



Department of Transport
Australia

ACCIDENT INVESTIGATION REPORT

Air Safety Investigation Branch

**Cessna 172M Aircraft VH-UGC and
Piper PA28-180 Aircraft VH-UQN
Parafield Airport
South Australia
on 1 February 1976**



Special Investigation Report 76-3

AIR SAFETY INVESTIGATION BRANCH

Accident Investigation Report

**Rossair Pty Ltd
Cessna 172M Aircraft VH-UGC, and
Royal Aero Club of South Australia
Piper PA28-180 Aircraft VH-UQN,
at Parafield, South Australia,
on 1 February 1976**

The Secretary to the Department of Transport authorised the investigation of this accident and the publication of this report pursuant to the powers conferred by Air Navigation Regulations 278 and 283 respectively.

Prepared by: Air Safety Investigation Branch

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Note 1: All times are Central Summer Time except where otherwise stated. Times are based on the 24-hour clock and, where applicable, seconds are shown using a 6 figure group.

Note 2: Metric units are used except for airspeed and windspeed, which are given in knots; and for elevation, height and altitude, which are given in feet.

THE ACCIDENT

At approximately 1216 hours Central Summer Time (CSuT) on 1 February 1976, a Piper PA28-180 Cherokee Archer aircraft, registered VH-UQN, and a Cessna 172M aircraft, registered VH-UGC, collided in flight at a height of about 250 feet, while both aircraft were on final approach for landing on Runway 15 Left at Parafield Airport, Adelaide, South Australia. The aircraft remained locked together following the collision and dived almost vertically to the ground 835 metres before the threshold of the runway. The sole occupant of the Piper and the four occupants of the Cessna were killed.

1 FACTUAL INFORMATION

1.1 HISTORY OF THE FLIGHTS

Cessna 172M aircraft registered VH-UGC was operating under a current certificate of registration, the holder of which was Yorke Motors Pty Ltd. The aircraft was operated by Rossair Pty Ltd and it was engaged on a private flight which had commenced from Parafield Airport at 1127 hours. The flight had been of some fifty minutes duration in the Parafield flying training area and, at the time of the accident, the aircraft was returning to the airport. It was operating under the Visual Flight Rules (VFR); it carried a pilot, Mr N. R. Court, and three passengers.

Piper PA28-180 aircraft registered VH-UQN was operating under a current certificate of registration, the holder of which was the Royal Aero Club of South Australia, and it was operated by that club. At the time of the accident it was engaged on a private flight consisting of a series of take-offs, circuits, and landings at Parafield Airport. The aircraft was operating under the Visual Flight Rules; the pilot, Mr J. R. Fox, was the sole occupant at the time of the collision.

At 1142 hours VH-UQN was cleared to take-off from Runway 15 Left at Parafield to carry out a flight in the circuit area under the supervision of a flying instructor employed by the Royal Aero Club of South Australia. The purpose of the flight was to refamiliarise Mr Fox with the aircraft type. After carrying out two 'touch and go' landings on Runway 15 Centre, the aircraft made a landing to a full stop on Runway 15 Left, then taxied to the apron where the instructor disembarked without the engine being stopped. Mr Fox then taxied VH-UQN to the holding point for Runway 15 Left with the intention of carrying out a period of solo circuits and landings.

At 1205:58 hours VH-UGC advised Parafield Tower that the aircraft was at a position five miles south of the airport and, further, that the current Automatic Terminal Information Service (ATIS) had been received. The transmission of this standard position report indicated the intention of VH-UGC to rejoin the aerodrome circuit pattern.

At 1206:13 hours VH-UQN was cleared to take-off, and 12 seconds later the pilot of VH-UGC sought information on any traffic which might have been crossing his path through the lane of entry to the Parafield Control Zone (see section 1.10). The aerodrome controller advised that there was no such conflicting traffic.

At 1209:03 hours VH-UQN reported 'base for runway centre'. Selection of the centre runway of the complex indicated the intention of the pilot to carry out a 'touch and go' landing. Subsequently VH-UQN was seen to touch down on the runway, continue rolling, take off and climb away.

At 1212:47 hours VH-UGC reported 'base, runway left, full stop', and at 1213:51 hours VH-UQN reported 'base, runway left, full stop'. These transmissions indicated that it was the intention of the pilots of both aircraft to carry out landings to a full stop on Runway 15 Left. Witness evidence indicates that when VH-UGC reported 'base' it was considerably further downwind than VH-UQN when it made its corresponding report consequently, the base leg flown by VH-UGC was further from the airport and its final approach longer than that of VH-UQN.

At 1215:35 hours, during a routine scan of the circuit pattern, the aerodrome controller observed VH-UGC and VH-UQN in close proximity to each other on final approach, with VH-UQN above the other aircraft, and he transmitted the instruction 'Uniform Quebec November go round'. A transmission from another aircraft then occurred on the frequency and, as there had been no response apparent from VH-UQN, the controller repeated the instruction at 1215:41 hours and again at 1215:46 hours.

A few seconds later VH-UQN and VH-UGC collided, the aircraft became locked together, pitched nose-up momentarily and then dived to the ground.

The collision occurred at or about 1215:49 hours in daylight, and in visual meteorological conditions, at a height above the ground of approximately 250 feet. The elevation of the ground impact site was 45 feet above mean sea level, the location being Latitude 34° 47' 20" South, Longitude 138° 37' 38" East.

1.2 INJURIES TO PERSONS

Injuries	Crew	Passengers	Other
Fatal (VH-UGC)	1	3	—
(VH-UQN)	1	—	—
Non-fatal	—	—	—
Minor/None	—	—	—

1.3 DAMAGE TO AIRCRAFT

Both aircraft were destroyed by the collision and subsequent ground impact.

1.4 OTHER DAMAGE

A section of wire fencing at the ground impact point was damaged.

1.5 PERSONNEL

1.5.1 Pilots

Neil Andrew COURT, aged 21 years, was the pilot in command of VH-UGC, and he occupied the left-hand pilot seat. He held a valid private pilot licence endorsed for the aircraft type. Additionally, as he had not carried out the prescribed course of navigational training, his licence was endorsed with appropriate restrictions.

Mr Court's total flying experience amounted to 50 hours 46 minutes of which 25 hours 30 minutes was in command. Except for 4 hours 36 minutes flown in PA28 aircraft, all of Mr Court's experience had been gained in Cessna 150 or 172 type aircraft. He had last flown on 4 January 1976 when he carried out local flying at Parafield Airport in a Cessna 172 aircraft for a period of one hour. His most recent aviation medical examination was passed on 20 May 1974.

John Robert FOX, aged 37 years, was the pilot in command of VH-UQN, and he occupied the left-hand pilot seat. He held a valid private pilot licence endorsed for the aircraft type. Mr Fox's flying log book was not located, but at the time of his last

licence renewal he indicated that he had accumulated a total of 157 hours. It is estimated that his total flying experience at the time of the accident was about 200 hours. The available records indicate that he had last flown on 9 November 1975 when he carried out 50 minutes of local flying at Parafield Airport in the Cessna 172M VH-UGC. Additionally, from the information available it appears that Mr Fox flew reasonably regularly at a fairly low rate. His most recent aviation medical examination was passed on 5 July 1974.

1.5.2 Air Traffic Control

An air traffic control unit is established in the Parafield Tower with provision for two operating positions. Normally it is manned by an aerodrome controller and a surface movement controller.

Michael John MOYNIHAN, aged 29 years, was the aerodrome controller on duty in Parafield Tower at the time of the accident. He held a current air traffic controller licence, and he held ratings for aerodrome control, operations departures control and surface movement control at Parafield. Mr Moynihan completed his basic air traffic control training in February 1974 and he had been stationed at Parafield since February 1975 where, after training in local procedures, he gained his Parafield ratings on 3 May 1975. His last proficiency check was carried out on 27 November 1975 and his last aviation medical examination was passed on 22 May 1975. On the day of the accident, Mr Moynihan was rostered for duty as aerodrome controller between the hours of 0700 and 1310.

