

Department of Transport  
Australia

**ACCIDENT INVESTIGATION REPORT**

Air Safety Investigation Branch

**DH104 Series 5 Aircraft VH-WST,  
and PA30-160B Aircraft VH-WWB,  
near Bankstown Airport,  
New South Wales,  
on 13 March, 1974**



Special Investigation Report 74-1

**AIR SAFETY INVESTIGATION BRANCH**

## **ACCIDENT INVESTIGATION REPORT**

**Skyway Pty. Ltd.  
De Havilland DH104 Series 5  
Aircraft VH-WST and  
Navair Pty. Ltd.  
Piper PA30-160B Aircraft VH-WWB  
at Bankstown, New South Wales  
on 13 March 1974**

The Secretary to the Department of Transport and Director General of Civil Aviation 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

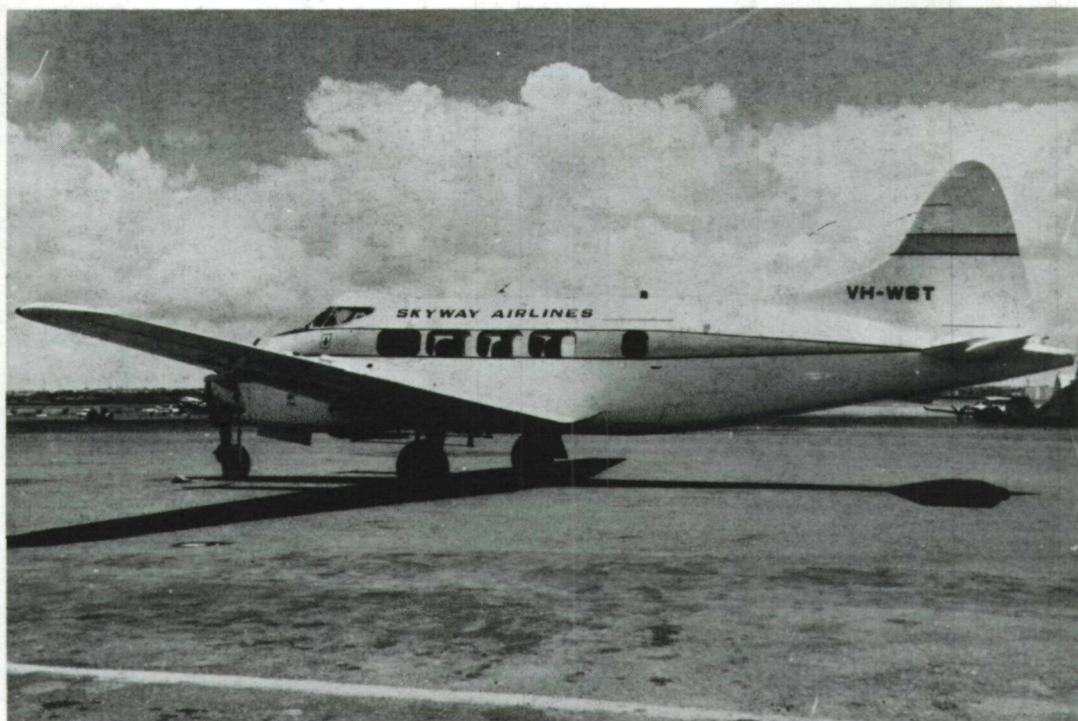
July 1974

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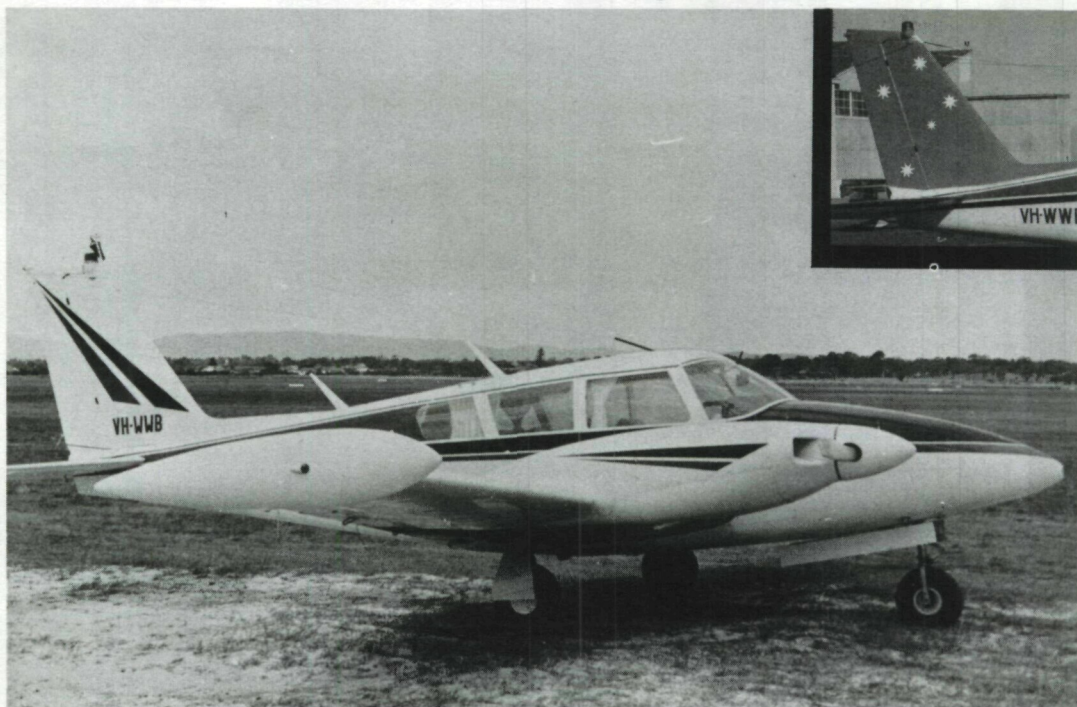
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**Note:** Metric units are used except for airspeed and wind speed which are given in knots; and for elevation, height, and altitude where measurements are given in feet.



Above: The De Havilland DH104 Series 5 (Dove), VH-WST.

Below: The Piper PA30-160B (Twin Comanche), VH-WWB.  
Inset: Fin and Rudder Markings, 13 March, 1974.



