



No. 95-008

Piper PA28-161 ZK-MBI

Missing After Departing From Gisborne

21 May 1995

Abstract

The aircraft departed from Palmerston North Aerodrome on the afternoon of 21 May 1995 on a solo cross-country flight to Napier, Gisborne and return. A touch and go landing was made at Napier in the course of the outbound flight, and following a similarly uneventful touch and go landing at Gisborne the aircraft departed for Palmerston North. During the return flight the pilot requested, and received, clearance to pass through the Napier Terminal Control Area. The pilot's acknowledgement of the clearance was the last recorded communication from the aircraft. The aircraft failed to arrive at Palmerston North. Aerial searches organised by the Rescue Co-ordination Centre (RCC) and coastal searches for wreckage conducted in conjunction with the Police have revealed no trace of the aircraft or its sole occupant.

Transport Accident Investigation Commission

Aircraft Accident Report No. 95-008

Aircraft type, serial number and registration:	Piper Aircraft, PA28-161 ZK-MBI
Number and type of engines:	1 Avco Lycoming 0-320-D3G
Year of manufacture:	1983
Date and time:	21 May 1995, time unknown
Location:	Unknown
Persons on board:	Crew: 1 Passengers: Nil
Injuries:	Crew: 1 unknown
Nature of damage:	The aircraft is missing
Pilot in Command's Licence:	Private Pilot Licence (Aeroplane)
Pilot in Command's age:	19
Pilot in Command's total flying experience:	94 hours (approx.), all on type
Information sources:	Transport Accident Investigation Commission field investigation
Investigator in Charge:	Mr D G Graham

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

1. Factual Information

1.1 History of the flight

- 1.1.1 The pilot was a student at Massey University School of Aviation. He had progressed to a stage in his flight training for a CPL(A) at which he was required to complete a series of solo cross-country navigation exercises. Flying days reserved for his particular Block Course included Saturdays and Sundays.
- 1.1.2 On Sunday, 21 May 1995, in accordance with his training programme, the pilot arranged to carry out a flight from Palmerston North Aerodrome to Napier and Gisborne and return. The aircraft allocated for the flight was Piper PA28-161 ZK-MBI, one of a number of similar aircraft operated by the School of Aviation.
- 1.1.3 ZK-MBI had been flown to Waipukurau and back during that morning. On return it had been parked on the flight line adjacent to the school building, and had subsequently been refuelled to capacity by the duty re-fueller. (See Section 1.6 Aircraft information)
- 1.1.4 The pilot had been to the School of Aviation in the morning, at approximately 0830 hours, to deliver a headset, and had subsequently returned to his flat. He arrived back at the School by bicycle, his normal mode of transport, between 1230 hours and 1245 hours. He was wearing the Massey Aviation uniform, a white short sleeved shirt with Massey epaulettes and name tag, blue tie, grey slacks and black shoes. He carried his flight equipment in a sports bag but was believed not to have had a jacket or jersey with him. He was observed to be wearing sunglasses on his way to the school.
- 1.1.5 It was normal procedure for students to obtain relevant weather and flight information for their cross-country flying from the School's computer, by modem. This data enabled the necessary calculations to be made for preparation of the navigation log and flight plan in a form satisfying the requirements of the school. (Pre-flight documentation, including weather and notam information, in conjunction with the completed flight log, was subject to review by the school after a flight as a component of the student's overall assessment process.)
- 1.1.6 The pilot held a PPL(A) and had already flown satisfactorily some of the scheduled dual and solo cross-country navigation exercises. Massey School of Aviation policy and procedure required, however, that before departure the proposed flight should be "signed out" by the Duty Flying Instructor. The authorisation procedure was to ensure that the student's navigational preparation had been completed to the standard necessary for compliance with the school's requirements.
- 1.1.7 The pilot showed the Duty Flying Instructor his flight log, flight plan and maps prepared for the route, Palmerston North to Napier, a landing at Napier, thence to Gisborne for a touch and go landing, and returning to Palmerston North via overhead Napier.
- 1.1.8 The Duty Flying Instructor had authorised other cross-country flights during the morning, and was aware that the prevailing, and forecast, weather favoured an East Coast flight route.
- 1.1.9 Prior to "signing off" the proposed flight, the Duty Flying Instructor checked the pilot's flight log, and was satisfied that the tracks and distances and navigational calculations, which took into account the winds over the route, were in order.

- 1.1.10 The Duty Flying Instructor also discussed with the pilot the end of daylight (Evening Civil Twilight) and established that he was aware of the School requirement to return to Palmerston North at least 45 minutes before Evening Civil Twilight (ECT). The pilot confirmed that his ETA on the return flight was 1644 hours. (ECT for 21 May 1995 at Palmerston North had been correctly ascertained by the pilot as 1737 hours.)
- 1.1.11 The Duty Flying Instructor considered the pilot to be relaxed and confident and his normal alert self, when signing him off for the flight.
- 1.1.12 The Duty Operations Co-ordinator, responsible for aircraft dispatch, had driven to the Aerodrome at about 1230 hours. He had passed the pilot en-route. He knew that, where possible, the pilot liked to depart early on his flights. He was not surprised that, as ZK-MBI was available, the pilot was ready to leave in this aircraft at about 1330 hours, although his programmed departure slot had been 1400 hours.
- 1.1.13 The Duty Operations Co-ordinator had a brief chat with the pilot, who did not appear stressed in any way, and seemed his usual friendly self. He was well organised for departure, with his headset bag, and folder containing maps and charts and weather information. It only remained at that time for the pilot to file a flight plan.
- 1.1.14 Palmerston North Flight Information Service duly received the pilot's telephoned flight plan details, and transmitted the relevant data over an aeronautical fixed telecommunications network at 1309 hours. The pilot subsequently walked out to ZK-MBI and carried out a pre-flight inspection, which included fuel tank drain checks for water and other contamination.
- 1.1.15 The Duty Operations Co-ordinator recalled noticing that on initial start the propeller of ZK-MBI turned very slowly. However, the pilot succeeded in starting the engine without assistance. He was later observed to taxi ZK-MBI from the flight line in a normal manner.
- 1.1.16 The pilot contacted Palmerston North Surface Movements Control by radio at approximately 1334 hours, prior to taxiing. He used his call sign Massey 703, as the flight identification. Prompt clearance was given to him to proceed to the holding point for Runway 07, and the pilot followed this instruction. Massey 703 was cleared for take-off at 1347 hours. Take off and departure was uneventful.
- 1.1.17 At 1357 hours the pilot informed Palmerston North Tower that Massey 703 was at Woodville at 1500 feet and clear of the control zone. He was cleared to continue with Napier on 124.8 MHz.
- 1.1.18 After entering the Napier Control Zone, Massey 703 was cleared for a touch and go landing on Runway 34 at Napier Aerodrome. The landing and ensuing take-off for Gisborne took place uneventfully at approximately 1435 hours.
- 1.1.19 Shortly before 1441 hours the pilot indicated to Napier Tower that he was "one mile to the east of Waipatiki" at 1500 feet. (Waipatiki Beach is a designated reporting point 11 nm north-north-east of Napier Aerodrome). He requested clearance into the Terminal Control Area (TMA) at 3500 feet, on track for Gisborne. The flight was cleared as requested.
- 1.1.20 Massey 703 called Napier Tower again at 1457 hours. The following transmissions took place:
- "Massey 703 Waipukurau five four, three thousand five hundred feet estimating Gisborne one six"

Napier Tower responded:

“Massey 703 confirm that’s overhead Wairoa?”

The pilot replied:

“Waipuk Wairoa, Massey correction Wairoa Massey 703”.

Massey 703 was then requested to change frequency and contact Gisborne Tower.