William Patrick HOLLAND, aged 46 years, was the surface movement controller on duty in Parafield Tower at the time of the accident. He held a current air traffic controller licence, and he held ratings for aerodrome control and surface movement control at Parafield. Mr Holland completed his basic air traffic control training in September 1964 and he was normally employed on 'check control' duties. Mr Holland had been on duty in the tower since 0700 hours observing procedures and, at about 1200 hours, he took over the surface movement control duties. Mr Holland's last aviation medical examination was passed on 27 August 1975.

1.6 AIRCRAFT INFORMATION

VH-UGC: History

The aircraft VH-UGC was a Cessna 172M manufactured by the Cessna Aircraft Company, Wichita, USA in 1974 and allotted Serial Number 17263669. The aircraft was maintained and operated by Rossair Pty Ltd and its total time in service at the time of this accident was 227 hours. There was a certificate of airworthiness current for the aircraft and it was operating under a current maintenance release.

The Cessna 172M is a four seat, high wing, single-engined monoplane: VH-UGC was painted white with red stripes along the sides of the fuselage and the leading edge of the fin, extending over the top of the fin and rudder. A red anti-collision light was fitted to the top of the fin.

VH-UGC: Loading

The aircraft was engaged on a normal category flight and the maximum take-off weight for a flight in this category, as specified in the flight manual for the aircraft, is 1045 kg. It has been calculated that at the time of the last take-off from Parafield Airport the gross weight was 1017 kg and at the time of the collision it was 998 kg. It has also been calculated that throughout the flight the centre of gravity of the aircraft was within the specified limits.

VH-UQN: History

The aircraft VH-UQN was a Piper PA28-180 Cherokee Archer manufactured by the Piper Aircraft Corporation, Vero Beach, USA in 1974 and allotted Serial Number 28-7505081. The aircraft was maintained by the Royal Aero Club of South Australia and its total time in service at the time of this accident was 250 hours. There was a certificate of airworthiness current for the aircraft and it was operating under a current maintenance release.

The Piper PA28-180 Cherokee Archer is a four seat, low wing, single-engined monoplane: VH-UQN was painted white with green and gold stripes on the sides of the fuselage extending over the tailplane, fin and rudder. A red anti-collision light was fitted to the top of the fin.

VH-UQN: Loading

The aircraft was engaged on a normal category flight and the maximum take-off weight for a flight in this category, as specified in the flight manual for the aircraft, is 1114 kg. It has been calculated that at the time of the last take-off the gross weight was 876 kg and, at the time of the collision it was 870 kg. It has also been calculated that throughout the flight the centre of gravity of the aircraft was within specified limits.

1.7 METEOROLOGICAL INFORMATION

Routine weather observations are made at Parafield Airport by the Weather Service Office of the Bureau of Meteorology. Such observations are made at one-hourly intervals and the weather conditions recorded at 1130 hours were: wind velocity 160 degrees (True) at 16 knots, visibility in excess of 10 kilometres, 6/8 strato cumulus cloud with a base of 2500 feet, dry bulb temperature 22 degrees Celsius, dew point 12 degrees Celsius, altimeter setting QNH 1016 millibars. The weather conditions recorded at 1230 hours were: wind velocity 150 degrees (True) at 17 knots, visibility in excess of 10 kilometres, 4/8 strato cumulus cloud with a base of 3000 feet, dry bulb temperature 22 degrees Celsius, dew point 12 degrees Celsius, altimeter setting QNH 1017 millibars.

The meteorological information being broadcast, at the time of the accident, on the Automatic Terminal Information Service was '... wind one six zero degrees one five to two zero knots, seven eights cloud at three thousand ...'

The cloud cover was evenly distributed across the sky and the sun was virtually overhead. The ground visibility was the same in all sectors and pilot reports indicate that the flight visibility was good in all sectors.

1.8 AIDS TO NAVIGATION

The procedures being followed by each aircraft did not require reference to radio navigation aids and they were not a factor in the accident.

1.9 COMMUNICATIONS

The aerodrome control service communicates with aircraft operating on the active runways and with aircraft flying within or approaching the Parafield Control Zone; these communications are conducted on the VHF frequency of 118.7 MHz. The surface movement control service communicates with traffic operating on the airport surface, other than aircraft operating on the active runways, and these communications are conducted on the VHF frequency of 109.9 MHz.

During the flight of each aircraft, at least until such time as each had completed its 'base' report, all communications were normal. In the fourteen seconds preceding the collision, however, a positive air traffic control instruction was transmitted to VH-UQN on three occasions by the aerodrome controller, but no response was apparent. The question of the tuning and serviceability of the VHF communications equipment in VH-UQN, and also in VH-UGC, was considered: the results of the examinations which were carried out are detailed at section 1.12 of this report.

There is no evidence that the communications equipment in Parafield Tower was not operating normally.

All communications between Parafield Tower and aircraft operating on its radio frequencies are recorded on continuously running magnetic tape. A transcript of the recording for the period relevant to this accident is at Appendix A.

1.10 AERODROME AND GROUND FACILITIES

Parafield Airport is 19.2 kilometres north-east of Adelaide Airport and is contained in airspace designated as a Control Zone which extends vertically to a height of 2000 feet above mean sea level, and laterally for a radius of 3.7 kilometres from the centre of the airport except in the north-western segment where, at a distance of 3 kilometres, the Parafield Control Zone shares a common boundary with the Edinburgh Military Control Zone. The Parafield flying training area is located some 27 kilometres north-west of the airport. Passage between the Parafield Control Zone and the flying training area is provided by a lane of entry with a vertical limit of 2000 feet above mean sea level.

Parafield Airport has three runway complexes numbered 15/33, 08/26 and 03/21, and take-offs and landings may be made in any of the six directions. Each runway complex contains three runways designated Right, Centre and Left by reference to the take-off and landing direction. The runway nearest the apron area is normally used for arriving aircraft, the centre runway is normally used for departing aircraft, and the runway most distant from the apron area is normally used for 'touch and go' landings.

At the time of the accident Runway 15 was the runway complex in use; Runway 15 Right was not available because of a rough surface and was the subject of an appropriate NOTAM. Consequently, Runway 15 Left was being used for take-offs and landings to a full stop, and Runway 15 Centre was being used for 'touch and go' landings.

Operations within a control zone are required to be conducted in accordance with procedures contained in Aeronautical Information Publications and it is specified that secondary control zone procedures and services apply within the Parafield Control Zone. Such procedures are intended to cater for high density operations by general aviation aircraft operating in visual meteorological conditions (VMC), and it is intended that they allow for the fact that judgment by an air traffic controller of aircraft positions and flight paths by visual observations is not sufficiently precise, and his retention of aircraft identity may not be sufficiently reliable in high traffic densities, to enable him to individually direct aircraft flight paths with safety.

The basic concept of the procedures in force in the Parafield Control Zone is that landings and take-offs will be conducted in a standard circuit pattern, the prime responsibility of air traffic control being to control the use of the runways. Other responsibilities include regulating the number of aircraft operating concurrently, issuing clearances for non-standard operations, and providing when practicable and necessary, a collision risk alerting service to aircraft in the circuit pattern. Pilots, irrespective of flight category, are responsible for maintaining their own separation from all other aircraft when operating in VMC by day and it is expected that this will be achieved by their visual observations assisted by position reports made by other pilots in accordance with a prescribed system.

An aircraft being flown in accordance with the standard circuit pattern would climb straight ahead after take-off to a minimum height of 500 feet above the airport elevation; turn left through 90 degrees onto the 'crosswind leg' continuing the climb to 1000 feet above the airport elevation; turn left again through 90 degrees and fly on the 'downwind leg' at 1000 feet parallel to the runway until in a position to make a landing approach; then turn left through 90 degrees onto the 'base leg' descending to about 500 feet; and finally turn left again through 90 degrees onto the 'final leg' and continue the descent to the runway. Allowances for drift would be made on each leg of the circuit pattern in order that the aircraft would track over the ground in a rectangular pattern.

