



AIRCRAFT ACCIDENT REPORT
OCCURRENCE NUMBER 06/307
TWO PIPER PA-28-161
ZK - MBD and ZK - MBL
LOCATION 4.4 KM N OF SHANNON
09 FEBRUARY 2006

Glossary of abbreviations used in this report:

AGL	Above Ground Level
AMSL	Above Mean Sea Level
ATIS	Automatic Terminal Information Service
CAA	Civil Aviation Authority
CPL(A)	Commercial Pilot Licence (Aeroplane)
E	east
ELT	Emergency Locator Transmitter
FISCOM	Flight Information Service Communications
ft/min	feet per minute
ft	foot or feet
kts	knots
km	kilometre(s)
m	metre(s)
M	magnetic
MHz	megahertz
METAR	Aviation routine weather report
NZDT	New Zealand Daylight Time
PFL	Practiced Forced Landing
S	south
SOP	Standard Operating Procedures
T	true
TCAS	Traffic Alert and Collision Avoidance System
UTC	Coordinated Universal Time
VHF	very high frequency
WGS 84	World Geodetic System 1984

AIRCRAFT ACCIDENT REPORT

OCCURRENCE No 06/307

ZK-MBD

Aircraft type, serial number and registration:	PIPER PA-28-161, Cherokee Warrior II, 28-8416025, ZK-MBD
Number and type of engines:	1 Lycoming O-320-D3G
Year of manufacture:	1983
Date and time:	9 February 2006, 0947 hours ¹
Location:	Latitude ² : S 40° 30' 33.9" Longitude: E 175° 25' 33.5"
Type of flight:	Training
Persons on board:	Crew: 1
Injuries:	Crew: 1 (Fatal)
Nature of damage:	Aircraft: destroyed
Pilot's licence:	Private Pilot Licence (Aeroplane)
Pilot's age:	27 years
Pilot's total flying experience:	129.3 hours, 129.3 on type
Information sources:	Civil Aviation Authority field investigation
Investigator in Charge:	Mr M Carrelli

¹ Times are NZDT (UTC + 13 hours)

² WGS 84 co-ordinates.

ZK-MBL

Aircraft type, serial number and registration:	PIPER PA-28-161, Cherokee Warrior II, 28-8316103, ZK-MBL
Number and type of engines:	1 Lycoming O-320-D3G
Year of manufacture:	1983
Date and time:	9 February 2006, 0947 hours ³
Location:	Latitude ⁴ : S 40° 30' 33.9" Longitude: E 175° 25' 33.5"
Type of flight:	Training
Persons on board:	Crew: 1
Injuries:	Crew: 1 (Fatal)
Nature of damage:	Aircraft: destroyed
Pilot's licence:	Private Pilot Licence (Aeroplane)
Pilot's age:	20 years
Pilot's total flying experience:	124.6 hours, 117.7 on type
Information sources:	Civil Aviation Authority field investigation
Investigator in Charge:	Mr M Carrelli

³ Times are NZDT (UTC + 13 hours)

⁴ WGS 84 co-ordinates

Synopsis

The Civil Aviation Authority was notified at 1000 NZDT hours on Thursday 9 February 2006 that there had been a mid-air accident involving two fixed-wing aircraft. The Transport Accident Investigation Commission was in turn notified shortly thereafter, but declined to investigate. A Civil Aviation Authority field investigation commenced later that day.

The two pilots had departed Palmerston North airport at separate times to engage in general flying training exercises in the southern training area in preparation for their Commercial Pilots Licence flight tests.

Witnesses reported to the police that the two aircraft had collided in mid-air.

The pilots of both aircraft were found deceased in the wreckage of their respective aircraft.

