NO. 94-004

MITCHELL WING B10

ZK-FKY

NEAR PORT WAIKATO

25 JANUARY 1994

ABSTRACT

This report explains the in-flight failure of the wing of Class 1 microlight aircraft ZK-FKY on 25 January 1994. Safety issues discussed relate to the design of the aircraft.

TRANSPORT ACCIDENT INVESTIGATION COMMISSION

AIRCRAFT ACCIDENT REPORT NO 94-004

Aircraft Type, Serial Number and Registration:	Homebuilt Microlight, Class 1 (ex Mitchell Wing B10), MAANZ 330, ZK-FKY
Number and Type of Engines:	1 KFM 107
Year of Manufacture:	1990
Date and Time:	25 January 1994, 1910 hours*
Location:	In the Waikato River, 4 km north-east of Port Waikato. Latitude: 37° 22' south Longitude: 174° 46' east
Type of Flight:	Private
Persons on Board:	1
Injuries:	1 Fatal
Nature of Damage:	Destroyed
Pilot in Command's Licence:	MAANZ Advanced Pilot Certificate, group B
Pilot in Command's Total Flying Experience:	318 hours 160 hours on Type
Pilot in Command's Age:	50
Information Sources:	Transport Accident Investigation Commission field investigation
Investigator in Charge:	Mr J J Goddard

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

1. NARRATIVE

1.1 The pilot had constructed a Mitchell Wing B 10 microlight aircraft, ZK-FKY, which he flew for some 11 hours in 1985/86. After the engine failed he dismantled the aircraft, and the aircraft logbook records that he redesigned and rebuilt it over the next four years.

1.2 The first flight after the rebuild was in January 1990. The pilot subsequently flew it over the next 4 years on both local and cross-country flights around North Island, logging 149 hours in the process. No other pilot had flown the aircraft since its construction.

1.3 After the last flight before the accident, on 18 January, the pilot discussed with a friend, another microlight pilot, a flying control problem which had occurred. He reported that a low frequency pitch oscillation had started at about 65 mph, and he had "pulled up" to stop it. He described it as "flutter" and said that the stick had been oscillating backwards and forwards. The episode had been frightening.

1.4 The friend had inspected the aircraft with the pilot, and pointed out to him that the elevator control surface had about 75 mm of free play at its trailing edge. He noted looseness in various elevator system connections and pivots, and about 10° of free play at one aileron. The pilot had said that he would check all the controls.

1.5 The pilot's diary showed that during the following week he worked on the aircraft's control systems. He also entered in the aircraft logbook "...overhaul control linkage, mass balance tailplane".

1.6 On the afternoon of 25 January he telephoned his friend, to say that he was going to fly his aircraft to see if the controls were improved. He said that the elevator play was reduced to 15 mm, and that he had removed the aileron droop system from the aircraft.

1.7 The aircraft was seen to take off from Pukekohe Racecourse at 1745 hours. The take-off and departure were normal and unremarkable.

1.8 It was next seen at about 1910 hours, flying down the Waikato River towards the south-west at about 1500 feet. It made an "S" turn near an island in the river, then flew straight down river. Initially it was in steady flight, but then it was seen to pitch up and down sharply 2 or 3 times before most of one wing detached. The aircraft fell in a steep spiral into the river. The emergency parachute was not seen during its fall.

1.9 Nearby boats were taken to the scene promptly, and a person dived from one of the boats to recover the pilot from the wreckage. He had been killed in the water impact, however. Police divers, who had been on an unrelated search upriver, arrived shortly afterwards and were able to recover wreckage to the shore.

1.10 The weather at the time was fine, clear and warm. A light south-west breeze was blowing upriver.

1.11 The redesigned aircraft was very different from the original Mitchell Wing B10. It comprised an enclosed, streamlined fuselage with a rear mounted engine and propeller. Tricycle undercarriage was fitted, with a retractable nosewheel. Tail booms on either side of a shoulder mounted stub wing supported the tailplane, elevator and twin fins and rudders. Detachable outer wing panels allowed easy trailerage on the ground. The structure was mostly wood, with plastic foam ribs and stiffeners under plywood skins. A light alloy frame structure supported the engine and wings.