# THE ACCIDENT

At approximately 1537 hours Eastern Standard Time (EST) on 13 March 1974, a De Havilland Dove DH104 Series 5 aircraft, registered VH-WST, and a Piper Twin Comanche PA30-160B aircraft, registered VH-WWB, collided in flight above a point 3 225 metres north of Bankstown Airport, Sydney, New South Wales.

The Dove aircraft had taken-off from Bankstown Airport and was orbiting the airport at about 1 500 feet above terrain before proceeding to Sydney (Kingsford-Smith) Airport. Some two minutes later the Twin Comanche aircraft also took-off from Bankstown Airport and was proceeding to a training area in the vicinity of Camden. The collision occurred in the Bankstown Control Zone in visual meteorological conditions (VMC), and both aircraft were operating under the Visual Flight Rules (VFR).

Following the mid-air impact, both aircraft fell to the ground in a residential area of the suburb of Bass Hill, causing damage to houses and other property. The sole occupant of the Dove aircraft and the three occupants of the Twin Comanche aircraft were killed. Both aircraft were destroyed by the collision and ground impact.

## 1 – Investigation

### 1.1 History of the Flights

The De Havilland Dove DH104 Series 5 aircraft VH-WST was operated by Skyway Pty. Ltd. and the holder of the certificate of registration was A. H. Baker, a director of that Company. The aircraft was equipped with nine passenger seats and was normally operated on "commuter" services under the terms of appropriate licences.

Following an examination of the aircraft at Bankstown Airport to rectify reported radio communication and navigation equipment malfunctions, the pilot commenced preparations to re-position it at Sydney (Kingsford-Smith) Airport. The flight plan submitted indicated that the flight category was Instrument Flight Rules (IFR) but the flight procedures to be observed were the Visual Flight Rules. Additionally, it indicated that the pilot intended to spend 10 minutes in the Bankstown Control Zone checking the aircraft radio equipment then, subject to satisfactory operation of the equipment, he would proceed to Sydney (Kingsford-Smith) Airport. Subsequently, whilst the aircraft was taxiing, and again shortly after becoming airborne, the pilot made check calls utilising his No.1 and No.2 transceivers on the Bankstown surface movement and aerodrome control frequencies with no difficulties being evident.

VH-WST was taxiing at 1526 hours and the pilot requested approval to hold in the Bankstown Control Zone at an altitude of 1 500 feet. This request was approved, and at 39 seconds after 1531 hours (1531:39 hours) whilst the aircraft was being held clear of the runway, the aerodrome controller issued a clearance to take-off from Runway 11Left. The time of take-off has not been precisely determined but it was manually recorded by the controller as being between 1532:30 and 1533:30 hours and it is considered that about 1532:30 hours is the most probable time. At 1534:23 hours the pilot said, on the Bankstown aerodrome control frequency, that he was "climbing to one five zero zero will advise when we're ready to depart". At 1537:06 hours the pilot completed a

check call of eight seconds duration to Sydney Flight Service on the frequency 5498 kHz and this communication check was satisfactory. There was no further radio communication with the aircraft.

The Piper Twin Comanche PA30-160B aircraft VH-WWB was being operated by Navair Pty. Ltd. under the terms of an appropriate flying school licence, and the same Company was the holder of the certificate of registration for the aircraft.

On the day prior to the accident two pilots, who were experienced flying instructors, for the purpose of obtaining Class I instrument ratings, commenced a course of training in VH-WWB with a qualified instructor employed by Navair. One flight was undertaken on that day with the non-flying trainee observing from a rear seat. On the day of the accident two flights were undertaken during the morning and it was arranged that a third flight would be undertaken during the afternoon.

On behalf of the instructor, who was the pilot-in-command, the trainees submitted a flight plan indicating that the flight category was Instrument Flight Rules and that the tracks to be flown from Bankstown Airport to the training area were those applicable to an "Instrument Meteorological Condition (IMC) Departure". The flight procedure to be observed for this sector of the flight was not indicated, but the flight plan indicated that Visual Flight Rules would be observed for the return flight from the training area to Bankstown.

VH-WWB was taxiing at 1526 hours and at 1532:06 hours acknowledged, on the Bankstown surface movement control frequency, an airways clearance which was in accordance with the flight plan submitted. At 1533:42 hours, on the Bankstown aerodrome control frequency, VH-WWB acknowledged instructions to proceed in accordance with 'IMC Departure procedure', and an altitude restriction of 3 000 feet which was imposed on its airways clearance. The IMC Departure procedure required that, after take-off, the aircraft climb straight ahead to 500 feet, then turn left on to a heading of 290 degrees magnetic climbing to 2 000 feet until 11 km from Bankstown Airport, and then proceed to Camden climbing to the assigned cruising altitude.

At 1534:07 hours VH-WWB acknowledged a clearance for take-off from Runway 11Left and an instruction to "call Sydney Departures one two five decimal two, airborne". The aircraft was lined-up on the runway at this time and the take-off time was manually recorded by a controller as having occurred before 1534:30 hours.

At 1535:19 hours an unidentified radar return was observed by Sydney Air Traffic Control. This return indicated that an unreported aircraft, maintaining an easterly track consistent with Bankstown Runway 11 direction, had penetrated Sydney controlled airspace to a depth of 3.7 km and was then turning left through approximately 180 degrees. At that time Bankstown air traffic controllers visually observed the Twin Comanche turning in a position consistent with the normal flight pattern and thus clear of Sydney controlled airspace. The Dove was not sighted until some time later, northeast of the airport.

At 1535:47 hours the Twin Comanche called Sydney Departures on 125.2 MHz. The controller replied "not yet identified, report at the diversion point", and this was acknowledged. There was no further radio communication with the aircraft.

At approximately 1536:40 hours the two aircraft were observed by several witnesses on the ground to be on flight paths which converged at an angle of between 45 and 60 degrees, with the Dove aircraft to the right of the Twin Comanche aircraft. The majority of these witnesses reported that no evasive action appeared to have been taken by either aircraft. In these observations the port wing of the Dove and the starboard wing of the Twin Comanche appeared

to make contact following which the Twin Comanche passed through the tail section of the Dove.