The control tower at Parafield is located in the north-eastern sector of the airport and all traffic on the aerodrome movement area and in the traffic circuit is visible from the tower, but the roof of a large hangar some 300 metres to the north-west of the tower obscures the ground through an arc from 308 degrees to 322 degrees magnetic. The ground beneath the approach path to the Runway 15 complex is included in this area. The distance from the hangar roof to the aerodrome boundary in the line of view from the tower to the accident ground impact site is some 620 metres, and the distance from the boundary to the site is a further 330 metres.

1.11 FLIGHT RECORDERS

Neither aircraft was equipped with flight recorders nor is there any requirement for such equipment to be installed.

1.12 WRECKAGE

With the exception of several slivers of metal which were cut from the rear cabin roof of VH-UGC (Cessna) by the propeller of VH-UQN (Piper), the wreckage of both aircraft was at the point of impact with the ground. All significant components of both aircraft were found. Following a preliminary examination at the impact site, the wreckage of both aircraft was removed to a hangar at Parafield Airport where a more detailed examination was carried out.

The impact with the ground was at an angle of some 70 degrees to the horizontal and the impact forces were absorbed primarily by the collapse of the forward fuselage, the cabin and the wings of the Cessna. After the initial ground impact both aircraft fell rearwards to a horizontal position. Arising from inertia forces at initial ground impact, some forward movement of the Piper occurred relative to the Cessna but, when the wreckage came to rest, both were in essentially the same relative positions as when they had become locked together during the collision.

The Piper nosewheel strut was against the Cessna port inboard flap, close to the fuselage wing root junction, with the nosewheel below the flap. The Piper starboard wing root rested on the Cessna tail cone with the Piper starboard wheel on the right side of the Cessna fuselage. The Piper starboard flap trailing edge was in front of the Cessna fin. There were a series of light scrape marks down the leading edge of the Cessna fin and a light deposit of red paint from the fin of the Cessna was found on the Piper starboard flap trailing edge extending from the flap root and outboard for 1.15 metres. These marks and paint deposits are consistent with the Piper flap having progressed down the leading edge of the Cessna fin.

The Cessna cabin roof and the inboard portions of each wing flap had been slashed. The slashes penetrated the roof and starboard flap from above, and the port flap from below. There were five slash marks on the Cessna cabin roof with the most forward mark being a dent rather than a penetrating slash. These slashes were caused by the Piper propeller, and the most forward mark was consistent with the propeller having come to rest after having rotated two and one half turns following the initial cabin roof

slash. The distance between the two most rearward slash marks was 76 mm. Examination of the propeller slash marks indicated that at the moment of collision the longitudinal axes of the Piper and the Cessna were converging at angles of 7 degrees in the horizontal plane and 5.5 degrees in the vertical plane.

It was determined that, at the time of the collision, the landing flaps of the Piper were fully extended and those on the Cessna were fifty per cent extended. The throttle of the Piper was found fully open and that of the Cessna was half open but, as both aircraft suffered substantial damage as a result of the ground impact, it is considered these are not reliable indications of the throttle settings prior to that time. In both aircraft the lamp filaments of the anti-collision lights were intact and unstretched: it was not possible to establish whether they had been illuminated or switched on at the time of the collision.

The VHF radio transceivers in both aircraft were damaged by impact forces. The transceiver fitted to the Piper was found selected to the frequency of 118.7 MHz, and that of the Cessna to 118.8 MHz—the aerodrome control frequency at Parafield is 118.7 MHz. The volume control potentiometer shaft of the Piper transceiver had been broken off in the impact and accordingly its setting was not necessarily the same as immediately prior to the accident. After replacement of some components which had been crushed in the impact, the transceiver operated satisfactorily although the volume setting was low. Microscopic examination of the frequency selector knob from the transceiver installed in the Cessna disclosed a tangential score across one of the flutes. The score was in the direction which could have moved the frequency selector from a lesser to a higher value and it probably occurred during the break-up of the fuselage at ground impact. The impact damage sustained by the transceiver installed in the Cessna was extensive and it was not possible to carry out a functional test. The volume control was set at about 40 per cent of available travel.

No evidence was found of any defect or malfunction in either aircraft which might have contributed to the collision.

1.13 MEDICAL AND PATHOLOGICAL INFORMATION

Post-mortem examinations were undertaken of all the victims. There was no evidence of any pre-existing abnormality or of any condition which could have contributed to the accident.

1.14 FIRE

Neither aircraft was subject to fire either in the air or on subsequent impact with the ground.

1.15 SURVIVAL ASPECTS

This was not a survivable accident.

1.16 TESTS AND RESEARCH

1.16.1 The Perceptibility of Each Aircraft

Consideration has been given to the question of whether or not each aircraft would have been discernible to the pilot of the other having regard to the probable flight paths of the aircraft, the ambient conditions existing, visual acuity, and assuming an absence of physical obstruction.

At Appendix B the probable flight paths of the aircraft are shown and three positions deemed to be significant were selected for study. These positions are notated as A, B and C on the probable flight path of the Piper, the corresponding positions in time being notated as A1, B1 and C1 on the probable flight path of the Cessna. These positions are calculated to have been 100 seconds, 60 seconds and 20 seconds prior to collision.

The results of the study indicated that, provided the contrast was reasonable, the eyes were accommodated to distant vision, and having regard to the target sizes at these points in time, the pilot of each aircraft had the capability to have sighted the other aircraft if he looked in the appropriate direction. If, however, the pilot of the Piper only looked straight ahead, then normal peripheral vision is such that he could not have sighted the Cessna at Position A1; it would have been marginally possible for him to have sighted the Cessna at Position B1, but he could have sighted the Cessna at Position C1. In the case of the pilot of the Cessna, normal peripheral vision is such that he could not have sighted the Piper at Positions A, B or C.

In respect of contrast it should be noted that if the background to an aircraft is sky, the contrast is usually good; but if the background is terrain, the contrast can be so low that an aircraft may be hard to see even at close range. At the positions considered in this study the Cessna was below the horizon as viewed from the Piper, and because of the variations in the height of the range of hills behind the Piper it may have been just above or just below the horizon as viewed from the Cessna.

1.16.2 Cockpit Visibility

A study of cockpit visibility of the aircraft types was conducted. Two aircraft having window configurations identical with the Cessna and the Piper were selected to determine the restrictions to visibility imposed on each pilot by the aircraft structure when seated in a normal flying position. The seats were adjusted to the positions as determined from the examination of the aircraft wreckage. Two persons of stature similar to that of the pilots involved in the accident assisted, and each was restrained with a seat belt and shoulder strap. For each 5 degrees of azimuth the limiting angles of vision in elevation and declination were measured. These values were corrected for terrain slope and aircraft attitude to obtain angles relative to the longitudinal and lateral axes of each aircraft.

A chart for each aircraft was then prepared showing angles of azimuth horizontally and the limiting angles of elevation and declination in a vertical plane. These charts are presented at Appendixes C and D. When used in conjunction with the probable flight paths flown by the Piper and the Cessna, Appendix C indicates that provided the wings of the Piper were level, there was no obstruction to the sighting of the Cessna by the pilot of the Piper when the Cessna was at Positions A1, B1, and until about 25 seconds prior to the collision; but the Cessna would have been obscured when it was at Position C1 and the Piper was at Position C (20 seconds prior to the collision) at which position the Piper was banked some 30 degrees to the left. Appendix D indicates that in respect of the pilot of the Cessna, the Piper would have been either obscured, or likely to have been obscured by the port wingtip area of the Cessna during the time the Cessna was initially banked some 5 degrees to the left, through Position A1, and as it then continued on its final approach in a wings level attitude.