1. Factual information

1.1 History of the flight

- 1.1.1 In this report ZK-MBD is the aircraft that is descending in the final sequence of events and ZK-MBL is the climbing aircraft.
- 1.1.2 At 0838 NZDT on Thursday 9 February 2006 the pilot of ZK-MBD departed from Palmerston North airport to conduct general flying exercises in preparation for a test for the issue of a CPL(A). The exercises consisted of practicing medium level turns, stalling, practice forced landings (PFL) and circuits on return to Palmerston North. The exercise had a planned duration of one and a half hours and the aircraft was due back at 1000 NZDT. The pilot was briefed and authorised to fly by his instructor on the day of the accident.
- 1.1.3 Aircraft ZK-MBD completed a number of touch and go landings prior to departing Palmerston North to the southern training area. The southern training area is located to the south west of Palmerston North airport. Once established in the training area the pilot conducted a series of manoeuvres as briefed in preparation for the CPL(A) flight test.
- 1.1.4 At about 0913 NZDT on Thursday 9 February 2006 the pilot of ZK-MBL also departed from Palmerston North airport to conduct general flying exercises in preparation for a test for the issue of a CPL(A). The exercises consisted of practicing medium level turns, stalling and PFLs. The exercise had a planned duration of one and a half hours and the aircraft was due back at 1030 NZDT. The pilot had been briefed by his instructor on the previous day and was authorised to fly by the duty instructor on the day of the accident.
- 1.1.5 ZK-MBL also tracked to the southern training area in the vicinity of Shannon where the pilot conducted a series of manoeuvres as briefed in preparation for the CPL(A) flight test.

1.1.6 At 0944:24 NZDT ZK-MBD was flying in an easterly direction and commenced a descent from 3000ft AMSL at a rate of 600ft/min. At 0945:03 the aircraft turned right towards the south before commencing a left hand descending turn through 180° to track towards the north. The aircraft maintained this heading and rate of descent until the collision with ZK-MBL.

At 0944:34 NZDT ZK-MBL commenced a descending left hand orbit to an altitude of 600ft AMSL. This profile and descent rate is consistent with a PFL. During the initial left hand turn the aircraft crossed the flight path of a helicopter being flown from Palmerston North to Wellington. The helicopter ZK-HZM had the aircraft on TCAS and remained clear.

At 0946:02 ZK-MBL commenced a climb in an easterly direction. During the climb out from the PFL the chosen direction and time of day would have placed the pilot flying directly into Sun.

At time 0946:32 ZK-MBL commenced a right turn onto a heading of approx 098°M⁵ and maintained this heading until the collision with aircraft ZK-MBD.