The collision resulted in the detachment of the port wing and tail section of the Dove and the main wreckage of this aircraft then fell in the rear yard of a residence at 4 Orchard Road, Bass Hill. The port propeller, both wingtip tanks and sections of the forward fuselage were detached from the Twin Comanche which then crashed in a steep nosedown attitude into the rear of another residence nearby at 44 Beatrice Street, Bass Hill. Numerous pieces of wreckage from each aircraft fell on to other buildings and properties in the area (see Appendix B).

The collision occurred at approximately 1537:13 hours in day-light and in visual meteorological conditions at an altitude of approximately 1 500 feet. The elevation of the ground impact sites was 91 feet above mean sea level and the mean latitude and longitude co-ordinates of the ground impact sites were 33° 54' 05" S 150° 59' 37"E.

## 1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	1 (VH-WST)	—	—
	3 (VH-WWB)	—	—
Non-Fatal	—	—	—
None	—	—	—

## 1.3 Damage to Aircraft

Each aircraft was virtually destroyed by the collision and subsequent ground impact. Additionally the major portion of the wreckage of the Twin Comanche VH-WWB was seriously affected by fire after the ground impact.

## 1.4 Other Damage

The main wreckage of the Twin Comanche struck the rear section of a private residence. This section of the residence was destroyed by impact and fire but relatively minor damage was inflicted upon the remainder of the residence. Minor damage was inflicted upon several other residences, outbuildings and installations near the accident site.

## 1.5 Crew Information

The pilot-in-command of the Dove VH-WST, Anthony Michael LANE, occupied the left hand pilot seat. He was 24 years of age and he held a valid senior commercial pilot licence endorsed for the aircraft type. His total flying experience amounted to 2 586 hours of which 88 hours had been gained on the De Havilland Dove DH104 Series 5 aircraft since he had commenced flying the aircraft type early in February 1974. He held a valid Class I instrument rating.

The pilot-in-command of the Twin Comanche VH-WWB, Clinton Grant EDWARDS, occupied the right hand pilot seat. He was 27 years of age and he held a valid commercial pilot licence endorsed for the aircraft type. His total flying experience amounted to 3 274 hours of which 293 hours had been gained on the Piper Twin Comanche PA30 type of aircraft his licence having been endorsed as from 27 June 1972. He held valid Class I instrument and B Grade instructor ratings. He had completed approximately 2 481 hours instructional flying of which 52 hours were instrument instruction since gaining his Class I

instrument rating; 36 of these instrument instructional hours had been gained in PA30 type aircraft. His licence was endorsed requiring him to wear corrective lenses whilst exercising its privileges: his uncorrected visual acuity has been assessed as — right eye 6/12, left eye 6/9.

The pilot-under-instruction in VH-WWB, Trevor Stanley ALDRIDGE, occupied the left hand pilot seat. He was 26 years of age and he held a valid senior commercial pilot licence endorsed for the aircraft type. His total flying experience amounted to 2 736 hours of which 278 hours were gained in Piper Twin Comanche PA30 type of aircraft during the period May 1969 to March 1971. He held valid Class IV instrument and B Grade instructor ratings and had completed approximately 1 520 hours as a flight instructor.

The third crew member in VH-WWB, Robert George CUMMING, occupied one of the two second row seats. He was 23 years of age and he held a valid commercial pilot licence. His total flying experience amounted to 1 300 hours. He held a valid B Grade instructor rating and had completed approximately 610 hours as a flight instructor. His duties as a crew member in VH-WWB were to supplement the field of vision of the pilot-in-command whenever the aircraft was being flown under simulated instrument flying conditions, and also to observe the training being undertaken by the pilot-under-instruction.

## **1.6 Aircraft Information**

### **1.6.1. History**

The De Havilland Dove DH104 aircraft Serial No. 04-509 was constructed in England in 1960 by the De Havilland Aircraft Co. Ltd. and was imported into Australia in November 1971 as a used aircraft which had then flown a total of 3 135 hours. The aircraft was a twin engined, low wing, all metal cabin monoplane and was fitted out as a Series 5 with nine passenger seats for use in transport operations. The wingspan was 17.4 metres and the fuselage length 12 metres; the aircraft was painted white with a yellow window-line flash, and yellow flashes on the top of the engine installations, mainplanes, fin and rudder.

At the time of the accident, VH-WST had flown a total of 4 247 hours since new, of which 1 112 hours had been flown since the aircraft last underwent major inspection. The aircraft was operating under a current maintenance release and had flown 1 hour 25 minutes since the inspection for issue of that document on 8 March 1974. Its Certificate of Airworthiness was current.

There was no evidence of any pre-existing defect in the aircraft, its engines, or components. The pilot of VH-WST had experienced radio communication and radio navigation aid difficulties during recent earlier flights. No fault had been found with the radio equipment during the examination of the aircraft at Bankstown, but the possibility that an intermittent fault existed and was not found, cannot be discounted. The weight of evidence suggests however, that the difficulties had arisen because of operating procedures which resulted in all electrical power being drawn from the two aircraft batteries at the relevant times, in lieu of generated electrical power. One battery was found to be unserviceable and the total battery voltage available was less than that required to operate the majority of the radio equipment satisfactorily. This battery had been replaced.

The Piper Twin Comanche PA30-160B aircraft Serial No. 30-1034 was constructed in the U.S.A. in 1965 by the Piper Aircraft Corporation and was imported into Australia in October 1966 as a used aircraft which had then flown a total of 307 hours. The aircraft was a twin engined, low wing, all metal cabin monoplane and was fitted with three rows each of two seats for use in charter, aerial work, and flying training. The wingspan was 11.3 metres and the fuselage length 7.6 metres; the wings, fuselage and tailplane were painted white with red and black flashes along the sides of the fuselage and engine installations. The fin and rudder were red.

The aircraft was equipped with flight instruments, radio communication and navigation equipment to enable pilots to be trained to Class I instrument rating standard. Four paper screens designed to restrict the visual field of the pilot-under-training outside the aircraft, thereby simulating instrument flight conditions, were normally available.