1.16.3 Interference to Tower Transmissions

Examination of the tape recording of the aerodrome control frequency indicated that the first 'go-round' instruction transmitted by the aerodrome controller partially coincided with a transmission from an aircraft, VH-SUN. Although the pilot of another aircraft reported hearing all three 'go-round' transmissions clearly, tests were

carried out with aircraft at various positions in the Parafield circuit pattern in order to determine whether or not interference generated by simultaneous transmissions may have caused the controller's 'go round' instruction to be unintelligible to the pilots of VH-UQN and VH-UGC. It was determined that a tower transmission will invariably be heard above a simultaneous aircraft transmission: the power output of the aerodrome control transmitter is some 60 to 75 watts, whereas the output of the average light aircraft transmitter is between 1 and 5 watts.

1.17 ADDITIONAL INFORMATION

1.17.1 Traffic

The traffic situation and its spacing in time in the Parafield Control Zone in the five minute period preceding the collision was as follows:

- 1210:45 : Piper VH-BWE reported 'base' for a landing to a full stop on Runway 15 Left; and the landing was subsequently completed
- 1211:46 : Piper VH-POH reported 'base' for a landing to a full stop on Runway 15 Left; and the landing was subsequently completed
- 1212:47 : Cessna VH-UGC reported 'base' for a landing to a full stop on Runway 15 Left
- 1213:51 : Piper VH-UQN reported 'base' for a landing to a full stop on Runway 15 Left
- 1215:35 : Beech VH-SUN reported 'base' for a landing to a full stop on Runway 15 Left
- 1215:49 : Collision
 - Piper VH-BWE was taxiing on the taxiway parallel to the Runway 15 complex, towards the holding bay adjacent to the threshold of Runway 15 Left
 - Piper VH-POH had just vacated Runway 15 Left and was about to enter the same taxiway as VH-BWE

1.17.2 Flight Path Reconstruction

Parafield Airport is bounded on three sides by populated areas and although there were a number of witnesses who saw both aircraft when they were in very close proximity to each other immediately before the collision, and an even larger number whose attention was attracted by the sound of the collision, only two witnesses were found who observed both aircraft for any substantial period of time prior to the collision.

The aerodrome controller saw each aircraft turning from the downwind leg onto the base leg of their respective circuits at the time the pilots transmitted their 'base' reports but, other than recalling that the position of the Cessna had been further downwind than the position of the Piper when it reported about one minute later, he was not able to indicate accurately the position at which each transmitted its 'base' report. He next sighted the aircraft about 16 seconds before the collision when both were on final approach.

One witness, familiar with traffic in the Parafield circuit pattern, was located directly below a Cessna aircraft when it passed overhead proceeding in a south-westerly direction apparently on the base leg of a circuit. He has stated that he then entered his car and while driving in a south-westerly direction saw the same aircraft ahead of him proceeding towards Runway 15 at Parafield Airport. A few seconds later he looked to his left and saw a Piper aircraft in a turn to the left, apparently completing its turn from a downwind leg onto the base leg of a circuit. He continued to observe both aircraft and when they disappeared from his view behind trees they were in close

proximity to each other with the Piper in a 30 to 40 degree banked turn to the left, positioned above, to the left, and a little behind the Cessna. The positions from which this witness observed the aircraft are shown on Appendix B as X, X1, X2 and X3.

Another witness was located 1525 metres north-west of the threshold of Runway 15 Left and 290 metres to the left of the extended centreline of the runway. She has stated that she first saw a Cessna aircraft, on a bearing subsequently measured as 290 degrees magnetic, in descending flight, with the wings level and on a heading of approximately 150 degrees magnetic. She then saw a Piper aircraft approaching directly towards her position on a bearing subsequently measured as 062 degrees magnetic. The Piper was higher than the Cessna and it appeared to be descending at a faster rate. When directly over her head, at a time calculated to have been 23 seconds prior to the collision, the Piper banked about 30 degrees to the left still descending and after it had turned onto the same heading as the Cessna, its wings levelled and it continued descending until the aircraft collided. The position of this witness is shown on Appendix B as Y.

Because neither aircraft was equipped with flight recording equipment, it has not been possible to determine their flight paths with absolute precision. The illustration of the reconstructed flight paths at Appendix B has been constructed mathematically within the constraints imposed by the time of the collision—calculated to have been 1215:49 hours—using normal aircraft operating procedures and air speeds. Allowance has been made for wind effect, and the observations of the eyewitnesses and the information obtained from the examination of the wreckage have been taken into account. The heights of each aircraft during flight from their respective downwind legs of the circuit pattern to the collision point have been based on both aircraft descending at constant rates from a height of 1000 feet above the ground at the time of their 'base' reports, to a height of 250 feet at the collision point. Any departure from normal procedures or airspeeds will have varied the flight paths to some degree from those illustrated, but not to an extent significant to an analysis of the circumstances of the accident.

2 ANALYSIS

The investigation did not reveal any evidence of any weather condition, defect or malfunction of either aircraft, which could have had a bearing on the accident.

There was no evidence that either of the pilots concerned, or the air traffic controllers, were in other than normal health, and both pilots were familiar with the aerodrome layout and the procedures at Parafield Airport.

The traffic sequence in the period immediately prior to the collision consisted of five aircraft; the first four aircraft were in the circuit pattern and the fifth aircraft, Beech Musketeer VH-SUN, was joining the circuit pattern. The first four aircraft reported 'base' at approximately one minute intervals to carry out landings to a full stop on Runway 15 Left; Cessna VH-UGC and the Piper VH-UQN were the third and fourth aircraft respectively in the sequence. All of the aircraft were of approximately similar performance and the first two aircraft completed their landings without incident. Although they were initially separated in time, similar to the first two aircraft, the third and fourth aircraft collided whilst they were on final approach, and it is apparent that factors significant to the investigation are the circumstances which gave rise to a loss of separation, and why the loss of separation was not detected in sufficient time for the collision to have been avoided.

The probable flight paths of Cessna VH-UGC and Piper VH-UQN are illustrated at Appendix B, and it can be seen that the downwind leg of the circuit pattern flown by the Cessna was longer than the norm, with an incidental result that when the Cessna was on the base leg of its circuit it was flying within the Edinburgh Military Control

Zone. Having regard to the fact that when the accident occurred, the Cessna was separated longitudinally by an appropriate distance behind the preceding aircraft in the traffic sequence, it is possible that the pilot consciously flew this circuit pattern in order to obtain such separation. It is significant, however, to the accident circumstances and to the loss of separation in time with the Piper, that the circuit flown by the Cessna resulted in a long final approach into a relatively strong wind of some 20 knots with a consequent low ground speed. It is calculated that this flight path, in conjunction with Cessna 172 approach speeds which are normally some 10 knots slower than those of a Piper PA28-180, resulted in the Cessna taking three minutes two seconds to fly from the position at which the pilot reported 'base', to the collision point; whereas the Piper took one minute fifty-eight seconds to fly from the position at which the pilot reported 'base', to the collision point.

At the commencement of the circuit on which the collision occurred, the Piper had carried out a 'touch and go' landing on Runway 15 Centre and at the time the Cessna reported 'base', it is probable that the Piper would have been on a crosswind leg of the circuit pattern and about to turn onto a downwind leg. There is no reason to believe that the pilot of the Piper was not maintaining the required listening watch on the aerodrome control frequency but, assuming that he heard the report from the Cessna, it is very doubtful whether, in the knowledge of the geographical separation then existing, i.e. a complete downwind leg, he would have considered the Cessna to be a potential traffic hazard for the remainder of his circuit. Conversely, at this time the pilot of the Cessna probably would not have been aware of the presence of the Piper and his primary traffic concern would have been the preceding aircraft. The substantial longitudinal separation then existing between Cessna VH-UGC and Piper VH-UQN would have appeared to the aerodrome controller to have been more than adequate.

When the pilot of Piper VH-UQN reported 'base' as he was initiating the turn onto a base leg, the first aircraft in the traffic sequence, Piper VH-BWE, was either on very short final nearing touchdown, or on the ground. The second aircraft, Piper VH-POH, was in the vicinity of the turn from its base leg onto final approach. The third aircraft, the Cessna VH-UGC, was in a shallow, banked left turn from its base leg onto a long final approach, this position being some 3400 metres distant from VH-UQN, at a lower height than VH-UQN, and some 65 degrees to the left of VH-UQN.