1.1.7 Figure 1 depicts the radar plot of both aircraft for the final two and a half minutes prior to collision.

⁵ Magnetic Variation 22°E

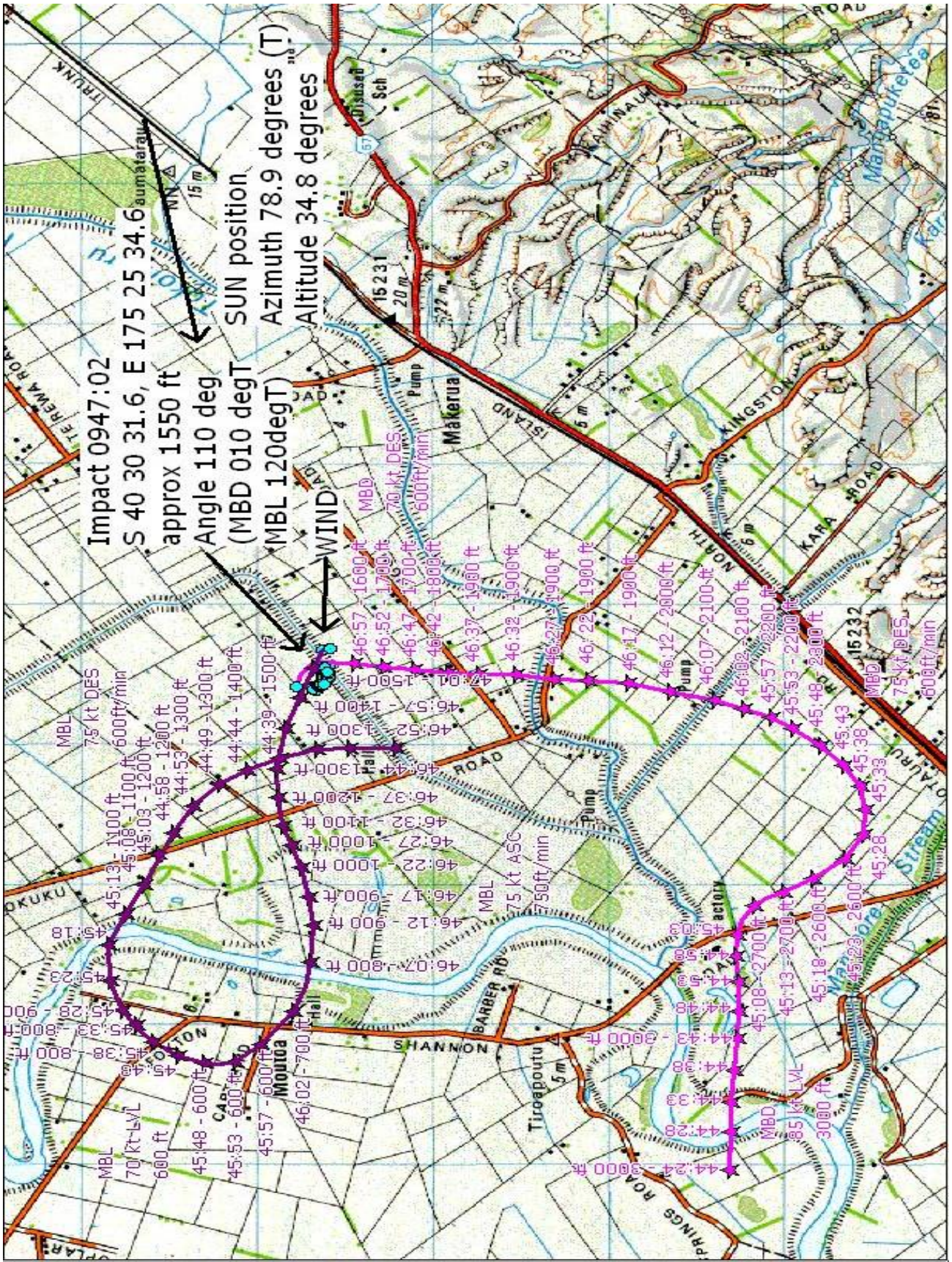


Fig. 1 (Radar Plot)

1.2 Injuries to persons

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Other</i>
Fatal	2	0	0
Serious	0	0	0
Minor/None	0	0	

1.3 Damage to aircraft

1.3.1 Both aircraft were destroyed.

1.4 Other damage

1.4.1 Nil.

1.5 Personnel information

Pilot of **ZK-MBD**

1.5.1 The pilot held a Private Pilot Licence - Aeroplane PPL(A).

1.5.2 The pilot held a Class 1 medical certificate which was valid until 18 Jul 2006.

1.5.3 The pilot had successfully passed the flight test for a PPL(A) on 17 August 2005.

1.5.4 The pilot had flown a total of 129.3 hours, all of which was on type, until the last logbook entry on 7 February 2006.

1.5.5 The authorising instructor described the pilot as being well prepared and in good spirits on the day of the accident.

Pilot of **ZK-MBL**

1.5.6 The pilot held a Private Pilot Licence - Aeroplane PPL(A).

1.5.7 The pilot held a Class 1 medical certificate which was valid until 2 January 2007.

1.5.8 The pilot had successfully passed the flight test for a PPL(A) on 18 August 2005.

1.5.9 The pilot had flown a total of 124.6 hours, which included 117.7 on type until the last logbook entry on 7 February 2006.

1.5.10 The pilot's instructor described the pilot as being in good spirits on the day of the accident.

1.5.11 An instructor who had flown with both students described both pilots as having above average ability, and being conscientious about safety.