- 1.1.21 The pilot established communications with Gisborne Tower, and obtained clearance to enter Gisborne controlled airspace at 3500 feet. At approximately 1509 hours the pilot reported his position as 10 miles south-west of Gisborne Aerodrome at 3500 feet. He was given joining instructions and at 1513 hours was cleared to land on Runway 14. The pilot requested a touch and go landing, and was so cleared.
- 1.1.22 The aircraft was observed by the Air Traffic Controller to make a normal approach and touch and go landing on runway 14. The aircraft departed at approximately 1517 hours and was last seen from the Control Tower to be passing abeam the Waipaoa River mouth heading in a south westerly direction towards Wairoa.
- 1.1.23 At approximately 1520 hours the pilot reported his position as five miles south, at 3000 feet, and indicated that he was estimating Napier at 02 (1602 hours). He requested clearance through the TMA on track for Napier.
- 1.1.24 The Gisborne controller ascertained from the pilot that his desired en-route altitude was 3,500 feet, and cleared him to operate at this altitude, or below, in the Gisborne TMA.
- 1.1.25 The pilot was requested to contact Napier Tower on 124.8 MHz when abeam “the Dams” (a designated reporting point 16 nm south-west of Gisborne Aerodrome). The pilot read back the clearance and instructions promptly and correctly.
- 1.1.26 The Gisborne Controller then telephoned Napier Tower and advised that Massey 703 would be calling when abeam “the Dams”.
- 1.1.27 At approximately 1529 hours Napier Tower contacted the Gisborne Controller by telephone in connection with a scheduled flight inbound to Gisborne. The Controller determined that Massey 703 had not yet contacted Napier Tower. He therefore requested Massey 703 to report his position. In response, at approximately 1530 hours, Massey 703 advised “20 to the south and will be changing Napier Tower 124.8”. This was the last transmission received from ZK-MBI by Gisborne Tower.
- 1.1.28 At approximately 1533 hours the pilot established communications with Napier Tower, and reported his position as follows:

“Massey 703 abeam the Dams three zero, three thousand five hundred feet estimating Palmerston ... Napier zero two and request clearance into Napier TMA at three and a half thousand feet.”

Napier Tower replied, clearing the flight as requested, and providing the QNH setting.

- 1.1.29 The pilot of Massey 703 responded without hesitation or delay, reading back the clearance clearly and accurately. Napier Tower confirmed the readback to be correct. This was the last communication received by Napier Tower from Massey 703 and the last recorded transmission from the aircraft.

- 1.1.30 Between 1535 hours and 1538 hours, a Massey student on a visual navigational flight from Palmerston North to Dannevirke and Napier, was taxiing for take-off at Napier, to return to Palmerston North. During this period he overheard a transmission on 119.1 MHz, which he had selected as a secondary frequency. The following details were remembered (recorded in no particular order or sequence)
- “Massey 703”
“Wairoa” (A distance or position, if transmitted, in relation to Wairoa, was not remembered)
“3500”
- 1.1.31 The Massey student was airborne from Napier at 1538 hours. Ten minutes later he heard Napier Tower attempting to contact Massey 703. Between 1550 hours and 1600 hours he tried to establish communication with Massey 703 on 119.1 MHz, 133.3 MHz (Massey frequency), and 123.45 MHz. There was no response to any of his calls.
- 1.1.32 At approximately 1548 hours Napier Tower called Massey 703 requesting the pilot to report when abeam Waipatiki Beach. No response was received from Massey 703. Napier Tower repeated the request after some 20 seconds but again there was no response. Further attempts to make contact with the aircraft utilising a range of frequencies proved to be unsuccessful.
- 1.1.33 No RTF communication had been obtained, and no sighting of the aircraft had been made, or reported, by 1602 hours, the pilot’s estimate for overhead, or abeam, Napier. The Napier controller therefore declared an INCERFA (uncertainty phase concerning an overdue aircraft) and alerted the Duty Search and Rescue Mission Co-ordinator regarding the circumstances.
- 1.1.34 At about 1500 hours a farmer at Clydebank some 10 km north-east of Wairoa, had observed a Piper Cherokee aircraft passing overhead his property towards Gisborne, at an estimated height of about 2000 feet agl. About 40 minutes later he heard an aircraft returning. Although he did not see it on this occasion, the similar engine sound convinced him that it was the same aircraft flying back from Gisborne. He recalled that it sounded quite high. Just before hearing this aircraft the farmer had seen a local top-dressing aircraft fly in towards Wairoa.
- 1.1.35 Two golfers at the Wairoa Golf Course, located about 6 km north of Wairoa had watched the top-dressing aircraft come in and land. They observed another aircraft “a lot higher up” approaching from the north or north-east. The aircraft was clearly visible, against the background of high cloud, and appeared grey in colour with low wings. Its flight path seemed likely to take it south overhead Wairoa Aerodrome and towards the rail bridge and Waihua.
- 1.1.36 Between 1530 hours and 1600 hours a farmer near his yards on a property in the Waihua region, about 7 nm south-west of Wairoa Aerodrome, briefly observed a light aircraft flying overhead at an estimated height of some 1500 feet to 2000 feet agl. The aircraft appeared to be flying slowly. It was flying toward the south, on a heading likely to result in a crossing of the coast close to Waihua and thence out to sea.
- 1.1.37 The direction of flight was unusual, as the farmer was accustomed to seeing aircraft proceeding from the Wairoa area to Napier following a route which involved crossing the coast further south. (There was a designated reporting point on the boundary of the Napier Terminal Control Area at Mohaka River 5 nm to the south-west). An aircraft being flown on a direct, over water, track from Wairoa Aerodrome to Napier would, however, have crossed the coast about one nautical mile east of Waihua.

1.1.38 A re-enactment flight using a similar aircraft established the probability that the aircraft observed by the farmer was ZK-MBI. It also confirmed that the aircraft, when observed, was tracking essentially south, directly out into Hawke Bay rather than proceeding at an angle, (in terms of the farmer's view), along the south-westerly Wairoa-Napier track. (See Section 1.16 Tests and Research).

1.1.39 The farmer's observation was the last known sighting of an aircraft fitting the description of ZK-MBI.

(The pilot's position report south of Gisborne, and all subsequent RTF communications between Massey 703 and Gisborne and Napier Control Towers are included in a transcript form in Section 1.9 Communications.)

1.2 Injuries to persons

1.2.1 The sole occupant of the aircraft is missing.

1.3 Damage to aircraft

1.3.1 The aircraft is missing.

1.4 Other damage

1.4.1 Not known.

1.5 Personnel information

1.5.1 The pilot in command, who was 19 years of age, had commenced his studies at Massey University School of Aviation in February 1994. He was enrolled candidate No. 1703 in the Bachelor Of Aviation Degree course, Massey 17.

1.5.2 The course normally required four years for completion. He had commenced flying training in July 1994 during the School's second semester. He had progressed satisfactorily in his theoretical and practical training and had passed the required written examinations and flight test for a PPL(A) early in 1995.

1.5.3 He held New Zealand lifetime PPL (A) No. 41089, issued 12 April 1995. He held a Flight Radiotelephone Operator Rating. His licence was endorsed:- Aircraft Types: Piper PA28. The pilot's flying training and subsequent consolidation had been conducted solely on the Piper PA28-161 aircraft type.

1.5.4 His Pilot's Logbook was not located. It was believed to have been amongst the flight documents in his possession on 21 May 1995.

1.5.5 A review of the Flight Crew Development records held by the School of Aviation provided details of his training and experience, up to and including flying on 20 May 1995, as follows:

Total flying experience 93.9 hours. This was comprised of 41.5 hours dual and 52.4 hours pilot in command.

The pilot had a total of 7.8 hours night flying experience. He had accumulated 3.2 hours of Instrument Flight time and had received 5.9 hours Instrument Ground instruction.

- 1.5.6 In the course of his training, and while increasing his experience after obtaining his PPL (A), the pilot had flown ten individual PA28 - 161 aircraft of the Massey School of Aviation fleet. He had flown ZK-MBI on 9 separate occasions, for a total of approximately 13.8 hours in this aircraft. Two daytime cross-country navigational flights were included in this total. He had flown ZK-MBI on a cross-country flight of approximately two hours duration on 20 May 1995 (the day prior to the aircraft's disappearance).
- 1.5.7 Visual navigation training in the Massey University School of Aviation syllabus was divided into two 'Blocks'. Block 6 "Visual Navigation Techniques" facilitated coverage during the pilot's earlier training of the navigational requirements relating to the PPL. The primary focus was defined as "development of piloting competency in navigation management by visual reference, including aircraft performance management, systems management and command." Block 10 "Visual Navigation Mastery" further developed and consolidated the pilot's basic visual navigational skills, and provided the required flight time, to meet the standards of the CPL(A). Block 10 emphasised development in competency in operations in controlled airspace, at unfamiliar aerodromes, and the management of in-flight diversions.
- 1.5.8 The pilot had received 9.7 hours of dual instruction in "Visual Navigation Techniques", and had accumulated 32.1 hours as pilot in command on cross-country navigational flights.
- 1.5.9 The pilot's navigational training had involved dual cross-country flights interspersed with solo practice flights. At the conclusion of each dual flight the instructor held a debrief, and the grading sheet in the student's school records was completed. A self-grading system applied in the case of the solo cross-country flights.
- 1.5.10 None of the three instructors who had provided dual navigational training for the pilot found any significant deficiency in his flight management or navigational technique. Within the limitations of his experience, the pilot had exercised sound judgement in regard to en-route weather and flight conditions and had operated the aircraft competently and in accordance with established procedure at all times.
- 1.5.11 In terms of his Block 10 Navigation training, the pilot was permitted to operate within the following parameters:
- Maximum wind speed 20 knots
 - Maximum crosswind 12 knots
 - Minimum visibility 25 km
 - Minimum cloud base 2500 feet
- 1.5.12 Another instructor had assessed the pilot during his PPL (A) Navigation Test on 2 April 1995. The assessment covered Aircraft Performance and Systems Management, Flight Navigation and Aircraft Command. The pilot had consistently scored "above average" in each aspect of this test. The test had been flown in ZK-MBI, and comprised a flight from Omaka to Palmerston North via the Marlborough Sounds and Paraparaumu, for a flight time of 1.8 hours.
- 1.5.13 The pilot had successfully completed six dual instructional periods covering basic instrument handling and the use of the aircraft's ADF and VOR equipment, as well as eight periods of related simulator instruction.
- 1.5.14 The pilot's Flight Crew Development records indicated that during July and August 1994, and March 1995, he had discussed, demonstrated and/or practised (dual), as appropriate, a range of abnormal and emergency situations relating to the operation of a single engined aircraft of the PA28 type.