At the time of the accident, VH-WWB had flown a total of 4 080 hours since new, of which 1 073 hours had been flown since the aircraft last underwent major inspection. The aircraft was operating under a current maintenance release and had flown 75 hours 20 minutes since the inspection for issue of that document on 15 February 1974. Its Certificate of Airworthiness was current.

There was no evidence of any pre-existing defect in the aircraft, its engines, or components.

### **1.6.2 Loading**

The maximum permissible take-off weight for the Dove aircraft VH-WST was 3 992 kg. It has been calculated that, at the time of the take-off from Bankstown Airport, the gross weight was 3 490 kg, and at the time of the collision it was 3 464 kg. It has also been calculated that the centre of gravity of the aircraft was within the specified limits throughout the flight.

The maximum permissible gross weight of the Twin Comanche aircraft VH-WWB when it was being operated in IFR aerial work or charter categories was 1 615 kg. It has been calculated that, at the time of the last take-off from Bankstown Airport the gross weight was 1 591 kg and, at the time of the collision, it was 1 586 kg. It has also been calculated that the centre of gravity of the aircraft was within the specified limits throughout the flight.

### **1.6.3 Hazard Lighting**

Both aircraft were required to be equipped with anti-collision beacons to be displayed at night and in other conditions of poor visibility. The aircraft were so equipped and each installation complied with the relevant Air Navigation Orders. On the Dove two beacons were installed; one on the topside and one on the underside of the fuselage, each being approximately in the mid-length position. On the Twin Comanche aircraft one beacon was installed and this was located on the top of the fin.

## **1.7 Meteorological Information**

The meteorological observation made at Bankstown Airport at 1500 hours recorded that the wind velocity was 180 degrees (True) at 18 knots, the visibility 21 km, there was 3/8 cumulus cloud at 2 500 feet and 7/8 stratocumulus cloud at 3 000 feet. A post-accident analysis by the Bureau of Meteorology indicates that similar conditions would have prevailed at the time of the collision (i.e. 37 minutes later); some turbulence would have been present at 1 500 feet but it would have been more pronounced at lower levels; the wind velocities at heights of 1 000 feet and 2 000 feet in the Sydney area were recorded as 190 degrees (True) 36 knots and 180 degrees 42 knots respectively.

The consensus of pilots operating in the Bankstown Control Zone at or about the time of the collision was that there was no cloud below 2 500 feet. The cloud base was generally estimated to be between 3 000 and 4 000 feet. The flight visibility, whilst flying the downwind leg of the circuit pattern, was stated to be in excess of 8 km, the consensus being between 16 km and 24 km, with distant haze which tended to blend with overcast cloud conditions ahead.

It has also been determined that the cloud cover was generally confined to the northern sector of the sky and it presented a light grey background. There was no sun glare but the light conditions were bright.

## **1.8 Aids to Navigation**

The procedures to be followed by each aircraft did not require reference to radio navigation aids.

## **1.9 Communications**

In respect of the relevant times, there were no reports of radio communication difficulties and there is no evidence to indicate that the radio equipment in each of these aircraft was operating other than normally.

The crew of Twin Comanche VH-WWB were instructed to call Sydney Departures Control on 125.2 MHz when airborne; they did so and acknowledged an instruction at 1535:47 hours which required them to call again at about 1539 hours. During the examination of the aircraft wreckage it was noted that the frequency of 125.2 MHz was selected and there is no reason to believe that the transceiver was not operating during the final two minutes of flight.

All communications with the Dove VH-WST were normal including the last communication on 5498 kHz which was completed seven seconds before the collision. During the wreckage examination it was noted that the generators were switched ON; additionally the Bankstown aerodrome control frequency of 118.1 MHz was selected on the No.1 transceiver, the transmitter selector was selected to the No.1 transceiver and examination of the associated switching provides no reason to believe that it was not operating nor that the audio was not selected ON.

At the time of the collision the Dove and the Twin Comanche were tuned to different radio frequencies. However, they taxied at the same time and were both on the Bankstown surface movement control frequency first of all when the pilot of the Dove said "we'd like to hold in the Bankstown Control Zone at one five zero zero while we check the radios before proceeding"; and when there were subsequent communications with the Dove on that frequency. The two aircraft were on different frequencies when the Twin Comanche was first issued with its airways clearance, but both aircraft were on the Bankstown aerodrome control frequency when the Twin Comanche was given "IMC Departure procedure, maintain three thousand", and subsequently cleared for take-off. At the time that clearance for take-off was issued, the Dove had been airborne for about two minutes.

## **1.10 Aerodrome and Ground Facilities**

Bankstown Airport, some 16.5 km west of Sydney (Kingsford-Smith) Airport is contained in airspace designated as a Control Zone which extends laterally for a radius of 3.7 km from the centre of the airport and vertically to 1 500 feet above mean sea level. The elevation of Bankstown Airport is 21 feet above mean sea level. The Bankstown Control Zone shares a common boundary with Sydney Control Zone from a position east of Bankstown Airport through to a position south of the airport.

Earlier on the day of this accident the Bankstown Airport multiple runway system, with the exception of Runways 11Left/29Right and 11Centre/29Centre was closed to operations because of a soft wet surface. For the operations which continued, Runway 11Left was specified for take-offs and full stop landings, whilst Runway 11Centre was specified for touch-and-go operations.

The Bankstown Airport Control tower is located on the western side of the airport some 488 metres from the threshold of Runway 11Left, the normal eye level of the controllers being 15 metres above the airport level. At the time of the accident the tower was manned by an aerodrome controller, a surface movement controller/intercommunication co-ordinator, a controller under training, and a control tower check controller.

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 Bankstown Control Zone. Such procedures are intended to cater for high density operations by general aviation aircraft operating in visual meteorological conditions (VMC) and they take into account the fact that judgement by an air traffic controller of aircraft positions and flight paths by visual observation 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 Bankstown 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. Additionally, the maximum permissible indicated airspeed in the circuit pattern is 120 knots; there is no airspeed restriction when flying elsewhere in the control zone.

An aircraft being flown in accordance with the standard circuit pattern would climb straight ahead after take-off to a height of 500 feet above the airport elevation; turn left through 90 degrees continuing the climb to 1 000 feet above the airport elevation; turn left again through 90 degrees and fly at 1 000 feet parallel to the runway until in a position to make a landing approach; then turn left through 90 degrees descending to about 500 feet and finally turn left again through 90 degrees 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.

