of the dive.

1.7 The aircraft had last been inspected for a renewal of its Flight Permit in December 1993, and at the same time it received a complete overhaul of the airframe. Several improvements were embodied and a number of components replaced. The final inspection revealed nothing untoward. (Note: "Flight Permits" are issued under the authority of Civil Aviation Rules Part 103, and replace the former "Permit to Fly" issued under Civil Aviation Regulation 161A.)

1.8 Metallurgical examination of the primary fractures in the spar tubes determined that the breaks were simple overload failures, with no visible evidence of fatigue or pre-existing damage. Analysis and tests showed that the alloy in each case met the specifications for UNS A96351-T6 as normally used by the manufacturer. Although this is a "commercial" grade of aluminium alloy, its physical properties are virtually identical to UNS A96061-T6, an alloy widely used in aviation.

1.9 It was concluded that, during flight, loads in excess of the structural strength of the wing spar tubes were encountered. These could have been due either to manoeuvring loads or to gust loads experienced in turbulence.

1.10 Analysis of a meteorological aftercast indicated the latter case to have been unlikely.

1.11 The witness reports of the manoeuvre preceding the wing failure were varied, one stating that the failure occurred "at the apex of a steep climb", another was of the opinion that it was in a 60° left bank, and a third, who was riding a motorcycle along a nearby road and watching the aircraft intermittently, thought that it was "just flying around". However, a fourth witness had seen the microlight whilst driving his car, and having done some microlight flying himself, was sufficiently interested to stop and watch. He described the final manoeuvre as a wingover to the left, i.e. a steep pull-up followed immediately by a steep bank to the left (which in the normal course of events, would have resulted in the aircraft levelling out on a heading at 180° to the entry heading, with little or no nett change in height).

1.12 While this manoeuvre alone may not have generated destructive forces, the possibility remains that a combination of high "g" loads and the simultaneous application of aileron to roll the aircraft may have caused the wing to fail. This is sometimes referred to as a "rolling pull-up manoeuvre". Application of aileron gives rise to twisting forces on the wings, and the sum of these forces and existing manoeuvring loads may be sufficient to cause a wing to fail, even though the "g" load alone may still be within the normal operating limits.

1.13 Limiting load factors were not required to be determined or promulgated for the Bantam type, but the manufacturer had conducted static load testing on a sample wing identical to those on ZK-TKP. Testing to +4g without failure was achieved, at which point the test was terminated.

1.14 The witness observations indicated that the final manoeuvre of ZK-TKP consisted of an initial steep pull-up, and a roll into a steep turn to the left. The right wing would have been subject to the normal loads encountered in a "pull-up" manoeuvre, and when aileron for a roll to the left was applied, the wing would have been subject to an additional twisting force. The twisting force described would have been in a "nose-down" sense, i.e. the leading edge forced downward and the trailing edge upward, decreasing the nett load on the leading edge tube and increasing the load on the trailing edge tube. The trailing edge failure was consistent with this, in that it was in an upward and slightly forward sense. This was considered to be the primary failure.

1.15 A wingover manoeuvre, properly executed should not introduce excessive structural loads. However, the pilot may have been unaware of the pitfalls associated with initiating the roll component of the manoeuvre whilst the "pull-up" loading was still applied, in which case the structural strength of the wing could have been exceeded.

2. FINDINGS

2.1 The pilot held a MAANZ Advanced Microlight Pilot Certificate, although his MAANZ membership and Medical Certificate had lapsed, invalidating the Pilot Certificate.

2.2 The pilot was suitably experienced for the flight.

2.3 The aircraft had a valid Flight Permit.

2.4 During a wingover manoeuvre, the right wing failed outboard of the lift strut attachments.

2.5 The failure was probably due to the loads generated by the application of aileron while "g" loading was being applied.

2.6 The aircraft was uncontrollable following the failure, and struck the ground while in a steep spiral descent.

2.7 The accident was unsurvivable.

12 October 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
ATIS	Automatic terminal information service
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
cm	Centimetres
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
km	Kilometres
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
mm	Millimetres
mph	Miles per hour
N	North
NDB	Non-directional radio beacon
NOTAM	Notice to Airmen
nm	Nautical mile
NZ	New Zealand
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)
octa	Eighths of sky cloud cover (eg: 5 octas = 5/8 of cloud cover)
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
TIS	Time-in-service
UHF	Ultra high frequency

US	United States
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