1.5.15 Relevant topics which, however, had not been formally signed off in this section of the pilot's records, included the following:

- Total electrics failure VFR
- Communications failure VFR
- Alternator failure
- Electrical overload
- Transponder failure
- Suction pump failure
- Autopilot failure
- Heater malfunction
- Inadvertent cloud penetration
- Crew incapacitation
- Door opening in flight
- Ditching

- 1.5.16 In the absence of an Instructor's initials and date it could not be confirmed conclusively that the pilot had discussed or practised appropriate action in regard to the above abnormal or emergency situations. Nevertheless, the studies he had successfully undertaken to obtain his PPL, and his demonstrated competence in operating the PA28 aircraft type, suggested that he would have been aware of an appropriate action in each case.
- 1.5.17 The pilot had flown from Palmerston North to Napier on three previous occasions. One flight had continued over a route from Napier to Taupo. On 11 May 1995, the pilot had prepared a navigation log for a flight Palmerston North-Napier, Gisborne, Napier and return, involving touch and go landings at Napier and Gisborne on the outward leg. A passenger had accompanied him on this flight. In the event, the flight had not proceeded as far as Gisborne, the pilot noting "divert Napier" on the completed log. The passenger recalled that following the touch and go landing at Napier they had continued towards Gisborne but while over the sea, before reaching Wairoa, the pilot had turned back in order to ensure their return to Palmerston North at the required time before ECT. Poor weather in the vicinity of the Ruahines did not affect the flight. The passenger recalled that although it was "bumpy" the pilot was impressed with the smoothness of the aircraft in the conditions. Time constraints were the sole reasons for shortening the flight.
- 1.5.18 The pilot had been medically examined in accordance with the standards required for a professional aircrew licence on 5 October 1993. He had been assessed fit. He had no history of previous illness or disability. At the time of the aircraft's disappearance, the pilot's Class 1¹ Medical Certificate had expired, but the Class 2 Medical Certificate was valid until 15 November 1998.

¹ To obtain and hold a Professional Aircrew Licence (Commercial Pilot Licence or higher), it is necessary to have a valid Class 1 Medical Certificate. To obtain and hold a Private Pilot Licence a Class 2 Medical is acceptable.

There are two main differences between the Class 1 and Class 2 Medical Certificates:

- (i) The Class 1 medical requirements are more stringent than the Class 2 requirements, and certain tests and examinations are necessary (Eg: audio, eye specialist report, chest X ray).
- (ii) For a pilot under 40 years of age, the Class 1 Medical Certificate is only valid for a year, whereas the Class 2 Medical Certificate is valid for 5 years.

1.6 Aircraft information

- 1.6.1 The Piper PA28 Cherokee type, which includes the PA28-161 'Warrior II' model, is an all-metal, single engined, low wing monoplane of conventional design, with a fixed tricycle undercarriage. The aircraft's cabin is arranged to seat four adult occupants. A single door providing for entry and exit is located on the right side of the cabin.
- 1.6.2 Piper PA28-161 aircraft serial number 28-8416022 was manufactured in the United States in 1983 and assigned the markings N4328U. It was exported to New Zealand in September 1990 with a total time of 2680 hours.
- 1.6.3 The aircraft was imported as one of a large fleet of Piper PA28-161, and other aircraft types, owned and operated by the Massey University School of Aviation. It was registered as ZK-MBI and issued with a C of A in the Standard Category valid from 22 November 1990 to 21 November 1994.
- 1.6.4 ZK-MBI was ferried to Malaysia in 1992 and ownership transferred to the Malaysian Flying Academy. The aircraft returned to New Zealand in 1993 and in conjunction with its re-registration as ZK-MBI, a new C of A was issued in the Standard Category on 18 November 1993. This C of A was non-terminating and endorsed Private and Aerial Work Operations only.
- 1.6.5 ZK-MBI was finished in an overall off-white colour scheme with blue and black stripes running the length of the fuselage and on each side of the fin and rudder. Matching blue and black stripes were located on each side of the three streamlined wheel fairings, and around the outboard portions of the wings. Both sides of the leading edge of the fin bore the name 'MASSEY' in large capital letters, and 'MASSEY UNIVERSITY SCHOOL OF AVIATION' appeared in white on the trim line extending along each side of the engine cowling.
- 1.6.6 ZK-MBI was maintained in accordance with Piper PA28-151/161 Programmed Inspection Schedule 761540 and NZCAR Vol 1 Leaflet F6. All applicable Airworthiness Directives and special inspections had been complied with.
- 1.6.7 An Event 1 (100 hour) maintenance inspection had been carried out on 7 April 1995.
- 1.6.8 The LAME responsible for fleet maintenance reported that part of this inspection involved examination of the engine exhaust assembly and the condition and operation of the heater system and its components. It included removal of the muffler shroud and inspection of the muffler for discoloration, bulging, and other indications of possible deterioration. No unusual indications were observed. The cabin heater operated satisfactorily when checked prior to the aircraft's release to service.
- 1.6.9 Maintenance Release Number A019269 had been issued following this inspection. The Maintenance Release was valid until 7 April 1996 or the attainment of 5694.84 hours in service whichever occurred sooner.
- 1.6.10 At the time of its departure from Palmerston North on the flight from which it failed to return, ZK-MBI had accumulated a total of 5680 airframe hours. The aircraft had flown approximately 89 hours since the Event 1 inspection.
- 1.6.11 Avco Lycoming O-320-D3G engine, serial number L 17553-39A had first entered service in May 1992. Following a complete overhaul it had been installed in ZK-MBI in June 1994. At the time of the aircraft's departure from Palmerston North, the engine had run a total of 2757 hours since new. This included 658 hours since installation in ZK-MBI. The engine change was the most recent occasion at which the exhaust system, including the muffler assembly, had been completely disassembled. The aircraft logbook indicated that the muffler assembly had been

replaced in June 1992, at an aircraft total time of 3379 hours. It had accumulated approximately 2300 hours time in service.

- 1.6.12 A Sensenich 74DM6-0-60 fixed pitch metal propeller, serial number 51989 was fitted. The propeller's total time since new was not known. It had accumulated 1281 hours since overhaul.
- 1.6.13 The maintenance schedule included a Piper Aircraft 50 hour inspection . ZK-MBI was inspected in accordance with this schedule on 30 April 1995. In addition to routine inspection of the airframe, propeller and engine, which included an oil and filter change, both magnetos were changed and the left main wheel tyre replaced. ZK-MBI had flown approximately 39 hours since the 50 hour service.
- 1.6.14 A defect recording system provided for any malfunction or abnormality in the operation of the aircraft to be noted during, or following, each flight. This enabled maintenance personnel to assess the aircraft's status on a daily basis, and take action to rectify defects or replace affected components before further flight, or alternatively defer such action, as appropriate.
- 1.6.15 ZK-MBI's current Defect Record Card formed part of the documentation on board the aircraft and was not recovered. However when checked on 20 May 1995 there were no outstanding defects. No defects were recorded on the card by the pilot who flew ZK-MBI to Waipukurau and return, on the morning of its disappearance. The aircraft's landing light was replaced on 5 May 1995. The most recent defect action had involved replacement of an unserviceable artificial horizon on 19 May 1995 with a serviceable instrument.
- 1.6.16 The previous Defect Record Card covered the period from 4 April 1995 to 12 May 1995. The following defects had been recorded.

No date	Stall warning stopped in flight - worked when tested on ground.
5/5/1995	DI precesses real fast (cleared 8 May 1995 Instrument replaced).
10/5/1995	DI precesses 10° in a Rate 1 90° turn. (vacuum lines checked.) Deferred by Maintenance Engineer 12 May 1995.