Procedures, known as IMC Departure procedures, are also published for the use of IFR category flights departing from Bankstown Airport. They are intended to facilitate the departure of such flights from Bankstown Airport when instrument meteorological conditions prevail, and also to facilitate the entry of such flights into en-route controlled airspace. During daylight, when visual meteorological conditions prevail, and when flying those sections of the IMC Departure procedures contained within the Bankstown Control Zone or non-controlled airspace, the pilot-in-command is responsible for maintaining his separation from all other traffic in the same way as he is responsible in such areas when proceeding under the Visual Flight Rules during any other flight.

### **1.11 Flight Recorders**

Flight recorders were not installed in either aircraft nor is there any requirement for such equipment to be installed.

### **1.12 Wreckage**

The wreckage of both aircraft was found within an area approximately 1 740 metres by 570 metres with the main wreckage of the Twin Comanche 290 metres from the Dove on a bearing of 339 degrees (True). The main wreckage of the Dove was found on a bearing of 011 degrees (True), 3 081 metres from the Bankstown Airport reference point.

The distribution of major components from each aircraft indicated that neither could have been controllable following the collision. The in-flight contact between the two aircraft resulted in the separation of both engines from the Dove, as well as the port wing outboard of the port engine, and the fuselage aft of the main door. From the Twin Comanche both wingtip tanks were detached, the port propeller, and a substantial amount of the fuselage nose skin as well as nose mounted equipment. The cabin door was broken from its hinges and portion of the right hand side instrument panel coaming separated in flight.

The main wreckage of the Dove fell on to a concrete paved area, at the rear of a residence, in a nose-down roll-left attitude. The main wreckage of the Twin Comanche struck the rear of another residence in a steep nose-down attitude, possibly inverted.

All of the wreckage was removed to Bankstown Airport and there assembled into a three dimensional layout so that the relative positions of the two aircraft at the time of the collision might be determined. Score marks indicated that the initial contact between the two aircraft occurred when the port wingtip of the Dove and the rear outboard end of the Twin Comanche starboard wingtip fuel tank touched. The rearmost portion of the fuel tank was torn off and the deformation adjacent to the fracture matched an indentation on the Dove wingtip immediately adjacent to the navigation light fitting. When these impact marks were matched, the vertical plane of the Twin Comanche wingtip tank was almost perpendicular to the chordwise cover strip on the Dove wingtip; this being consistent with little, if any relative bank existing between the two aircraft at the moment of collision. The position of the Twin Comanche wingtip tank relative to the Dove wing at the first contact indicated that the longitudinal axes of the aircraft differed by about 60 degrees in the horizontal plane.

The rear of the Twin Comanche wingtip tank was pushed into contact with its starboard aileron, and the forward end of the wingtip tank was torn away from the wing leading edge. Marks on the Dove wing indicated that the wingtip tank had then come into contact with the Dove upper wing leading edge and had passed over the top of that wing. Other score marks on the Dove wing, inboard from the tank marks, ran from the leading edge inboard and rearward at 45 degrees but few marks extended beyond the main spar.

Further evidence as to the relative positions of the two aircraft as the collision progressed was obtained from the slash marks of the Twin Comanche starboard propeller in the Dove wing outboard of, but adjacent to, the port engine nacelle. Marks on each propeller blade matched strike marks on the main spar upper cap. It was also evident that the Twin Comanche fuselage section, some 1.8 metres to the rear of its nose, had passed over the Dove main spar at a point immediately forward of the junction of the port flaps since a cover plate from the Dove wing upper surface at this location was found embedded in the underside of the Twin Comanche fuselage. Additionally, impact marks the same distance apart as the distance between the Twin Comanche port and starboard propeller spinners, indicated where the port propeller and spinner had struck the Dove port engine nacelle, and where the starboard propeller had struck the Dove fuselage and door at window height. These marks indicated the relative longitudinal centre lines of the two aircraft.

Other marks indicated that, as the collision progressed, the Twin Comanche starboard engine entered the rear fuselage of the Dove and the starboard propeller severed the upper fuselage which subsequently failed and separated from the forward fuselage section.

Additional points of contact between the two aircraft which were established, were ~~score~~<sup>SPAN</sup>wise score marks on the underside of the Twin Comanche ~~port~~<sup>STARBOARD</sup> wing; transfers of red paint from the Twin Comanche fuselage nose on to

the Dove port engine forward of the port propeller spinner mark; and a Dove engine cowl fastener found in the Twin Comanche cockpit heater.

The detailed examination of both aircraft indicated that each was operating with its wheels and flaps retracted. Examination of the Dove cockpit indicated that the radio navigation receivers had been tuned to the navigation aids at Sydney (Kingsford-Smith) Airport. The auto-pilot was OFF. Examination of the Twin Comanche cockpit indicated that the radio navigation receivers other than the ADF were not being used. The status of the ADF receiver could not be determined. The auto-pilot pitch control was selected ON, but the position of the secondary selector for pitch mode or altitude hold could not be determined.

The screens which might have been used for simulated instrument flight were not found but it is probable that, if the screens normally used in VH-WWB were present in the cabin at the time of the collision, they would have been destroyed by fire subsequent to the ground impact.

### **1.13 Medical and Pathological Information**

Post-mortem examinations of all four occupants were undertaken. These indicated that fatal injuries were sustained at the time of ground impact. There was no evidence of any pre-existing abnormality which might have affected the normal performance of any member of the flight crews.

The biochemical reports associated with the post-mortem examinations of the pilot-in-command and third crew member of the Twin Comanche determined blood alcohol figures of 25 mg and 20 mg per 100 ml. There is no evidence that any member of the flight crews consumed alcohol on the day of the accident and their movements preceding their flights virtually precluded normal opportunity to do so. The bodies of the pilot-in-command and third crew member of the Twin Comanche had incurred a degree of incineration, whereas the others had not. Having regard to all the evidence, it is considered that the biochemical findings reflect post-accident effects or conditions.