1.6 Aircraft information

ZK-MBD

- 1.6.1 Piper Aircraft Corporation PA-28-161, ZK-MBD, serial number 28-8416025 was manufactured in the United States of America in 1983.
- 1.6.2 The most recent maintenance check was a 100 hourly inspection on 30 January 2006 and the aircraft had flown a total of 10930 hours up until the time of the accident.
- 1.6.3 The aircraft had a standard non-terminating Certificate of Airworthiness issued on 2 May 1990.
- 1.6.4 The Lycoming, O-320-D3G engine, serial number L-8457-39A, had run a total of 1341 hours at the time of the accident.

ZK-MBL

- 1.6.5 Piper Aircraft Corporation PA-28-161, ZK-MBL, serial number 28-8316103 was manufactured in the United States of America in 1983.
- 1.6.6 The most recent maintenance check was a 100 hourly inspection on 12 December 2005 and the aircraft had flown a total of 8357 hours up until the time of the accident.
- 1.6.7 The aircraft had a standard non-terminating Certificate of Airworthiness issued on 22 November 1990.
- 1.6.8 The Lycoming, O-320-D3G engine, serial number L-13033-39A, had run a total of 742 hours at the time of the accident.

1.7 Meteorological information

- 1.7.1 On the day of the accident the weather at Palmerston North was generally fine as indicated by the METAR and ATIS below.
- 1.7.2 The METAR at the time of the accident indicated:
Weather: Nil
Cloud: Few at 7000ft AGL
Visibility: 90 km
Wind: 070° at 02 kts
- 1.7.3 The ATIS for Palmerston North 9 February 2006 0834 NZDT indicated the following:
Weather: Nil
Cloud: Nil Significant Cloud
Visibility: 90 km
Wind: Variable at 03 kts.
- 1.7.4 The azimuth of the sun at the time of the accident was 56° 56'M and its altitude was 34° 47' above the horizon.
- 1.7.5 Weather was not considered a factor in this accident; however, it is possible that the pilot of ZK-MBL, climbing in an easterly direction may have had his vision compromised by flying directly into Sun.

1.8 Aids to navigation

1.8.1 Nil.

1.9 Communications

1.9.1 The Palmerston North southern training area is bound by three different radio frequencies. The flying school SOP is for aircraft operating in the southern training area to listen out on Palmerston Tower (120.6 MHz) and Massey base operations (133.3 MHz).

The aircraft are equipped with two VHF radios and the pilots would have been monitoring similar frequencies.

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 accident site was located in a dry flat pasture approximately 1200m, on a bearing of 003°M from the junction of Okuku and Ngui Roads and 4.4km, 354°M from Shannon. The wreckage of each aircraft was displaced approximately 150 metres east and west of this point.

1.12.2 The radar plot showed that ZK-MBD was heading approximately 348°M descending at 600ft/min. ZK-MBL was heading approximately 098°M and climbing at 750ft/min. The collision took place at an altitude of approximately 1550ft AMSL at an angle of 110° relative to each aircraft.

1.12.3 After the collision ZK-MBD turned left onto a heading of approximately 280°M and maintained this heading until impacting the ground.

1.12.4 After the collision ZK-MBL continued on a heading of approximately 098°M prior to impacting the ground.



ACCIDENT SITE

ZK-MBD

- 1.12.5 The aircraft impacted the ground in an almost vertical attitude and came to rest in a drainage ditch on its roof. The majority of the impact forces were absorbed by the engine compartment and roof section.
- 1.12.6 The wreckage trail extended over approx 300m on a heading of 296°M from the mid-air impact point. The wreckage trail consisted mainly of small pieces of aircraft structure and windscreen Perspex™, with some larger components dispersed along the main axis. It was determined that the majority of the debris in the trail was from ZK-MBD.
- 1.12.7 The right wing of ZK-MBD had separated in flight, after being severed by the propeller of ZK-MBL, and fell to the ground approx 100m to the south of the main wreckage.



ZK-MBD - Right Wing

- 1.12.8 The horizontal stabiliser and lower portion of the rudder fell almost vertically from the mid-air impact point, as described by a witness, and was displaced 240m from the main fuselage.
- 1.12.9 The right main undercarriage was found near the fuselage of ZK-MBL. There was evidence that it had collided with the right wing of ZK-MBL and had been torn off and carried with that aircraft for some distance.