- 1.6.17 In respect of the deferral, a restriction had been placed on ZK-MBI, limiting the aircraft to VFR operation, due to the extent of precession of the directional gyro. Subsequent ground checks failed to reproduce the fault. A review of earlier defects did not indicate any unusual trend or area of concern in regard to the maintenance and operational history of ZK-MBI.
- 1.6.18 An instructor at the School of Aviation flew ZK-MBI from Palmerston North to Waipukurau and return on the Sunday morning. He departed at about 0715 hours, and arrived back at approximately 0940 hours. Total flight time amounted to 1.2 hours. The aircraft's fuel tanks were full prior to the departure from Palmerston North. Records showed that a total of 39 litres of Avgas 100 was placed in the tanks to bring them to full capacity again, in accordance with the School of Aviation's normal practice, prior to the next flight.
- 1.6.19 During shut-down checks after arrival at Waipukurau, the Instructor heard an ELT transmission on 121.5 MHz. This prompted him, and other pilots assembled at the aerodrome following the early morning "fly-in", to examine their aircraft in case an ELT installation had inadvertently activated. The Instructor removed the ELT access panel in the rear fuselage of ZK-MBI and confirmed the security and proper attachment of the ELT unit, its external aerial and wiring and the switch setting on the unit in the normal "armed" position. There was no indication of inadvertent activation. The ELT installation appeared to be capable of functioning as intended.

- 1.6.20 The Instructor was aware of the reported defect in the aircraft's directional indicator. He experienced no problem with this instrument, nor with the operation of the aircraft in any other respect during his flights.
- 1.6.21 The aircraft's fuel was contained in left and right wing tanks, each having a placarded capacity of 94 litres. Total usable fuel was 182 litres. This provided an endurance with full tanks of approximately five hours and 20 minutes. The fuel selector could be positioned to the left tank, the right tank or 'OFF'. Normal flight procedure, to maintain a balanced fuel load, involved selecting the opposite tank approximately every 30 minutes.
- 1.6.22 The Instructor operated ZK-MBI at approximately 65% power and cruised briefly at heights in the 3000 feet to 4000 feet range during the outbound and return flights. The achieved fuel consumption, during this flight, of approximately 32.5 litre/hour was consistent with that to be expected of the aircraft type. The School of Aviation used 34 litres/hour as a nominal figure for the PA28-161. No noticeable consumption of oil occurred during the Sunday morning flight.
- 1.6.23 The Instructor confirmed that operation of ZK-MBI's carburettor heat control resulted in an rpm drop and a rise in temperature on the carburettor air temperature gauge, and that observed static rpm, and magneto rpm drops during his pre-take off checks were normal. Both the number 1 and number 2 radio transceivers were used for communications during his flights and both functioned satisfactorily.
- 1.6.24 ZK-MBI was equipped with a KAP 100 ALTIMATIC 3 autopilot, a Piper derivative of a CENTURY II type autopilot installation. An altitude hold was not incorporated but the two functions of the unit were designed to maintain the aircraft on a given heading, set by means of a 'bug' on the direction indicator, and to maintain the wings level. The individual characteristics of the autopilot in ZK-MBI and its serviceability at the time of the pilot's cross-country flight cannot be established. However it was likely that in operation with the Heading Hold selected, the aircraft could have remained in essentially straight flight until the engine stopped from fuel exhaustion.
- 1.6.25 The available evidence indicated that, at the time of the aircraft's departures from Palmerston North, Napier, and Gisborne, ZK-MBI's weight and centre of gravity position were within the allowable limits.

1.7 Meteorological information

- 1.7.1 The Meteorological Service of New Zealand reported as follows:

“During the afternoon of 21 May 1995 a shallow depression was centred 400 nm to 500 nm west of Auckland. An associated frontal zone was moving south over Northland and Auckland. A ridge of high pressure, with its axis lying east of North Island, and over the south of South Island and the South Tasman Sea to the south of the depression, covered much of New Zealand and the sea to the east of the country.

Between 1500 hours and 1600 hours the ridge of high pressure caused mostly settled conditions over the route between Gisborne and Napier. Cloud was scattered Cumulus/Strato cumulus (Cu Sc) at 3,500 feet to 4,000 feet, chiefly about the ranges. It became broken at Gisborne at 1600 hours. A satellite picture taken at about 1545 hours showed some areas of broken cloud further south particularly over Hawke Bay. There was broken cloud above 10,000 feet, which was the leading edge of the cloud associated with the front near Auckland.

The visibility was good and no precipitation was reported apart from some showers about the ranges to the north-west of Gisborne. The possibility existed that isolated patches of light rain occurred east of the ranges but the visibility was not seriously reduced. The outside air temperature and dew-point at 3,500 feet were estimated to be 7°C and 5°C respectively. The winds at 3,500 feet between Gisborne and Napier were approximately 290° 10 to 15 knots with little or no turbulence.

In Hawke Bay the surface winds were probably light and variable with a flat sea. No significant swell was reported. Visibility was good with no haze reported. However, for haze to be reported in the METAR code applicable at the time, visibility had to be reduced to 3,000m or less.”

1.7.2 Gisborne Control Tower reported local conditions to an inbound aircraft at 1525 hours as follows:

“Surface wind 110°/5 knots
Visibility 40 km
Adjacent showers on the north western ranges
1 octa Stratocumulus 3,500 feet
3 octas Stratocumulus 5,000 feet
7 octas Altocumulus 9,000 feet
Temperature +15°C
Forecast 2,000 feet wind 020° magnetic / 15 knots
QNH 1022 hPa.”

1.7.3 The Controller considered that the weather in the vicinity of Gisborne, and towards Wairoa and Napier appeared ideal for VFR flight. There was ample visibility and no low cloud.

1.7.4 The ATIS broadcast from Napier Tower during the period of ZK-MBI’s return flight from Gisborne and at the time of the aircraft’s last recorded transmission was as follows:

“DELTA- Recorded at 0150, expect a visual approach runway 16 or 34. Surface wind light and variable, visibility 60km, light haze. Cloud 1 okta 4000 feet, high cover above. Temperature 13 QNH 1023 two thousand foot wind forecast 020/15 knots.”

1.7.5 The North Island General Aviation forecast valid between 1300 hours and 2400 hours indicated that a front with an associated low in the Tasman was crossing North Island. Conditions in the Gisborne Hawkes Bay Wairarapa area were forecast as follows:

Gisborne Hawkes Bay Wairarapa Wellington Manawatu: Scattered rain developing in afternoon/evening. Few areas broken stratocumulus 4000 feet tops 7000 feet. Areas broken altocirrus/altostratus 8000 feet tops above flight level 100 spreading from the north.

The forecast winds for the Gisborne area at 1800 hours were:

3000 feet	5000 feet	7000 feet	9000 feet
315°T/13 knots	300°T/12 knots	285°T/12 knots	275°T/13 knots

Comment - winds north-east ahead of front. more north-west behind.
All heights in feet amsl.

The Terminal Area Forecast for Gisborne and Napier indicated visibilities of 50 km, and a 2000 foot wind of 040°T/15 knots for both stations.

1.7.6 One of the golfers near Wairoa, who reported sighting ZK-MBI, made the following comments:

“.. I could see the plane clearly, the cloud above was high cloud ..., ... it was overcast and hazy ... I think there would have been cloud on the main ranges ... I think we got rain later that night ...”

1.7.7 The farmer who probably was the last to sight ZK-MBI near Waihua, recalled:

“... It wasn't a bright clear day .. there must have been overhead cloud but there was ample visibility ... I could see straight through to Panekiri (a prominent peak near Lake Waikaremoana, some 36km from his location) ... We recorded no rain on the Sunday.”

1.8 Aids to navigation

1.8.1 The pilot of ZK-MBI was carrying out a visual navigation exercise. This involved accurate identification of suitable ground features en-route, in conjunction with map-reading skills, to monitor the progress of the flight and ensure that the desired track was followed.

1.8.2 The use of a prepared navigation log, which took into account forecast winds and included pre-calculated elapsed times and headings to fly for the various sectors of the flight, provided among other benefits, an ordered method of recording progress and planning any required adjustments in terms of headings or ETAs during the flight.

1.8.3 Several prominent ground features to assist accurate visual navigation existed for the pilot of a light aircraft flying VFR between Wairoa and Napier.

The coastline provided an unmistakable and fairly direct route which could be followed safely, at low level if necessary, even in conditions of reduced visibility. If visibility was of the order of 15km or more the coastline was likely to provide a useful reference for orientation whether the flight was proceeding via an inland route, or to seaward. The direct 'over water' track remained within 5nm of the coast at its furthest point. In addition, with visibility greater than 15km, the foothills and the elevated inland ranges, between 25km and 50km away were also likely to assist as a general reference.