### **1.14 Fire**

The Dove aircraft was not subject to any in-flight or post-impact fire. The wreckage examination of the Twin Comanche aircraft, however, pointed to the possibility that there had been an in-flight fire in the starboard wing following the collision with the Dove. After ground impact an intense fuel and metal fire seriously affected much of the wreckage of the aircraft.

The fire initiated by the main wreckage of the Twin Comanche destroyed one room of a timber framed residence. The residence fire was controlled and extinguished with water; the aircraft fire was extinguished without difficulty by the application of 99 litres of foam compound.

### **1.15 Survival Aspects**

This was not a survivable accident.

### **1.16 Tests and Research**

#### **1.16.1 Configuration of Impact**

The reconstruction of the wreckage permitted the configuration of impact between the two aircraft to be determined. It was determined that the aircraft headings converged at an angle of 57 degrees with the Twin Comanche on the left of the Dove; and that the true airspeed of the Dove at the point of collision was 1.28 times that of the Twin Comanche (Appendix C).

It was not determined if there was a relative vertical movement between the two aircraft, but it was concluded that both aircraft were either flying with wings level or with the same angle of bank. Witness evidence suggests that both aircraft were banked slightly to the left.

If, prior to the collision both aircraft had been maintaining the headings which existed at the moment of collision then, in the horizontal plane, the constant angle of the Dove from the heading of the Twin Comanche would have been about 74 degrees to the right, and the constant angle of the Twin Comanche from the heading of the Dove would have been about 49 degrees to the left (Appendix C). Considering the wind velocity at 1 500 feet, as deduced from the post accident meteorological analysis the ground speeds of each aircraft would have been almost identical (Appendix D).

### **1.16.2 Cockpit Visibilities**

In the course of this investigation cockpit visibility studies were conducted in relation to the left-hand seat of the Dove aircraft as well as the right-hand pilot seat and the second row right-hand passenger seat of the Twin Comanche, to determine the physical limits of the field of view from these positions. The results of these studies are at Appendices E and F. Because of the advantages of binocular vision, windscreen joining strips or window pillars caused little restriction to the fields of visibility from any of these positions.

Having regard to the probable flight paths of these two aircraft (Appendix D), these studies suggest that, in respect of the pilot-in-command of the Dove aircraft, the Twin Comanche could have been obscured by the Dove port wingtip at about the time the Twin Comanche was completing its turn on to a westerly heading; at all other times there should have been no physical obstruction. In respect of the pilot-in-command of the Twin Comanche aircraft, the Dove could have been obscured by the starboard engine and wing during the latter half of the turn on to the westerly heading; at all other times there should have been no physical obstruction. In respect of the third crew member of the Twin Comanche aircraft, the Dove could have been obscured until such time as the Twin Comanche was completing its turn on to the westerly heading.

### **1.16.3 Hazard Lighting**

The selector switch in the Twin Comanche for the anti-collision beacon was so damaged by ground impact forces that it was not possible to determine its selected position at the time of the collision. The selector switch in the Dove activates both upper and lower beacons and in the wreckage it was found in the ON position. It was determined that the motor mechanism of the beacon on the Twin Comanche and of the upper beacon on the Dove were both capable of normal operation; the lower beacon on the Dove was crushed and so no conclusion could be drawn beyond the point that there was no evidence of pre-existing defect.

The filaments of the beacons were examined and it was concluded that neither the Twin Comanche beacon nor the upper Dove beacon were illuminated when these filaments failed. It was not possible to reach a reliable conclusion in respect of the Dove lower beacon. Nevertheless it is probable that the loads which disrupted the filaments were generated in the ground impact rather than in the air collision, and having regard to the other damage incurred by each aircraft in the collision, it is considered that electrical power would not have been available after that time. Thus no reliable conclusion can be drawn from the physical evidence as to whether or not the anti-collision beacons in either aircraft were activated prior to the collision.

The distance at which a standard anti-collision beacon is discernible varies considerably depending upon such factors as the condition of the atmosphere, background and ambient light. Considering the known characteristics of these beacons and the relatively good visibility conditions pertaining at the time of this collision, it was concluded that they would have been of little assistance in enhancing the perceptibility of either aircraft even if they had been illuminated.

#### **1.16.4 The Perceptibility of Each Aircraft**

Consideration has been given to the question of whether or not each aircraft would have been discernible to the crew members of the other at three significant points in time, having regard to the probable flight paths of the two aircraft, the ambient conditions existing, visual acuity, and assuming an absence of physical obstruction.

An accepted threshold of resolution for an average normal eye is the resolution of a black target letter on a white background whose overall size subtends an angle of five minutes of arc at the eye, the width of each stroke of the letter subtending one minute of arc. The standard testing distance is six metres and, using the Snellen notation, normal visual acuity is recorded as 6/6. Where, for the resolution of the target letter, the visual angle subtended at six metres is ten minutes of arc the notation is 6/12. The standard pre-supposes that the eye is correctly focussed for the distance of the target and that the observer is looking directly at the target, since the range at which an object of a given size is detectable visually diminishes as the object is located further from the direct line of vision.

The three significant points in time selected in this study were (see Appendix D):

- A: when the Twin Comanche was midway through its turn on to a westerly heading;
- B: when the Twin Comanche had completed this turn; and
- C.1: when the Dove had completed its turn on to its final heading.

It was found that, provided the contrast was reasonable — not necessarily ideal, the eyes were accommodated to distant vision, and having regard to the target size at these points in time; the crew members of each aircraft could have sighted the other aircraft whilst looking in the direction of that aircraft, but it is probable that they could not have sighted the other aircraft whilst looking straight ahead. These conclusions are also valid in respect of the pilot-in-command of the Twin Comanche even if it is assumed that he was not wearing the corrective lenses required under the terms of his licence (see Appendix G).

## **2 — Analysis**

### **2.1 Flight Paths**

Since neither aircraft was fitted with a flight data recorder it was not possible to determine precisely the flight paths followed by each aircraft. Other evidence, however, does permit these flight paths to be determined with a useful degree of reliability.