ZK - MBD

ZK-MBL

- 1.12.10 The aircraft impacted the ground in a vertical attitude making an impact crater of approximately half a metre deep. The impact forces were absorbed mainly by the engine compartment and leading edge of the left wing.
- 1.12.11 The right wing had been severed by impact with the right undercarriage of ZK-MBD, but the wing had been carried with the aircraft attached only by the control cables.
- 1.12.12 The aircraft structure remained intact with very little dispersion over the wreckage trail.



ZK-MBL

1.13 Medical and pathological information

- 1.13.1 Post-mortem examination of both pilots concluded that death was due to injuries consistent with high impact forces.
- 1.13.2 Toxicological tests disclosed no evidence of alcohol, or medicinal or recreational drugs in either pilot.

1.14 Fire

- 1.14.1 Nil

1.15 Survival aspects

- 1.15.1 The accident was not survivable, as the impact forces were beyond human tolerance.
- 1.15.2 ZK-MBD was fitted with a Narco 10 ELT which failed to activate due to it being destroyed during the impact sequence. Pieces, including the batteries, of the ELT were discovered in the wreckage trail. The cockpit switch was found in the armed position.
- 1.15.3 ZK-MBL was fitted with a Narco 10 ELT which failed to activate. Due to significant impact forces it could not be determined which position the cockpit switch was in. The switch on the unit itself was found in the off position.

1.16 Tests and research

- 1.16.1 One engine was examined to ensure that it was operating correctly. This engine was from ZK-MBD, as the aircraft was descending prior to the accident. The reason for the inspection was to rule out the possibility of an engine failure as the cause for the descent.
- 1.16.2 The inspection of the engine from ZK-MBD revealed no pre-existing faults. The engine was considered to be operating normally at the time of the accident.
- 1.16.3 The engine from ZK-MBL was not tested as the radar plot shows that the aircraft was climbing at 750 ft/min at the time of the accident. To achieve this rate of climb the engine would have to be producing normal power.

1.17 Organisational and management information

- 1.17.1 Both pilots were briefed and authorised for their respective flights by different instructors. There is no formal briefing between instructors as to the training areas being used. Students are briefed that other school aircraft may be operating in the same training area.
- 1.17.2 No procedures are laid down as to the maximum number of flying school aircraft which are permitted to operate in each training area.

1.18 Additional information

- 1.18.1 There are a number of other aviation organisations operating in the southern training area. It is also a common flight path for transiting aircraft from Feilding and Palmerston North. These aircraft may be listening out on different radio frequencies depending on their track and destination. The ranges of frequencies that may be monitored in this particular area are:

Palmerston North control tower: 120.6MHz

Palmerston ATIS: 129.7MHz

FISCOM: 121.3MHz

Massey Operations: 133.3MHz

At the time of the accident the southern training area had additional traffic to the two accident aircraft. The additional traffic were a helicopter transiting from Palmerston North to Wellington and a crop-duster operating at low level in the fields below the impact area.

The helicopter had earlier come into close proximity to ZK-MBL. It could not be determined if ZK-MBL had sighted the helicopter, but given the information from the radar plots it is possible that the helicopter was in one of the blind spots outlined in fig 2.

The crop-duster was conducting topdressing operations in the vicinity of the accident site and flew through some of the falling debris from the mid-air accident. The pilot did not witness the actual impact of the two aircraft.

1.19 Useful or effective investigation techniques

1.19.1 The New Zealand Police Serious Crash Unit assisted the CAA by digitally mapping the aircraft wreckage and wreckage trail. This provided a useful plan map of the site and wreckage dispersion, little extra information could be gained from examining wreckage distribution. The primary information in the accident sequence was provided by analysis of the radar plots.

Although the digital mapping provided limited information in this accident, it is considered that if this accident had been a single aircraft in-flight break-up this technique would be an invaluable tool for the plotting of the break-up sequence.