If an inland route between Wairoa and Napier was chosen, the distinctive aspects of the railway line and State Highway 2, running parallel to it in many places, together with the system of power transmission lines leading towards Lake Waikaremoana, offered a series of readily distinguishable navigational clues.

1.8.4 NDB's existed at Napier, Wairoa, and Gisborne. Napier and Gisborne Aerodromes were also equipped with VORs. The individual VOR and NDB frequencies were printed on the Visual Terminal Chart for Gisborne/Napier, and also on the 1:500,000 NZ Aeronautical Chart Sheet 2, which included the Hawkes Bay area. The pilot was believed to have had these charts with him when he departed in ZK-MBI.

1.8.5 ZK-MBI was fitted with two King KX155 Nav/Com units and associated VOR/ILS and VOR/LOC indicators. One King KR87/KI227 ADF system was fitted. The aircraft was also equipped with a King KN64 DME, and a King KT78a transponder. There was no reported unserviceability concerning the aircraft's radio-navigational equipment.

1.8.6 The intention of the flight was to navigate visually. However the available evidence suggested that in the event of failure or inability to determine the aircraft's position by visual navigational means, options open to the pilot would have included use of ADF or VOR equipment to establish, or assist in establishing, an appropriate heading to proceed to Napier, or return to Gisborne.

1.9 Communications

1.9.1 Final communications between Massey 703 and Gisborne Tower comprised the following:

Time (Local)	From	To	Transmission
15.20.11	MSY703	TWR	Massey 703 five to the south three thousand feet, request clearances through the TMA on track Napier estimating Napier zero two.
15.20.24	TWR	MSY703	Roger, what altitude would you like to climb to?
15.20.27	MSY703	TWR	Three and a half thousand feet
15.20.29	TWR	MSY703	Massey 703, Roger. You are cleared to operate three thousand five hundred feet or below in the Gisborne TMA. Abeam the dams contact Napier Tower one two four decimal eight.
15.20.39	MSY703	TWR	Cleared to three thousand five hundred feet or below. Abeam the dams contact Napier Tower one two four decimal eight Massey 703.
15.20.48	TWR	MSY703	Massey 703 correct

(Various communications ensued between Gisborne Tower and other aircraft, and telephone communications between Gisborne Tower and Napier Tower concerning traffic, including ZK-MBI who had not yet called Napier.)

15.30.33	TWR	MSY703	Massey 703 Report your position ...
15.30.37	MSY703	TWR	Massey 703 Twenty to the south and will be changing Napier Tower one two four decimal eight
15.30.43	TWR	MSY703	Roger, cheers.

1.9.2 Final communications between Massey 703 and Napier Tower were recorded as follows:

Time (Local)	From	To	Transmission
15.33.29	MSY703	TWR	Napier Tower Massey 703
15.33.34	TWR	MSY703	Massey 703 Napier Tower

15.33.36	MSY703	TWR	Massey 703 abeam the dams three zero, three thousand five hundred feet, estimating Palmerston ... Napier zero two, and request clearance into Napier TMA at three and a half thousand feet.
15.33.50	TWR	MSY703	Massey 703 cleared through the TMA, three thousand five hundred feet QNH one zero two three.
15.33.57	MSY703	TWR	Cleared through the TMA at three and a half thousand feet one zero two three, Massey 703.
15.34.02	TWR	MSY703	Massey 703, readback correct.
15.48.35	TWR	MSY703	Massey 703 report abeam Waipatiki beach.
15.48.56	TWR	MSY703	Massey 703 report abeam Waipatiki.
15.51.38	TWR	MSY703	Massey 703, Napier Tower.

Further calls to Massey 703 were made by Napier Tower on frequencies 124.8 MHz, 118.1 MHz, 119.1 MHz and 133.3 MHz. No response was received to any of these calls.

1.9.3 The pilot's acknowledgement of the clearance through the TMA, his last transmission to Napier Tower, was made promptly and clearly and was correct in content. His voice exhibited no indication of anxiety or stress, or the effects of fatigue or lassitude.

1.10 Aerodrome information

1.10.1 Not applicable.

1.11 Flight recorders

1.11.1 Not applicable.

1.12 Wreckage and impact information

1.12.1 The aircraft is missing. Despite extensive aerial searches of inland areas and the coastline, no items from the aircraft or pieces of wreckage have been recovered or sighted.

1.13 Medical and pathological information

1.13.1 No evidence was disclosed to indicate any pre-existing medical condition which might have affected the pilot's ability to complete the flight.

1.13.2 The pilot maintained a high level of fitness, taking part in various sports including volley-ball, squash and indoor cricket. He played soccer on a regular basis, usually practising two evenings a week, and participating in a game on most Saturdays.

- 1.13.3 In the early stages of his flying training the pilot had occasionally been affected by motion sickness. His Instructor had discussed with him practical ways to reduce the onset of such sickness and adjustments such as arranging flights at better times of the day were made to his training programme to assist in avoiding it. The available evidence suggested that in subsequent flying, he had succeeded in overcoming the problem. He was not believed to have taken medication at any time in relation to motion sickness.
- 1.13.4 The pilot was observed to be fit and well prior the flight. His appearance and indirect evidence of his probable rest and sleep prior to the accident did not suggest that the pilot would have been unduly fatigued at the time of departure or during the normal conduct of flight.
- 1.13.5 The pilot's medical history did not suggest any medical condition that would have had any potential to cause sudden pilot incapacitation. However, the most common causes of pilot incapacitation are gastrointestinal disturbances or simple fainting. Either might have occurred during the conduct of the flight, and cannot be discounted as a possibility.

1.14 Fire

- 1.14.1 Not known.

1.15 Survival aspects

- 1.15.1 ZK-MBI was fitted with an Artex 110-4 emergency locator transmitter. This unit was a "second generation ELT" transmitting on 121.5 MHz and 243.0 MHz. It was designed for simplicity of operation, and against human error or misuse in terms of its automatic activation. Neither the cockpit switch nor the ELT unit switch could be positioned to prevent automatic activation once the unit was mounted properly.
- 1.15.2 The ELT had been mounted on the right side of the rear fuselage of ZK-MBI in accordance with an approved modification, HAM/PIPER/002. The external antenna was located on the upper right side of the rear fuselage adjacent to the dorsal fin, with an internal co-axial cable connecting it to the ELT. The installation and operation of the ELT had been inspected and verified during the aircraft's most recent avionics check, completed on 13 March 1995. The ELT batteries were not due for replacement until September 1995.
- 1.15.3 The search for the source of an ELT signal, apparently inadvertently activated, had prompted the pilot who flew ZK-MBI on Sunday morning to double-check the proper installation and arming of the aircraft's ELT. He was satisfied, after inspection, that the installation was in order, and the unit capable of functioning as intended. (See paragraph 1.6.19)
- 1.15.4 The ELT unit was designed to withstand a considerable impact force, and to transmit a signal by means of its external aerial, for a period in excess of 48 hours. Nevertheless, signal strength and range was likely to be reduced significantly if the external aerial was broken or disconnected, or shielded, for example, if the aircraft became inverted during a ground or water impact sequence. Any transmitted signal would have been masked if the aircraft had descended into water and rapidly submerged.
- 1.15.5 The available evidence suggested that, in addition to an axe, fire-extinguisher and first-aid kit, ZK-MBI carried one of the School of Aviation survival kits which included three mini flares. However this could not be established conclusively. A "Student Sortie Equipment" register showed that the pilot had booked out one life-jacket and one seat cushion for the flight. It was believed he had placed these items on board the aircraft prior to departure. The register did not include reference to survival kits nor was there a system in place at the time to ensure a survival kit was carried on specific flights. There was no Civil Aviation Authority requirement for such kits to be carried.

- 1.15.6 Witness evidence indicated that at the time of his departure from Palmerston North the pilot was lightly clad, wearing the School of Aviation uniform without the benefit of a jacket or jersey. In the event of a survivable accident, a lack of suitably protective and warm clothing could have become a factor likely to diminish long term survival prospects.
- 1.15.7 The safety harnesses installed in the aircraft for the occupants of the left front (pilot's seat) and right front seats comprised a combined lap-belt and diagonal upper torso restraint.
- 1.15.8 The Search and Rescue Mission Co-ordinator received notification of the missing aircraft at 1622 hours on 21 May 1995. The Rescue Co-ordination Centre (RCC) was activated, and during the late afternoon and evening helicopter searches employing visual techniques and the use of infra-red equipment were carried out along the coast line between Napier and Wairoa.