It can be postulated that, if the pilot of Piper VH-UQN saw the second aircraft in the traffic sequence, he may have accepted it as the one immediately preceding him, although it was not a Cessna. If this was the case, and bearing in mind that he would then have been primarily concerned with planning his landing approach in respect of the first two aircraft in the traffic sequence, he may not have devoted the concentrated attention necessary to have detected the Cessna in an area in which he was not expecting other traffic. It is not insignificant that, at the time of collision, both Cessna VH-UGC and Piper VH-UQN were appropriately positioned to land behind the second aircraft in the sequence.

As the Cessna and the Piper continued their approaches the two aircraft converged and, from the cockpit visibility studies conducted (Appendixes C and D), it can be seen that, as the Piper was being flown along its base leg, the Cessna would have been visible in the right side of the windscreen of the Piper had the pilot been looking in that direction. It is also significant that during this period, the relative bearing of the Cessna from the Piper remained virtually constant at about 40 degrees to the right; thus, there was little relative movement to have attracted the attention of the pilot, also it is probable that there was little contrast between the Cessna and the background against which it could be viewed. Additionally, the perceptibility studies indicate that if the pilot of the Piper did not look directly at the Cessna, it is unlikely that he would have seen it in his peripheral vision. On the other hand it is probable that because of the high

wing configuration of the Cessna in conjunction with the lower height of the Cessna relative to the Piper, the sector of the circuit pattern occupied by the Piper would have been obscured to the pilot of the Cessna by the port wing tip area of his aircraft. Had he banked his aircraft and looked in the direction of the Piper, it should have been visible about 90 degrees to his left but, as mentioned above, there was little relative movement, and the Piper would have been just above or just below the skyline of the Mount Lofty Ranges as viewed from the Cessna.

The aerodrome controller did not observe the two aircraft during the period the Piper was proceeding along its base leg but, had he done so, it is unlikely that it would have been practicable for him to have made a proper assessment of the collision risk which was developing. For instance, when the Piper and the Cessna were at the positions notated B and B1 on Appendix B, they were some 2400 metres from the controller and it is improbable, having regard to the difficulty of depth perception at this distance, that he would have been able to perceive the flight path of the Piper with sufficient precision to have determined that it was approaching the final leg of the circuit pattern at an angle of 65 degrees instead of the normal 90 degrees; or that the relative ground speeds of the Piper and the Cessna differed significantly.

Immediately before the Piper commenced its turn onto final approach, i.e. about 25 seconds before the collision, the Cessna was some 300 metres from the Piper and 25 degrees to the right of directly ahead. Both aircraft were laterally level and it is calculated on the basis of the flight paths and profiles illustrated at Appendix B, that the Piper would have been some 50 feet higher than the Cessna and the Cessna would have been within the field of view of the pilot of the Piper. However, this is an idealised calculation; if the actual vertical distance between the two aircraft was 138 feet or more, the Cessna would have been concealed from the view of the pilot of the Piper by the instrument panel coaming. This is the most logical explanation for the apparent failure of the pilot of the Piper to see the Cessna at this time.

Some 23 seconds before the collision the Piper entered a 30 degree banked left turn onto final approach and during this turn, although continuing to converge on the Cessna, there was no possibility of the pilot of the Piper sighting that aircraft as it would have been below his field of view. Similarly, the pilot of the Cessna would have been unable to sight the Piper as it would have been concealed by the port wing of the Cessna. The transcript of communications at Appendix A indicates that at 1215:35 hours, some 14 seconds before the collision, the controller commenced his first transmission to the Piper to 'go round' and, due to an overlapping transmission from VH-SUN, the frequency was not clear until 10 seconds before the collision. If an allowance of 2 seconds is made for the controller's recognition and reaction time, it is probable that this instruction was issued when the Piper was rolling out of the turn from its base leg onto final approach. At this time the Piper was behind, above and to the left of the Cessna.

It has been established from the wreckage examination that at the instant of collision the Piper was flying at least 8 knots faster than the Cessna, and it has been calculated that 10 seconds before collision the distance separating the aircraft was 33 metres. Reverting to the idealised flight path profile, the Cessna should have been clearly visible to the pilot of the Piper, directly ahead, during the last 10 seconds; however, had the vertical separation between the two aircraft been as little as 10 feet in excess of that calculated it would have resulted in the Cessna being below the field of view of the pilot of the Piper. Since the pilot of the Piper did not take any avoiding action, and there is no evidence of any aircraft defect or of any pilot incapacitation, it is concluded that the vertical separation was such that the Cessna was not visible to him.

The circumstances of this accident were that the Cessna was making a long final approach; the Piper was joining the same final approach path at an oblique angle, initially behind the Cessna and it would have been difficult for the controller to have

determined whether or not adequate separation existed between the two aircraft until such time as both were established on final approach. The possibility that the initial transmission instructing the Piper to 'go round' may have been partially blanked out by VH-SUN transmitting on the same frequency has been considered but tests have shown that the tower transmission should have been readable by the pilot of the Piper. A second transmission 'UNIFORM QUEBEC NOVEMBER go round', commenced at 1245:41 hours and completed at 1245:42 hours, should have been clearly audible to the pilot of the Piper and it probably offered the last opportunity for the pilot to take action in the remaining 7 seconds to avoid the collision. At the time of the last transmission, which concluded 2 seconds before the collision, the accident was inevitable.

An instruction from an aerodrome controller to an aircraft to 'go around' is routine during flying training at secondary airports. It most frequently occurs when an aircraft is on the runway and another, on final approach for landing on the same runway, is too close to permit the first aircraft to clear the runway prior to its landing. In most such cases the pilot of the second aircraft will initiate 'go around' procedures but there are occasions when the aerodrome controller may consider it necessary to intervene and instruct the second aircraft to 'go around'. The situation may also arise when two aircraft are on final approach for the same runway with insufficient longitudinal separation to allow the first to land and clear the runway before the second lands. If the pilot of the second aircraft appears to the aerodrome controller to be unduly delaying his decision to go around, the controller will normally instruct him to do so.

The significant difference between the routine 'go around' situations described above and the circumstances associated with this accident is that in the routine cases the pilot of the second aircraft is aware of the presence of the preceding aircraft and at least partially mentally prepared to 'go around', whereas in this accident the pilot of the Piper was obviously totally unaware of the imminent presence of the Cessna. If the pilot of the Piper heard and appreciated the 'go around' call directed to his aircraft, he may well have been confused by the apparent absence of any visible reason for discontinuing his approach, for the second aircraft in the traffic sequence was taxiing clear of the runway and the runway was available for a following aircraft. Alternatively, the pilot of the Piper may not have heard and/or appreciated that an instruction was being transmitted to him because, having transmitted his 'base' report he was not expecting any further radio contact prior to landing, and he had not observed any potential conflicting traffic situation which would alert him to the possibility of a control instruction. The possibility that the pilot may have inadvertently reduced the volume control setting whilst operating other aircraft controls was examined but the proposition could not be supported. Another possibility considered was that the pilot may have deliberately reduced the volume control setting but this could not be resolved.

In May 1975 Aeronautical Information Circulars were issued to pilots and air traffic controllers to remind them of their responsibilities in respect to operations in, or in the vicinity of, control zones at secondary airports. In particular these circulars introduced the use of the cautionary word **ALERT** by air traffic controllers when providing a traffic alerting service to aircraft in apparent conflict. The phraseology commences with the word **ALERT**, then a brief description of the apparent situation using aircraft call signs, if readily available, otherwise aircraft types, e.g. **ALERT—FINAL—CHEROKEE CONVERGING ON CESSNA (from LEFT, ABOVE, etc.).** The instruction passed to VH-UQN by the aerodrome controller did not use the recommended phraseology, and consequently it did not provide a proper alert to the pilot of the Cessna to a situation in which he may have been able to take some avoiding action. Notwithstanding the fact that a positive control instruction was directed by the

aerodrome controller to the aircraft best placed to avoid the collision, and had the pilot of that aircraft reacted as expected by the controller the accident probably would have been avoided, it is considered that the use of the standard alerting phraseology would have been preferable.