2. Analysis

2.1 The engine of ZK-MBD revealed no existing mechanical failure. The reason for the descent was the pilot setting up to remain clear of the 1500ft step to the controlled airspace prior to returning to Palmerston North. The descent coincided with the expected time to depart the training area in order to meet the departure time for the next student pilot. The aircraft was operating normally up to the point of collision with the other aircraft.

2.2 ZK-MBL was operating normally as the radar plot showed the aircraft to be climbing at 75kts and 750ft/min. This is consistent with normal operations for the prevailing conditions and aircraft loading.

2.3 The sun position and elevation on the day (fig. 2) would have placed aircraft ZK-MBL flying directly into Sun on the climb out after the PFL. This would have made it almost impossible for the pilot to sight other aircraft in the vicinity. It has been determined that the right turn prior to impact may have been an attempt by the pilot to point the aircraft away from the Sun.

- 2.4 The blind spots⁶ of both aircraft were taken into consideration (fig. 2) and it is evident that for the majority of time, prior to collision, each aircraft would have had the other aircraft in a blind spot. Fig 2 does not detail all the blind spots for this type of aircraft, but excludes engine cowl and port wing of ZK-MBD. The blind spots depicted are those considered to be the most contributing factors.
- 2.5 The aircraft collided in mid-air, with ZK-MBL striking ZK-MBD from underneath the left side. The propeller of ZK-MBL severed the right wing of ZK-MBD with the right undercarriage of ZK-MBD severing the right wing of ZK-MBL. The loss of these primary surfaces rendered the aircraft uncontrollable.

⁶ The blind spots depicted in fig.2 are the left side windscreen support (16°) and the centre windscreen brace including the magnetic compass (20°).