In respect of the Twin Comanche, the purpose of the flight was the training of two experienced pilots to Class I Instrument Rating standard. This involved training not only in the control of an aircraft by reference to flight instruments, but training in the navigation of an aircraft to follow precise flight paths in the vicinity of aerodromes. The flight plan indicated that, on departure, the crew

intended to fly the flight path which would be required of a pilot departing Bankstown Airport in instrument meteorological conditions, and the aircraft was cleared accordingly. Visual observations by air traffic controllers and crews of other aircraft, during the period of initial climb and turn after take-off, suggest that the Twin Comanche was following the flight path specified in the IMC Departure procedure appropriate to its airways clearance.

The IMC Departure procedure required that, after take-off, the aircraft climb along the extended runway centre-line to a height of 500 feet then turn left to take up a heading of 290 degrees magnetic. There is evidence that the instructor involved required that this be a Rate 1 turn (i.e. 180 degrees per minute) and, as VH-WWB was equipped with a turn co-ordinator there is no reason to doubt that it was accurately flown. On the basis of this information, together with the known performance of the aircraft type at the power settings used by this instructor on previous flights, the flight plan indicated airspeed of 105 knots, and the post-accident analysis of the weather that existed, the position and altitude of the aircraft when the turn was completed can be computed.

The evidence establishes that the time of collision was about 1537:13 hours above a point slightly north of the Hume Highway. If it is assumed that the aircraft was flown on the required heading of 290 degrees magnetic from its computed position on completion of the turn after take-off, then the flight path and position at 1537:13 hours is entirely consistent with the witness evidence concerning the track flown and collision area, and the subsequent direction of the trajectories of the major components of the Twin Comanche to their ground impact positions.

In respect of the Dove aircraft, the purpose of the flight was to check the aircraft's radio equipment whilst orbiting Bankstown Airport at an altitude of 1 500 feet. The only two points at which its flight path can be established with certainty are at take-off and just prior to the collision, but circumstantial evidence suggests the possibility of a third such point midway during the flight. The elements of this circumstantial evidence are described hereunder.

The approximate time of commencement of the take-off was established and witness evidence indicated an area of lift-off from the runway which was consistent with the published performance data. The aircraft was then observed for a short period during which it climbed straight ahead in a manner which appeared normal.

In respect of the point of collision, the examination of the wreckage of both aircraft revealed that the angle between the headings of the aircraft at the time of initial contact was approximately 57 degrees. On the basis that the analysis in relation to the flight path of the Twin Comanche is correct, this places the Dove on a flight path from the north-east towards the south-west. The witness evidence covers only the final 30 seconds of flight, but such a flight path is supported in that this evidence variously describes the two aircraft as approaching along tracks converging at 55 degrees; at converging angles between 45 and 60 degrees; or with the Dove on a curving flight path towards the south-west converging at an angle between 45 and 90 degrees. Additionally, the direction of the trajectories of the major components of the Dove from the collision area to their ground impact positions, are consistent with such a flight path.

At about 1535:19 hours an unidentified radar return was observed by Sydney Air Traffic Control but, at the time of this observation, only a perfunctory attempt was made to identify the aircraft as it was not conflicting with existing traffic in Sydney controlled airspace and it was observed to turn through some 180 degrees and proceed in a westerly direction from a position north-east of Bankstown Airport. Subsequent investigation indicates that all

aircraft movements in the area, with the exception of the Dove, can be accounted for. The flight plan submitted by the pilot of the Dove stated that the indicated airspeed during the climb would be 110 knots, this being consistent with flight plans he had submitted for previous flights. Using this airspeed, normal climb power, and relevant performance data, and assuming that the aircraft was climbed along the extended centre line of the runway, it would have reached 1 500 feet at a point involving penetration of the Sydney Control Zone by 3.7 km. If the aircraft then made a Rate I turn to the left on to a westerly heading, the flight path would have been consistent with that observed on the radar.

Computed flight paths from the radar observed position on completion of the turn, utilizing various cruising airspeeds, all intercept the area north of Bankstown Airport where the witness and collision evidence positively established the Dove flight path during the final 30 seconds of the flight. It is significant that all such flight paths require a time of about 4½ minutes to be flown and that this is coincident with the total flight time of the Dove from take-off to collision. As the time available was not sufficient for the Dove to have already completed one orbit of Bankstown Airport, having regard to the initial flight path visually observed when it became airborne, it is concluded that the flight path flown was consistent with that shown at Appendix D.

## 2.2 Airspeeds

Examination of the wreckage of both aircraft revealed that the ratio between the respective true airspeeds of the Twin Comanche and the Dove, at the time of collision, was 1:1.28 (Appendix C). The wreckage examination, however, did not disclose the power settings or indicated airspeeds for either aircraft at the time of collision. If it is assumed that the Twin Comanche was flying at the flight planned indicated airspeed of 105 knots then the indicated airspeed of the Dove was 133 knots which is compatible with the manufacturer's performance data of 132 knots indicated airspeed for an economical cruise configuration. Conversely, if it is assumed that the Dove was cruising at an indicated airspeed of 120 knots, which is the maximum permissible speed in the circuit pattern, but not elsewhere in the control zone, then the indicated airspeed of the Twin Comanche was 94 knots which is compatible with the operator's performance data of 91 knots indicated airspeed for best single-engine rate of climb.

## 2.3 Altitudes

There is no evidence to suggest that the Dove aircraft was being flown at a reference altitude of other than 1 500 feet. No matter what combination of airspeed or rate of climb is selected from within the normal operating envelope, the aircraft would have reached an altitude of 1 500 feet at least one minute prior to the collision. The pilot's altimeter was found to have a subscale setting of 1003 mb instead of the correct setting of 1005 mb and this would mean that the aircraft was flying some 60 feet higher than that indicated on the altimeter. However, as the aircraft was being flown manually and the pilot was engaged in operating radio equipment, in particular during the period 15 to 7 seconds before the collision, it is possible that the altitude during the cruise would have varied by at least  $\pm 100$  feet from the reference altitude.

In respect of the Twin Comanche, using the same performance information as before, the computed climb performance at 105 knots with both engines operating would place that aircraft at an altitude of 1 700 feet at the time of

collision. If it is assumed that, at the time of collision, the crew of the Twin Comanche were simulating an engine failure, and therefore flying at the best single-engine indicated airspeed of 91 knots, and that such action was initiated some 20 seconds prior to the collision, the known performance would place the Twin Comanche at 1 500 feet at the time of collision. It would not have been unreasonable to have simulated an engine failure having regard to the nature of this flight, and the timing is such that the aircraft would have completed the Rate 1 turn after take-off before the engine power was reduced.