The chain of events leading to this accident commenced when the Piper turned onto a base leg inside that being flown by the Cessna, with each pilot apparently positioning himself for landing behind the second aircraft in the traffic sequence. This circumstance could have been overcome at any time whilst both aircraft were on their respective base legs, and initially whilst the Cessna was on its final approach, if either of the pilots had scanned, or adequately scanned, the airspace to the left and right of their aircraft. These are the principal areas of the circuit pattern where pilots must position their aircraft relative to one another; consequently, they are areas where scanning of the airspace is most important and it is significant that, due to the limitations of the human eye, it is in the area of the base leg where aircraft are a considerable distance from an aerodrome controller and moving across his line of vision, that a controller can render the least assistance in respect of visually separating the traffic. The last opportunity to avoid this accident was at or about the time the aerodrome controller sighted the two aircraft on final approach converging in a vertical plane; co-incidentally, this was the first practical opportunity available to the aerodrome controller to perceive the traffic situation and he reacted promptly in an attempt to prevent the collision.

3 CONCLUSIONS

1. The pilots of both aircraft, and the aerodrome controller, were appropriately qualified and licenced for the duties they were undertaking.
2. There was a current certificate of airworthiness for each aircraft and there was no evidence of any defect or malfunction in either aircraft which could have contributed to the accident.
3. Each aircraft was loaded within safe limits.
4. The weather conditions were better than the minimum prescribed for visual flight and did not contribute to the accident.
5. Each of the aircraft was required to be operated in accordance with the Visual Flight Rules; they were not subject to air traffic control directions for separation and the pilots were each responsible for securing separation from other aircraft based upon their own visual observations.
6. There were five aircraft of similar performance in the traffic sequence, all intending to land on Runway 15 Left. The first four aircraft reported 'base' at approximately one minute intervals: VH-UGC and VH-UQN were the third and fourth aircraft respectively.
7. During the period of flight from about 100 seconds to about 25 seconds prior to the collision, the constant angle in the horizontal plane of VH-UGC from the heading of VH-UQN was approximately 40 degrees to the right; and the constant angle of VH-UQN from the heading of VH-UGC was approximately 90 degrees to the left.
8. During the final 16 seconds of flight, both aircraft were established on final approach for landing: at the collision point VH-UQN was almost directly above VH-UGC, it was descending along a steeper flight path and its airspeed was at least 8 knots faster.
9. The aircraft collided at a height of approximately 250 feet, some 835 metres north-west of the threshold of Runway 15 Left, whilst both aircraft were in an appropriate position for a landing behind the second aircraft in the traffic sequence.

10. Fourteen seconds prior to the collision the aerodrome controller transmitted 'UNIFORM QUEBEC NOVEMBER go round'. This instruction was repeated eight seconds and again three seconds prior to the collision, but no change in the flight path of VH-UQN was apparent.

11. Notwithstanding the fact that a positive control instruction was directed by the aerodrome controller to the aircraft best placed to avoid the collision, the use of the standard alerting phraseology would have been preferable.

12. The reason for the apparent absence of response by VH-UQN has not been determined.

CAUSE

The cause of the accident was that, whilst operating in those areas of the circuit pattern where confliction could have been detected, neither pilot exercised the degree of vigilance necessary for the avoidance of collision.

A contributory factor was that the alerting service provided by air traffic control at secondary control zones is limited by the inherent difficulty of depth judgement.

APPENDIX A

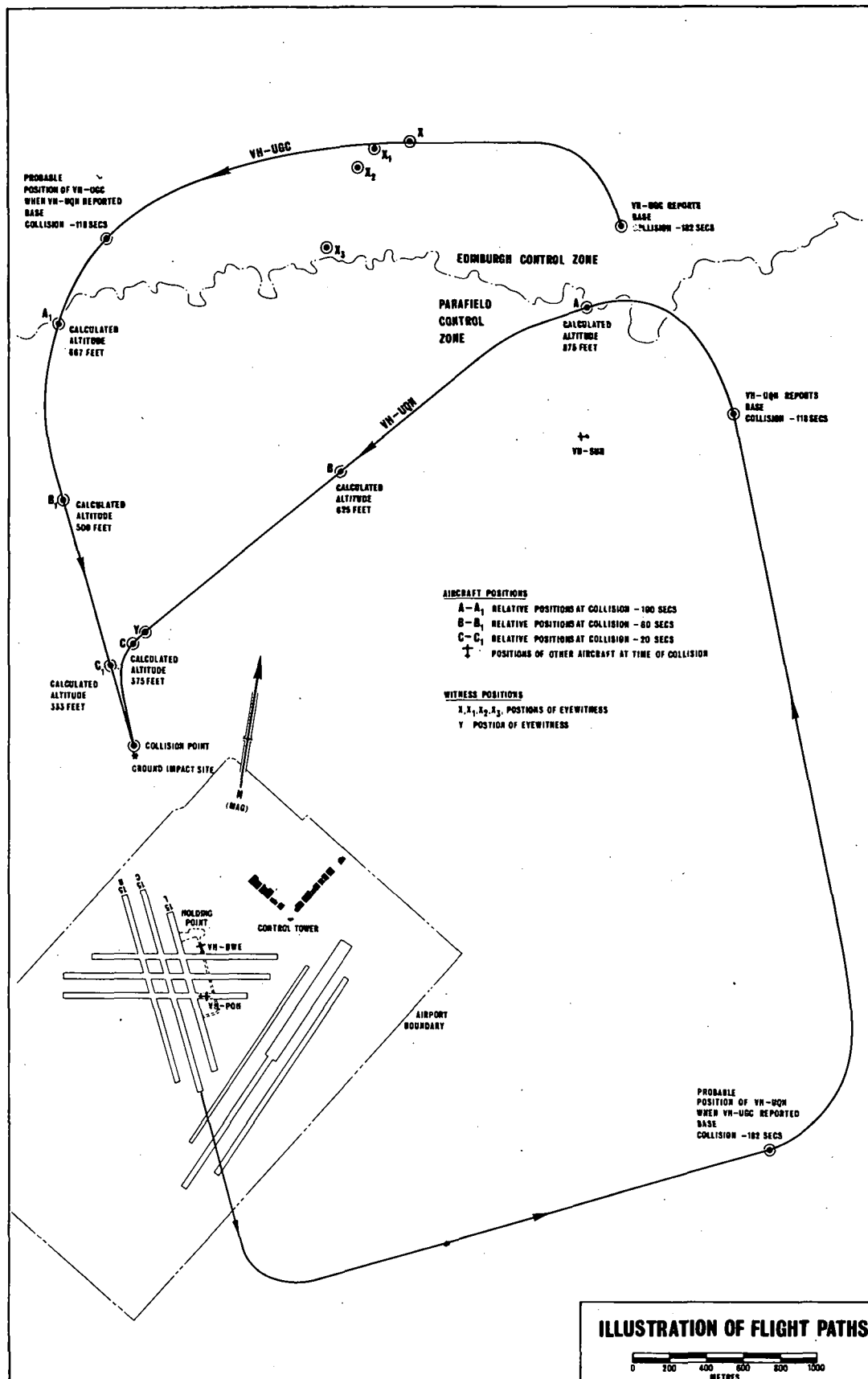
Transcript of Communications Recorded at Parafield Tower Between 1205 Hours and 1216 Hours on 1 February 1976