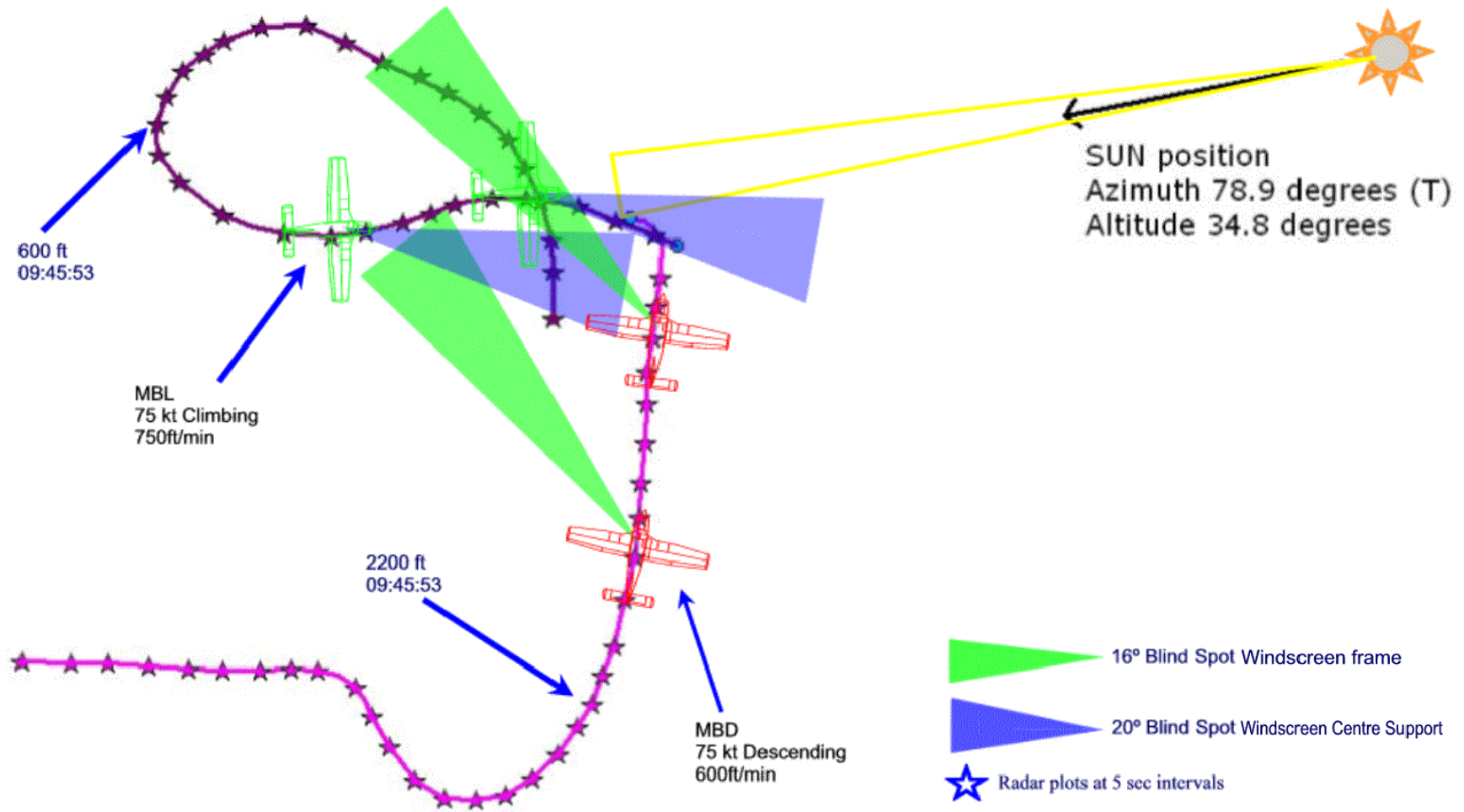


Fig 2 (Blind Spots)

3. Conclusions

- 3.1 Both pilots were appropriately licensed, and experienced for the training being conducted.
- 3.2 Both aircraft had a valid Airworthiness Certificate and had been maintained in accordance with normal aviation practice.
- 3.3 Both pilots were briefed and appropriately authorised for the sequences they were to fly.
- 3.4 ZK-MBL collided with ZK-MBD from underneath the left wing.
- 3.5 The collision resulted in the propeller of ZK-MBL severing the right wing of ZK-MBD. The right undercarriage of ZK-MBL severed the right wing of ZK-MBL.
- 3.6 The accident occurred due to the pilots not being able to sight each other, as a result of the aircrafts' inherent blind spots and the position of the sun.
- 3.7 The accident was not survivable.

4. Safety recommendations

- 4.1 Nil

5. Safety actions

- 5.1 After the accident the Massey University School of Aviation conducted its own internal investigation and implemented some procedural improvements, which relate to para. 1.17 of this report. Massey University School of Aviation has taken steps to implement the new procedures which are outlined at paragraphs 5.2 & 5.3 of this report.
- 5.2 Flight Authorisation: The flight authorisation book now reflects the anticipated training area to be used by each flying school aircraft.
- 5.3 Traffic Density: Massey has now put in place formal briefings between instructors and the duty instructor is to limit the number of Massey school aircraft in each training area.
- 5.4 Other Airspace Users: CAA is currently working with local operators to develop a Common Frequency Zone for the Palmerston North southern training area. Currently all operators in the southern training area have agreed to monitor 119.1 MHz as a common user frequency, until a discrete frequency is issued.

6. Observation

6.1 In 1991 the Bureau of Air Safety Investigation (now the Australian Transport Safety Bureau) (ATSB), produced a report on [Limitations of the See-and-Avoid Principle](#). This report highlighted a number of limitations to the principle of using visual methods of scanning for aircraft. The two areas highlighted in this accident that may have made it difficult to detect and prevent the collision were:

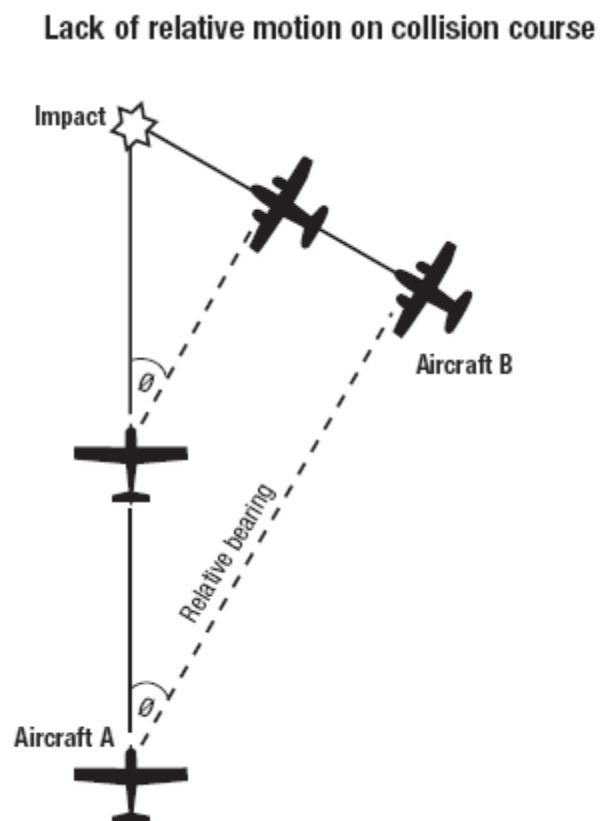
- Lack of relative motion; and
- Time required recognising a threat and taking evasive action.

These articles from the ATSB report “*Limitations of the See-and-Avoid Principle*” are reproduced at paragraphs 6.2 and 6.3.

6.2 Lack of relative motion

The human visual system is particularly attuned to detecting movement but is less effective at detecting stationary objects. Unfortunately, because of the geometry of collision flight paths, an aircraft on a collision course will usually appear to be a stationary object in the pilot’s visual field.

If two aircraft are converging on a point of impact on straight flight paths at constant speeds, then the bearings of each aircraft from the other will remain constant up to the point of collision. From each pilot’s point of view, the converging aircraft will grow in size while remaining fixed at a particular point in his or her windscreen.

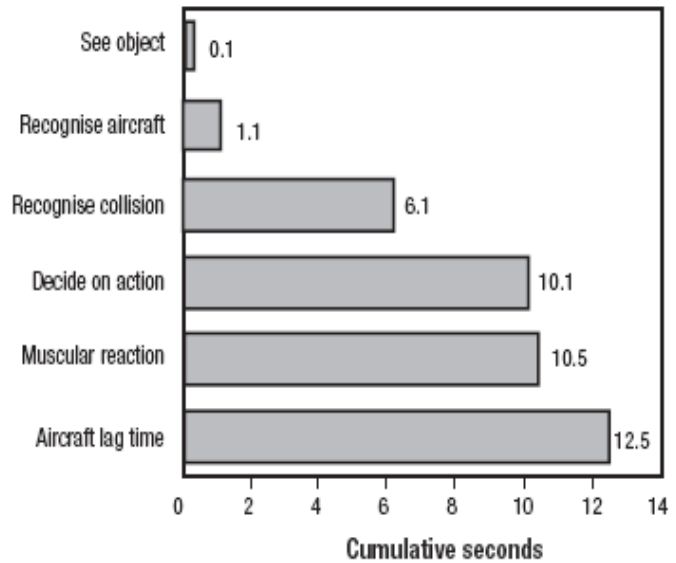


6.3

Reaction Time

The United States of America Federal Aviation Administration advisory circular 90-48-C provides military-derived data on the time required for a pilot to recognise an approaching aircraft and execute an evasive manoeuvre. The calculations do not include search times but assume that the target has been detected. The total time to recognise an approaching aircraft, recognise a collision course, decide on action, execute the control movement and allow the aircraft to respond is estimated to be around 12.5 seconds.

Time to react to collision threat from FAA advisory circular



Therefore to have a good chance of avoiding a collision, a conflicting aircraft must be detected at least 12.5 seconds prior to the time of impact. However, as individuals differ in their response time, the reaction time for older or less experienced pilots is likely to be greater than 12.5 seconds.

Authorised by:

(Signed)

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Date

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