An RNZAF Orion aircraft conducted an extensive infra-red, and radar search of Hawkes Bay from the coast to a line 5nm seaward of the direct track from Napier to Gisborne during the evening.

- 1.15.9 Search activity continued throughout the following week, involving the use of helicopters and fixed-wing aircraft, and monitoring of coastline areas by New Zealand Police for any sign of debris or wreckage which might have washed ashore. Searches inland were hampered for several days by cloud over the hill country north and west of Wairoa. However, good visibility and smooth sea conditions in Hawkes Bay held potential during initial searches for the sighting of even small items of wreckage in the areas covered.
- 1.15.10 Although the probable final sighting of ZK-MBI suggested that the aircraft had flown seawards over Hawke Bay the search coverage was extended to include an area west of Gisborne and along the line of the Ruahine and Kaiweka mountain range. Notwithstanding the wide area covered by searching aircraft and helicopters over a protracted period, no ELT transmissions were heard, nor was any wreckage sighted. Official search activity was concluded on Sunday 28 May 1995. No trace of the aircraft or its pilot has, to date, been reported, and their whereabouts, whether on land or sea, remains undetermined.

1.16 Tests and research

- 1.16.1 A re-enactment flight using a PA28-161 Warrior II aircraft closely resembling ZK-MBI in external colour and markings was carried out in the Waihua area on 24 May 1995. The aircraft was flown at a height of 3500 feet amsl from the direction of Wairoa towards Napier. The aircraft was observed from the ground by the witness, believed to have been the last person to observe ZK-MBI on the day of its disappearance, from a similar position on his property.
- 1.16.2 The aircraft was initially flown on a heading representing the south-westerly direct track from Wairoa to Napier (approximately 200°M). In response to the witness radioed request for an adjustment in flight direction, a second pass was flown on a heading of 180°M (towards the south-south-west). The witness confirmed that the aircraft's direction of flight, height appearance and sound, during the latter test duplicated his observations on the Sunday afternoon.
- 1.16.3 A review of the radar video tapes from the Auckland Control Centre was requested during the search for the missing aircraft. It was ascertained that due to terrain shielding, radar targets in the Gisborne area or on the Gisborne - Napier track, below 10,000 feet could not be detected. Some low level VFR targets were, however, observed to the south of Napier. A review of Ohakea and Christchurch radar video tapes provided no information useful in the search.

1.17 Additional Information

- 1.17.1 On Saturday morning, 20 May 1995, the pilot had planned a solo visual navigation exercise, involving a cross-country flight in the Wanganui, Raetihi and Taumarunui area. He departed on this flight, in ZK-MBI, at approximately 1030 hours. He had diverted from the planned route after Raetihi resulting in a return to Palmerston North around mid-day. There was no indication on his flight log of any problem encountered either in relation to the route flown, or the operation of the aircraft.
- 1.17.2 After playing a game of soccer on Saturday afternoon, the pilot had returned to the School of Aviation and had prepared for his first solo visual night navigation flight. He taxied out for this flight in ZK-MBL at 1826 hours. He flew the route Foxton - Paraparaumu, and return to Palmerston North, with no reported difficulty, enabling him to conclude the day's flying programme at about 2000 hours.
- 1.17.3 The pilot subsequently arrived at a friend's flat at 2230 or 2300 hours. After playing a board-game, he stayed on until the early hours of Sunday morning, watching the televised FA World Cup. The time at which he returned to his own flat could not be established precisely but may have been between 0300 hours and 0400 hours.
- 1.17.4 On Sunday morning the pilot got up at about 0800 hours and went to the School of Aviation (see Paragraph 1.1.4). His flatmate recalled that he came home for lunch, "had a sandwich", and then went back to the School of Aviation for his afternoon navigation exercise. He made no comment to his flatmate, who was also involved in flying training that day, regarding feeling fatigued, or otherwise adversely prepared for the proposed flight. Whether or not the pilot took advantage of an opportunity for further rest during the later part of Sunday morning is not known.
- 1.17.5 No reports were received to suggest any unusual or uncharacteristic actions on the part of the pilot in the days preceding the aircraft's disappearance. His flatmate and associates reported him to be in his usual good spirits. He was considered by his peers to be a conservative pilot who would abide by Civil Aviation rules, possessing ability and experience that should have enabled him to react coolly and competently if faced with an emergency. He had exhibited aptitude and a professional approach in his flying training and was making satisfactory progress.
- 1.17.6 The pilot was reported to have had a keen interest in computers and other electronic equipment. He had not been given formal instruction in the operation of the autopilot installed in ZK-MBI and the available evidence provided no indication to suggest that it had been activated. The pilot's knowledge and interest in such an installation was likely, however, to have rendered him capable of operating it successfully had he chosen to do so. This consideration also suggested that, under normal circumstances, the pilot, who was accustomed to flying the fleet range of PA28-161 aircraft, all similarly equipped, was sufficiently familiar with the standard installation to have been capable of operating the aircraft's radios and radio navigation equipment satisfactorily, including the use of appropriate audio panel switch selections.
- 1.17.7 Navigational details submitted to the Flight Information service by the pilot in his flight plan prior to departure on the afternoon flight included the following:

Estimated Time of Departure: 1330 hours

True Airspeed: 105 knots

Estimated Elapsed Times:	PM to NR 47 mins (plus an allowance for touch and go landing)
	NR to GS 38 mins (plus an allowance for touch and go landing)
	GS to NR 42 mins (overhead)
	NR to PM 47 mins

This comprised a total estimated elapsed time of 2 hours and 54 minutes (excluding the time allowed for the touch and go landings).

Fuel endurance was stated as 5 hours and 6 minutes.

- 1.17.8 The aircraft's achieved performance was obtained by correlation of relevant arrival and departure times from the ATC transcripts of RTF communications at Palmerston North, Napier and Gisborne, summarised as follows:

Actual Elapsed Time:	PM to NR 48 mins NR to GS 40 mins
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- 1.17.9 The pilot reported "20 to the south" of Gisborne at approximately 1530 hours, some 13 minutes after departure from Gisborne. In his communication with Napier some three minutes later he indicated he was at "the Dams" (located 16nm south-west of Gisborne) at 1530 hours.

(The apparent discrepancy is possibly a result of minor differences or approximations in regard to the actual time as observed by the pilot, and/or approximations or assumptions in regard to position at a given time, or a combination of both factors. Such discrepancies are not unusual with regard to visual reporting procedures. Nevertheless, in the context of the aircraft's disappearance it is worth noting.)

2. Analysis

- 2.1 On Sunday afternoon, 21 May 1995, a frontal zone was moving south over the upper North Island. A ridge of high pressure to the east resulted in relatively settled conditions in the Hawkes Bay region. The general weather in the area was better than elsewhere in North Island and was suitable for the pilot's proposed cross-country flight from Palmerston North to Napier and Gisborne and return.
- 2.2 Cloud and visibility at the time the flight took place were essentially as forecast. No significant cloud existed over the planned route at the pilot's selected cruising altitude of 3,500 feet, and visibilities of 40 km and 60 km were reported respectively by Gisborne and Napier Control Towers. The Gisborne Controller who observed ZK-MBI departing in the direction of Napier considered the conditions in his area ideal for VFR flight.
- 2.3 The North Island Forecast covering the period of the flight indicated that the winds ahead of the frontal zone were from a north-easterly quarter, tending north-west behind. The Terminal Area Forecasts, and conditions as reported during the afternoon at Gisborne and Napier, reflected the pre-frontal situation in regard to the 2000 foot winds. The most up-to-date forecast (issued at 1300) hours which would have been available to the pilot for flight planning and general information, presented the Gisborne area 3000 foot wind as 315°T/13 knots, at 1800 hours. The meteorological aftercast indicated the wind between Gisborne and Napier during the aircraft's

return flight as approximately 290°T/10 - 15 knots at 3000 feet. There was likely to have been little or no turbulence.