Legend

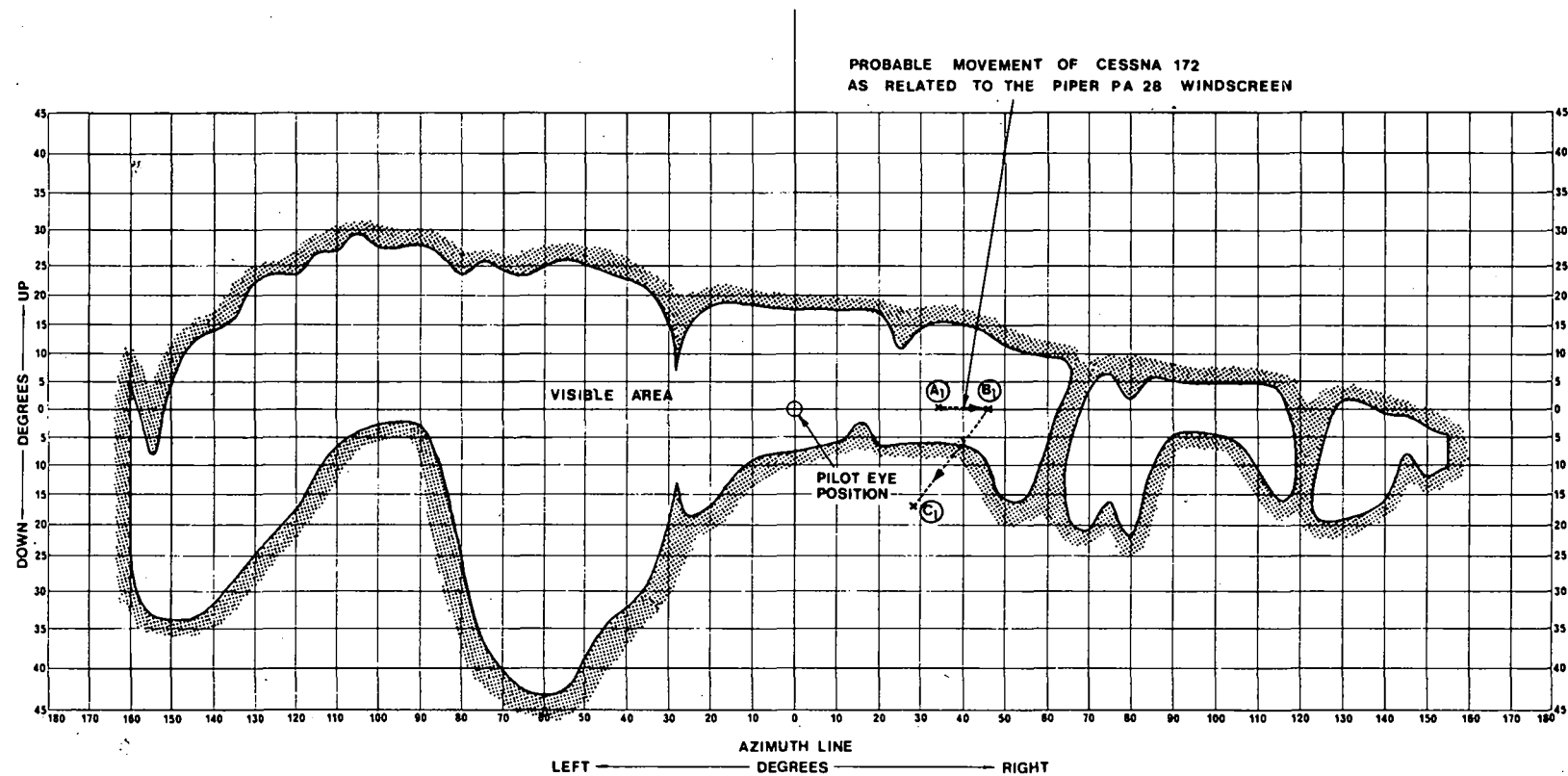
ADC — Aerodrome Controller, Parafield Tower
BWE — PA28-180 aircraft VH-BWE
POH — PA28-235 aircraft VH-POH
UGC — Cessna 172M aircraft VH-UGC
UQN — PA28-180 aircraft VH-UQN
SUN — Beech 23 aircraft VH-SUN
(:37) — Time transmission ends—seconds

TIME Hrs/Mins/ Secs	FROM	TO	TEXT
1205:58	UGC	ADC	Parafield Tower this is UNIFORM GOLF CHARLIE five miles south received charlie
1206:03	ADC	UGC	UNIFORM GOLF CHARLIE
1206:07	UQN	ADC	UNIFORM QUEBEC NOVEMBER ready
1206:13	ADC	UQN	UNIFORM QUEBEC NOVEMBER clear for take-off
1206:17	UQN	ADC	UNIFORM QUEBEC NOVEMBER
1206:25	UGC	ADC	Parafield Tower this is UNIFORM GOLF CHARLIE is there any cross route traffic
1206:30	ADC	UGC	UNIFORM GOLF CHARLIE negative
1206:34	UGC	ADC	UNIFORM GOLF CHARLIE say again
1206:35	ADC	UGC	Negative
1206:39	UGC	ADC	UNIFORM GOLF CHARLIE
1206:42	POH	ADC	Cherokee PAPA OSCAR HOTEL ... centre touch and go
1206:46	ADC	POH	PAPA OSCAR HOTEL
1207:16	BWE	ADC	BRAVO WHISKY ECHO ready
1207:20	ADC	BWE	BRAVO WHISKY ECHO clear for take-off
1207:23	BWE	ADC	BRAVO WHISKY ECHO
1207:44	SUN	ADC	Parafield Tower good afternoon this is Musketeer ah SIERRA UNIFORM NOVEMBER five north-east inbound received charlie and may we join base for one five
1208:03	ADC	SUN	SIERRA UNIFORM NOVEMBER ah Parafield Tower ah overfly
1208:11	SUN	ADC	SIERRA UNIFORM CHA ah NOVEMBER will you say again
1208:15	ADC	SUN	Roger ah SIERRA UNIFORM NOVEMBER do a standard rejoin due traffic
1208:25	SUN	ADC	SIERRA UNIFORM NOVEMBER make a full circuit
1209:03	UQN	ADC	UNIFORM QUEBEC NOVEMBER base for Runway centre

TIME Hrs/Mins/ Secs	FROM	TO	TEXT
1209:09	ADC	UQN	UNIFORM QUEBEC NOVEMBER
1210:45	BWE	ADC	BRAVO WHISKY ECHO base Runway left
1210:48	ADC	BWE	BRAVO WHISKY ECHO
1211:46	POH	ADC	Cherokee PAPA OSCAR HOTEL Base Runway left full stop
1211:51	ADC	POH	PAPA OSCAR HOTEL
1212:47	UGC	ADC	Parafield Tower this is Cessna UNIFORM GOLF CHARLIE base Runway left full stop
1212:53	ADC	UGC	UNIFORM GOLF CHARLIE
1213:51	UQN	ADC	Cherokee UNIFORM QUEBEC NOVEMBER base for Runway left
1213:56	ADC	UQN	UNIFORM QUEBEC NOVEMBER
1214:55	POH	ADC	PAPA OSCAR HOTEL request on ah two six to ah the taxiway
1215:00	ADC	POH	PAPA OSCAR HOTEL clear to taxi
1215:35	ADC	UQN	UNIFORM QUEBEC NOVEMBER go round (:36)
	SUN	ADC	... UNIFORM NOVEMBER base ah one five left full stop (:39)
1215:41	ADC	UQN	UNIFORM QUEBEC NOVEMBER go round (:42)
1215:46	ADC	UQN	UNIFORM QUEBEC NOVEMBER go round (:47)
1216:06	SUN	ADC	SIERRA UNIFORM NOVEMBER base for one five left.