1.12 The wreckage was laid out in order to examine the control systems and aircraft structure. Not all of the aircraft was recovered, but the complete control system linkages were present. Missing were most of the cockpit enclosure, instruments, and much of the tail boom structure. The extremities of the aircraft were found, indicating that the aircraft was complete before the separation of the wing.

1.13 The pre-impact continuity of the flying control systems was established, but the structural fragmentation precluded finding any evidence of control restriction or jamming, if such had occurred. Mass balances were in place or accounted for on the aileron and rudder surfaces, but no mass balance, or any possible provision for a mass balance was found on the elevator, in spite of logbook entries referring to "elevator bob weight" and "mass balance tailplane".

1.14 The elevator trim system comprised a spring bias attachment to the elevator push rod in the cockpit, and was in order. No elevator tab was fitted.

1.15 The ground rigging attachments for the detachable wing panels had been properly made, and had survived the impact.

1.16 Both wing outer panels had separated further outboard from the centre section. The right spar showed characteristic evidence of rearward bending failure, and the right leading edge was separated; both of these were consistent with diving into the water. The left spar had failed in upward bending, and the leading edge was intact, suggesting that the left wing had failed under positive flight overload, and subsequently had only a low energy impact with the water surface.

1.17 Insufficient pieces of tail boom were found to reconstruct them, but no obvious signs of premature failure were seen. The light plywood box structure with foam stiffeners appeared likely to have been vulnerable to damage.

1.18 The tailplane had separated from both booms, suggesting that both were intact at water impact. Its structure was robust in comparison with the booms.

1.19 The integrity of the light alloy fuselage centre section/engine mount structure was established, together with the lapbelt anchorages and the main undercarriage attachments. The engine and propeller were little damaged, and suggested that no power was being developed at water impact.

1.20 The emergency parachute was wrapped around the wreckage in the water, but had not opened in flight. The "Master Parachute Ballistic Deployment System" was probably released by the impact. It had relied on springs to push the parachute canister below the belly of the aircraft after activation by the pilot, and before deployment of the parachute. The release system in the cockpit was not determined. The parachute was intact and properly attached.

1.21 No plans or drawings of the redesigned aircraft were found, so the design parameters and structural strength margins could not be assessed. It was evident that the pilot had taken care with his detailed workmanship throughout the construction, and had used good quality material. No record was found of any supervision or guidance of the pilot by a suitably qualified person during his redesign and rebuild of the aircraft. No such supervision was required, however. While the flying he had achieved suggested that the basic design had some merit, it was possible that deterioration in service of the control systems or the structural rigidity of the airframe had allowed it to become susceptible to aeroelastic phenomena. The absence of any specific ongoing maintenance requirements may have led to such deterioration going uncorrected.

1.22 The low aspect ratio elevator surface, with no mass balance, would have been a likely source of either flutter or pilot induced oscillation, especially if the tail booms had developed any elastic compliance. Whether or not the critical speed for the onset of elevator flutter was within the aircraft's speed envelope was not established.

1.23 The failure of the left wing appeared to have resulted from overload, but as no design load factor was known it was not possible to assess the loads developed during the pitching manoeuvre which occurred. The pitching manoeuvre could have been either a pilot induced oscillation or the result of an elevator flutter which diverged until the wing failed. Alternatively the oscillation may not have diverged markedly but the pilot may have again "pulled up" to try to stop it, and this, combined with the oscillation, may have led to the overload of the wing.

2. FINDINGS

2.1 The pilot was appropriately certificated and experienced to fly his class 1 microlight aircraft.

2.2 No finding was made in respect of the airworthiness of the aircraft.

2.3 The aircraft differed substantially from the designated type, and was essentially unique.

2.4 The aircraft had developed an elevator control problem on the previous flight.

2.5 The pilot had attempted to rectify the elevator control problem.

2.6 During normal flight the elevator control problem recurred and led to the failure of the aircraft's wing.

2.7 The emergency parachute was not deployed in time to arrest the aircraft's subsequent dive into the river.

29 June 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