- 2.4 Some divergence between anticipated and actual winds aloft is a common feature of cross-country flights. The pilot's level of training and experience suggested that under normal circumstances if wind direction and/or strength differed appreciably from the values used for flight planning, he would have been capable of applying appropriate corrections to headings and ETAs, employing recognised visual navigation techniques. There was no evidence of any difficulty in regard to the winds encountered during the outbound sectors of the flight.
- 2.5 The extent to which haze may have reduced the visibility for the pilot of ZK-MBI over Hawke Bay during the return flight remains unknown. It was reported in the current ATIS, broadcast from Napier, as "light haze" in association with a visibility of 60 km, conditions which normally would not have been expected to create either navigational difficulties, or to have contributed significantly to spatial disorientation or loss of situational awareness over the sea.
- 2.6 The general weather conditions existing during the afternoon flight were unlikely to have placed undue demands on the pilot. Conditions as reported were well above the minimum weather margins to which the pilot was permitted to operate. The pilot was known to have turned back, or to have made a suitable diversion from his planned route during previous cross-country flights when adverse weather had been encountered.
- 2.7 The available evidence indicated that the pilot's navigation planning and pre-flight preparations were carried out in accordance with the School of Aviation procedures, and to an acceptable standard. The progress of the flight, as far as could be inferred from observation by ground witnesses, and analysis of the RTF recordings, suggested that up to, and including arrival at Gisborne and departure to the south, the aircraft had been flown in a responsible, competent, and routine manner.
- 2.8 The pilot navigated without apparent difficulty to Napier, and then to Gisborne, and achieved en-route elapsed times close to those predicted in his flight plan. This indicated not only that his navigational calculations were accurate, and that no significant diversions were made from the planned route, but also suggested that the manner in which the aircraft was operated and the performance of the aircraft itself fulfilled normal expectations for the aircraft type.
- 2.9 The last confirmed observations of ZK-MBI involved the aircraft's approach, the touch and go landing and the subsequent departure from Gisborne Aerodrome. The aircraft's visual appearance, the manner in which it was flown, its performance and the communications from the pilot provided no indication of anything untoward, concerning the aircraft or its engine, or the fitness or ability of the pilot at this stage of the flight.
- 2.10 The Gisborne Controller subsequently requested a position report from ZK-MBI, and received an immediate reply from the pilot indicating he was "twenty to the south" and would be shortly changing to the Napier Tower frequency. The pilot's reported position, approximately 13 minutes after leaving Gisborne, was consistent with a typical departure profile for the aircraft type, making good a ground speed of between 90 and 95 knots in the existing conditions. The pilot's rapid response in regard to his distance from Gisborne and his use of "five to the south" when transmitting a routine departure call ten minutes earlier, raised the possibility that he was using a DME read-out to assist in precise navigation. Use of the navigation equipment on board ZK-MBI as a back-up for established VFR cross-country techniques would have been in keeping with the pilot's known interests and capabilities. The use of DME in particular is a common practice among pilots flying suitably equipped aircraft even though navigating visually in all other respects.

- 2.11 On contacting Napier Tower the pilot advised, in part "... abeam the dams three zero ..." This introduced an apparent anomaly in that "the dams" were located approximately 16 nm south-west of Gisborne, and the pilot's earlier report to Gisborne Tower had indicated that by 1530 hours he had actually progressed some 20 nm. Various explanations could, however, be put forward in regard to this anomaly, given the practical difficulty of reconciling exact positions and times in the visual navigation context (see brief comment paragraph 1.17.9). Whether the pilot identified "the dams" visually and entered the time of passing abeam them on his navigation log, or whether his report to Napier Tower was based solely on an estimated 'abeam' time related to their charted position could not be established.
- 2.12 In conjunction with his position report the pilot advised he was estimating Napier at 1602 hours. This estimate, predicting an elapsed time of 32 minutes, was consistent with following a flight route to Napier from a position at, or abeam, "the dams" while maintaining a ground-speed of 105 knots. The estimate was likely to have represented accurately a typical cruise capability for the aircraft in the prevailing conditions.
- 2.13 The available evidence suggested that at the time of the last known position report from ZK-MBI the aircraft was functioning normally, and the pilot was not subject to any degree of incapacitation. In addition, it suggested that the aircraft was essentially on track, and signalled the pilot's expectation of an uneventful flight to Napier and Palmerston North.
- 2.14 The elapsed time from take-off at Palmerston North to the time of the pilot's last known transmission was approximately 1 hour 46 minutes. Taking into account fuel used during taxiing and run-up, and assuming a fuel consumption of the order of 35 litres/hour, the total quantity on board ZK-MBI at the time of the last communication with the aircraft was likely to have been more than 100 litres, sufficient for about three hours' continued flight. However this level of endurance would only have been achieved if fuel was progressively selected from the left and right tanks. If no further change in selection took place the probable flight time before a tank ran dry was likely to have been limited to two hours, or somewhat less.
- 2.15 The whereabouts of ZK-MBI and its pilot remain unknown, and it is conceivable that the aircraft, although observed departing to the south-west of Gisborne, eventually proceeded in some other direction. However, the sightings of an aircraft, fitting the description of ZK-MBI, flying overhead in the vicinity of Wairoa support the probability that the pilot succeeded in following his planned track from Gisborne towards Napier to a position near Waihua where the aircraft was last observed flying out to sea.
- 2.16 The RTF transmission on 119.1 MHz heard by another Massey School of Aviation pilot while taxiing at Napier reinforced the probability that the pilot of ZK-MBI tracked overhead, or close to, Wairoa Aerodrome during the return flight, flying at his selected altitude of 3500 feet. It also suggested that the pilot was sufficiently alert to the possibility of other traffic and the requirement to adhere to recognised cross-country procedures to transmit an appropriate call on the frequency for use at an unattended aerodrome such as Wairoa.
- 2.17 The possibility could not be discounted completely that in making a transmission on 119.1 MHz the pilot of ZK-MBI adjusted the audio panel switch sections and/or the volume controls on the aircraft radios in a manner such that subsequent calls to the aircraft by Napier Tower and the other Massey Aviation student were undetected by him. However, he was familiar with the equipment, and had communicated competently and clearly in RTF exchanges involving different frequencies earlier in the cross-country flight. This suggested that the absence of response to further radio calls, made on a variety of frequencies, including 119.1 MHz, was unlikely to have occurred for such a reason.

- 2.18 The pilot was operating on a flight plan, and would have been aware of the requirement to provide ATC with a position report or “operations normal” call within a 30 minute period. Under normal circumstances he could be expected to have initiated a transmission to Napier Tower at approximately 1600 hours, irrespective of whether, for various reasons, RTF calls to his aircraft had not been received. In the event, there was no known transmission from ZK-MBI, addressed to any station, following the Wairoa position report.
- 2.19 The pilot’s training and experience could be expected to have enabled him to take appropriate action had a partial, or total, communications failure occurred on board the aircraft. The available evidence indicated that at 1600 hours with normal fuel management ZK-MBI would have had sufficient fuel remaining for at least two hours further flight. Even if lost, or uncertain of his position at that time, the pilot’s level of training and demonstrated ability in previous cross-country flying suggested that he would have attempted by all available means including the use of radio navigation aids, if serviceable, to re-establish his whereabouts and take up a suitable heading to continue towards Napier, or return along his flight path to Wairoa or Gisborne. That he apparently did not do so and no RTF emergency calls, or requests for assistance were heard, suggested that prior to 1600 hours some occurrence or event had significantly affected the pilot himself, or the operation of his aircraft.
- 2.20 Napier Tower requested at 1548 hours that the pilot of ZK-MBI report when abeam Waipatiki. This request was transmitted about 15 minutes after the routine communications exchange in which ZK-MBI had been cleared to enter the Napier TMA, and probably some 10 minutes after the pilot had broadcast his Wairoa position report on 119.1 MHz. While other explanations were possible, as already discussed, the lack of response to Napier Tower at 1548 hours and thereafter, implied strongly that an event, or events, affecting the pilot, the aircraft, and/or the conduct of the flight, may have occurred by that time.
- 2.21 Calculation showed that ZK-MBI was likely to have passed over the Waihua region at about 1543 hours. This coincided with the approximate time that a local farmer observed an aircraft matching its description. At the time of this final sighting ZK-MBI was flying at a probable altitude of about 3500 feet and heading approximately 180° M. Continued flight in this direction would have taken ZK-MBI east of the Wairoa - Napier track and out to sea. The farmer, who observed the aircraft for a few seconds only, received the impression it was “flying slowly”. Whether or not the actual speed of the aircraft held any significance in relation to its subsequent loss remains unknown. At the time the farmer’s brief observation raised no question of concern in his mind for the safety of the flight.
- 2.22 No evidence to account conclusively for the disappearance of ZK-MBI was obtained. Reasons for the aircraft’s apparent seaward heading in the vicinity of Waihua, and eventual failure to arrive at Palmerston North can only be the subject of conjecture.

Among numerous possibilities, the circumstances suggested two distinct areas for consideration, summarised as follows:

a) **Pilot Incapacitation**

Any form of incapacitation, acute or insidious, which rendered the pilot oblivious to his environment or physically incapable of maintaining control of the aircraft for an extended period, was likely to lead to an accident.

In the context of the flight by ZK-MBI, some potential sources of incapacitation included the pilot’s fitness for flight, susceptibility to motion sickness, a gradual or rapid onset of disorientation induced by overwater flying in hazy conditions, the possibility of an in-flight

bird strike resulting in serious head injury², and the undetected ingress of carbon monoxide from the aircraft's exhaust into the cabin².