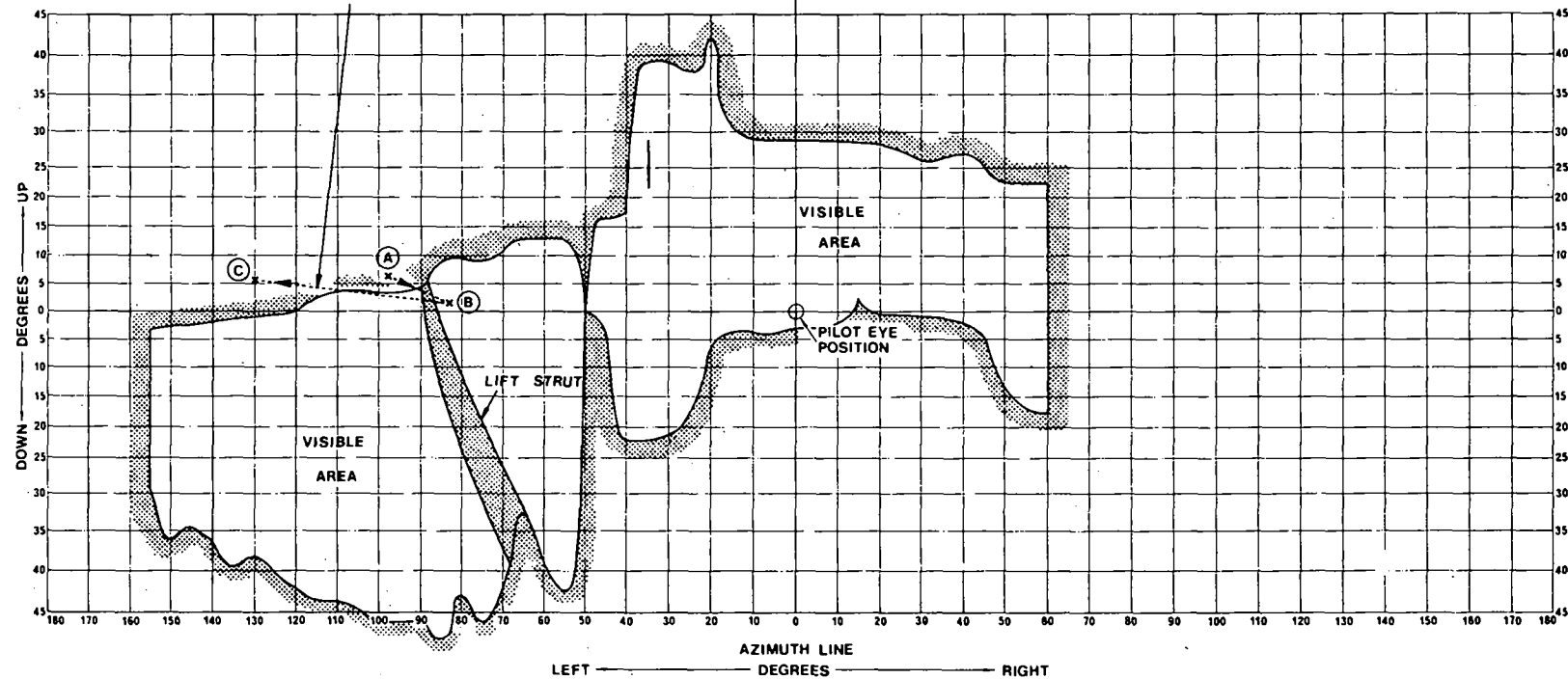
PILOT POSITION - LEFT HAND SEAT



PIPER PA 28 - 180
COCKPIT VISIBILITY DIAGRAM

PILOT POSITION - LEFT HAND SEAT

PROBABLE MOVEMENT OF PIPER PA 28
AS RELATED TO THE CESSNA 172 WINDSCREEN



CESSNA 172M
COCKPIT VISIBILITY DIAGRAM



Special Investigation Report 76-3

Corrigendum

AIR SAFETY INVESTIGATION BRANCH

Accident Investigation Report

**Rossair Pty Ltd
Cessna 172M Aircraft VH-UGC, and
Royal Aero Club of South Australia
Piper PA28-180 Aircraft VH-UQN,
at Parafield, South Australia,
on 1 February 1976**

The Secretary to the Department of Transport authorised the investigation of this accident and the publication of this report pursuant to the powers conferred by Air Navigation Regulations 278 and 283 respectively.

Prepared by: Air Safety Investigation Branch

November 1976

Page 1.

Paragraph 5, line 2.

Delete words "five miles south of the airport"

Insert in lieu "over Torrens Island inbound to the airport".

Page 16 and 17.

Delete Appendix A in toto

Insert in lieu new Appendix A attached.

APPENDIX A

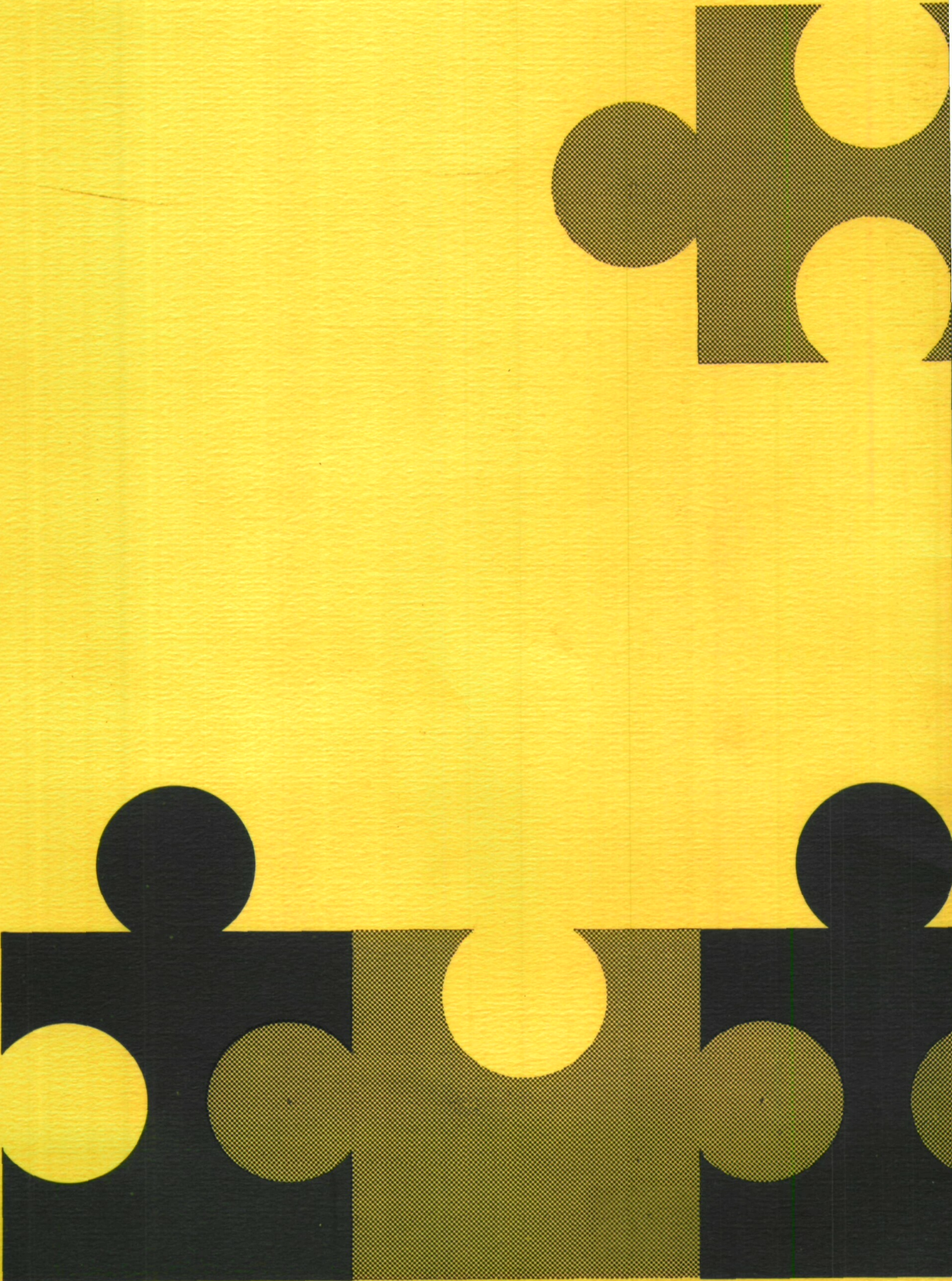
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... — Pause

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