The pilot was known to have stayed up late, watching the FA World Cup on television into the early hours of Sunday morning, and the quality and total amount of sleep he may have had prior to the cross-country flight is not known. Potential therefore existed for a degree of tiredness during the flight. However, although the pilot's RTF communications included some brief inaccuracies, these instances were infrequent and were rapidly corrected. The recorded transmissions disclosed no overall indication in the pilot's voice, or by delayed response, to suggest that, up to the time of the final position report, he was affected by tiredness to any significant extent. In the absence of other evidence whether the pilot's late night, and resulting lack of sleep contributed to the disappearance of ZK-MBI could not be established.

In relation to the pilot's fitness for flight the Commission's Medical Advisor provided the following comment:

“There is no evidence to suggest that the pilot would have been unduly fatigued during the normal conduct of this flight. While some aspects of pilot performance such as monitoring and vigilance may be affected by mild fatigue, it is unlikely that fatigue would have caused undue sleepiness or interfered with the pilot's ability to respond to an aircraft emergency or other problem.

Acute pilot incapacitation cannot be totally ruled out as the prime cause of this aircraft's disappearance. However, there is no evidence to suggest that this was probable and alternative causes may be more acceptable explanations of the incident.” (See also Section 1.13 Medical and Pathological information.)

b) Sudden loss of structural integrity, stability or control

An in-flight mechanical or structural failure, occurring without warning, which rapidly destroyed the integrity of the basic structure and/or critically affected the aircraft's stability and control would have inevitably resulted in an accident.

An occurrence of this nature was likely to have deprived the pilot of any realistic opportunity to make an emergency RTF transmission.

No wreckage from the aircraft has, to date, been recovered, precluding examination of its structure and/or component parts.

2.23 Whether or not pilot incapacitation in any form, or failure of any part of the aircraft, contributed to the disappearance of ZK-MBI remains unknown.

3. Findings

3.1 In the course of a VFR cross-country training flight the pilot navigated his aircraft successfully from Palmerston North to Napier and Gisborne. The aircraft subsequently failed to reach Napier or return to Palmerston North.

3.2 No trace of the aircraft or the pilot, its sole occupant, has been found.

3.3 The pilot held a PPL(A), and a valid Class 2 Medical Certificate.

² These have all been entered as factors in previous aviation accidents.

- 3.4 The pilot was in current flying practice and had suitable experience on the aircraft type.
- 3.5 The aircraft's Certificate of Airworthiness and Maintenance Release were valid.
- 3.6 The pilot was making satisfactory progress toward a CPL(A) and had completed part of his cross-country flight training successfully .
- 3.7 The weather was suitable, the pilot was authorised correctly, and adequate fuel was carried on the aircraft for the flight.
- 3.8 The aircraft had performed normally during two flights earlier that day.
- 3.9 The procedures followed by the pilot and the observed operation of the aircraft during the outward sectors gave no cause for concern regarding the conduct of the flight.
- 3.10 On departure from Gisborne on the return flight the aircraft's all-up weight and centre of gravity position were within the permitted limits.
- 3.11 The available evidence suggested that the flight had proceeded uneventfully, and the pilot had followed essentially his planned track, until the aircraft reached the vicinity of Waihua during the return flight.
- 3.12 The pilot's RTF communications, including his last recorded transmission, provided no indication of gradual or rapid deterioration of his own fitness, or of any problem experienced in relation to the aircraft or the progress of the flight.
- 3.13 The pilot's ability, level of training, and previous cross-country experience was likely to have enabled him, under normal circumstances, to react competently to an in-flight emergency, whether related to navigational difficulty, or to the operation of the aircraft or its engine.
- 3.14 The balance of evidence suggested that during the return flight for reasons unknown, the aircraft diverged from its planned track.
- 3.15 Following the aircraft's disappearance, there were no definitive clues as to its whereabouts.
- 3.16 In the circumstances of this occurrence, contributing factors, and the probable cause of the loss of the aircraft, could not be determined.

4. Safety Actions

Operator

- 4.1 Following the disappearance of ZK-MBI, the Massey University School of Aviation conducted a review of existing policies in regard to cross-country navigation training, and the overall fleet maintenance programme.
- 4.2 The baffling circumstances provided no evidence to prompt specific changes. Nevertheless, as a precaution, operational action included a requirement for a photo-copy of the students' navigation logs and prepared flight details to be left with flight dispatch prior to departure on a solo cross-country training flight.

- 4.3 Emphasis was also placed on the desirability of scheduling at least one “full-stop” landing, in the course of an extended solo cross-country exercise, to provide an opportunity for relaxation and refreshment.
- 4.4 The maintenance programme for each aircraft in the Massey School of Aviation fleet was expanded to include a check for carbon monoxide (CO) contamination at every 100 hour inspection, using an approved CO detector to obtain an assessment of the level of contamination (if any) during typical flight conditions. (The implementation of this procedure was predominantly related to a night training sortie in August 1995 in which the aircraft occupants were affected by possible CO ingress during the flight. It was subsequently determined that the CO level was above the acceptable limit.)
- 4.5 ELT performance and serviceability was also monitored in conjunction with existing maintenance requirements and the type of installation in ZK-MBI.

Air traffic service radar

- 4.6 The analysis of radar recordings has provided invaluable data regarding aircraft positions, height, tracks and groundspeeds, and other relevant information in connection with a number of recent aviation incidents and accidents. In areas where radar coverage exists, potentially useful data is likely to be available, or may be derived, even though an aircraft is not receiving a radar service, or equipped with a transponder.
- 4.7 The eventual provision of an effective low-altitude radar system for the East Coast of North Island would necessarily involve consideration of cost versus benefit.
- 4.8 Whether the existence of local radar coverage in the Napier and Gisborne regions would have assisted in resolving the circumstances surrounding the disappearance of ZK-MBI is not known.

5. Further report

This present report summarises the formal investigation into the circumstances under which the aircraft went missing. Should the aircraft be found the investigation may be re-opened and a further report published.

17 April 1996

M F Dunphy
Chief Commissioner

Glossary of Aviation Abbreviations

AD	Airworthiness Directive
ADF	Automatic direction-finding equipment
agl	Above ground level
AI	Attitude indicator
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
amsl	Above mean sea level
AOD	Aft of datum
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	Degrees Celsius
CAA	Civil Aviation Authority
CASO	Civil Aviation Safety Order
CFI	Chief Flying Instructor
C of A	Certificate of Airworthiness
C of G (or CG)	Centre of gravity
CPL (A or H)	Commercial Pilot Licence (Aeroplane or Helicopter)
DME	Distance measuring equipment
E	East
ELT	Emergency location transmitter
ERC	Enroute chart
ETA	Estimated time of arrival
ETD	Estimated time of departure
°F	Degrees Fahrenheit
FAA	Federal Aviation Administration (United States)
FL	Flight level
ft	Foot/feet
g	Acceleration due to gravity
GPS	Global Positioning System
h	Hour
HF	High frequency
hPa	Hectopascals
hrs	Hours
IAS	Indicated airspeed
IFR	Instrument Flight Rules
IGE	In ground effect
ILS	Instrument landing system
IMC	Instrument meteorological conditions
in	Inch(es)
ins Hg	Inches of mercury

kg	Kilogram(s)
kHz	Kilohertz
KIAS	Knots indicated airspeed
km	Kilometre(s)
kt	Knot(s)
LAME	Licensed Aircraft Maintenance Engineer
lb	Pounds
LF	Low frequency
LLZ	Localiser
Ltd	Limited
m	Metre(s)
M	Mach number (e.g. M1.2)
°M	Degrees Magnetic
MAANZ	Microflight 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	Millimetre(s)
mph	Miles per hour
N	North
NDB	Non-directional radio beacon
nm	Nautical mile
NOTAM	Notice to Airmen
NTSB	National Transportation Safety Board (United States)
NZAACA	New Zealand Amateur Aircraft Constructors Association
NZDT	New Zealand daylight time (UTC + 13 hours)
NZGA	New Zealand Gliding Association
NZHGPA	New Zealand Hang Gliding and Paragliding Association
NZMS	New Zealand Mapping Service map series number
NZST	New Zealand Standard Time (UTC + 12 hours)
OGE	Out of ground effect
okta	Eighths of sky cloud cover (e.g. 4 oktas = 4/8 of cloud cover)
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	Second(s)
S	South
SAR	Search and Rescue
SSR	Secondary surveillance radar
°T	Degrees True
TACAN	Tactical Air Navigation aid
TAF	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