The evidence of pilots who were flying in the area indicated that some seconds after the collision, aircraft wreckage was falling through an altitude of 1 000 – 1 200 feet. The altitude at which the collision occurred has not been precisely determined, however, it is considered that it occurred at or about 1 500 feet.

## **2.4 Traffic**

Separation between the two aircraft was provided by air traffic control at the time of take-off primarily to ensure that there was no confliction during use of the runway, but also to ensure that their flights were commenced with adequate separation. Additionally, as both aircraft were to be operated in other than the standard circuit pattern, both aircraft requested and were issued with clearances to operate as requested. Once the aircraft were airborne in the Bankstown Control Zone, and whilst visual meteorological conditions prevailed, each pilot-in-command was responsible for ensuring his own separation from other traffic by visual observation supplemented by knowledge gained from monitoring the radio transmissions between the control tower and other traffic. Although the Dove and the Twin Comanche were on different frequencies at the time of collision, they had been on common frequencies when being cleared by air traffic control for their respective flights and therefore, could have heard the relevant transmissions. The traffic situation (additional to the Dove and Twin Comanche) in the Bankstown Control Zone at the time of the collision is shown at Appendix H. In summary this was:

- 1 aircraft orbiting Bankstown Airport at 1 500 feet about 1 km ahead of the Dove;
- 2 aircraft at 1 000 feet on the downwind leg of the circuit pattern 1.5 km and 2.5 km behind the Twin Comanche;
- 1 aircraft about to touchdown on Runway 11Left;
- 1 aircraft at 1 000 feet south of Runway 11Left joining the upwind leg of the circuit pattern;
- 1 aircraft at 1 000–1 500 feet on the western boundary of the zone, outbound;
- 1 aircraft on the ground at the holding point for Runway 11Left.

## **2.5 Visual Observation**

The probable tracks of each aircraft, as determined in the investigation, are shown at Appendix D. In respect of the Twin Comanche, the cockpit visibility study indicates that at Positions A and A1 the visibility of the pilot-in-command was not obstructed (Appendix F); additionally the Dove would have been within visual perception range and very little scanning would have been required to look directly at the aircraft. It is possible that the Dove was seen at this time since the vision straight ahead from the Twin Comanche virtually swept the flight path of the Dove; however, as the Dove, if seen, would have appeared to be flying a westerly track parallel to that intended to be flown by the Twin Comanche, and it

was some 2 710 metres distant, there would have been no cause for immediate concern about an impending traffic conflict.

Whilst the Twin Comanche was flying from Position A to B the Dove would have been obscured (Appendix F). At Positions B and B1 visual reference would have been possible but it would have been necessary for the pilot-in-command and/or the third crew member to scan the relevant area in order to see the Dove. If the Dove was seen from this point and it was still flying a parallel track, again there would have been no cause for immediate concern. Alternatively, if the Dove was then seen to be flying in a south-westerly direction it should have been evident at this time that the aircraft were on collision paths.

At Positions C and C1 the Dove could have been seen from the Twin Comanche provided the pilot-in-command or third crew member scanned the relevant area. The bearing of 74 degrees thereafter would have remained constant until the collision occurred and consequently, the Dove could have been assessed as being on a collision path.

Having regard to the rate of roll of a Twin Comanche aircraft, it would have been necessary for the pilot to have initiated a 60 degree banked turn (i.e. moderate evasive action) 12-13 seconds prior to the collision in order to have avoided it. To this period must be added the average time taken by a pilot to perceive an aircraft, assess that it is on a collision path, and react. This has been found to be about two seconds. Therefore, from the moment the Twin Comanche completed its turn after take-off, the period of time for the crew to see the Dove and initiate such action to avoid the collision was the next 24 seconds.

In respect of the Dove, the cockpit visibility study indicates that at Positions A1 and A the pilot's ability to see the Twin Comanche was not impeded (Appendix E) and the Twin Comanche was within visual perception range if he scanned the relevant area. If the Twin Comanche was seen at that time it would have appeared to be following a standard circuit pattern and there would have been no cause for immediate concern.

At positions B1 and B it is possible that the Twin Comanche was obscured by the port wing tip of the Dove (Appendix E). However, if the Dove had commenced a turn at this time, following its postulated flight path, the Twin Comanche would have become visible within visual perception range if the pilot scanned the relevant area. If the Twin Comanche was seen at this time, again it would have appeared to be following a standard circuit pattern and its altitude of about 1 200 feet might have appeared to be consistent with that pattern.

At positions C1 and C visibility from the Dove was not obstructed and the Twin Comanche could have been seen, provided the area was scanned. The Twin Comanche's relative bearing of 49 degrees at that time would have remained constant until the collision occurred and so it could have been assessed as being on a collision path.

Having regard to the rate of roll of a Dove aircraft, it would have been necessary for the pilot to have initiated a 60 degree banked turn 15 seconds prior to the collision to have avoided it. Allowing for reaction time, perception would need to have occurred 17 seconds before the collision. Thus, from the moment the Twin Comanche completed its turn after take-off, the period of time within which the pilot of the Dove had to sight the other aircraft and initiate such action to avoid the collision was the next 22 seconds.

As the Twin Comanche was on a constant heading for only 39 seconds prior to the collision, it was only during this period that either crew would have been able to assess accurately whether or not a collision risk existed. The witness evidence indicates that no evasive action was taken and this should have been evident if any sighting had occurred during this period.

## 2.6 Cockpit Activity

The pilot-in-command of the Twin Comanche was almost certainly engaged in instructing the pilot in the left-hand seat in instrument flying procedures; it is possible that this instruction included a simulated failure of one engine. There is also the possibility that at the critical time he was placing screens against the windscreen in order to simulate instrument flight conditions for the pilot in the left hand seat. If the screens normally carried in this aircraft were being used, the vision of the pilot-in-command straight ahead of his position would have been adequate and there would have been no screens to his right. One of the duties of the third crew member in the second row seat was to supplement the vision of the pilot-in-command; vision to his right would not have been obstructed by the screens.

The attention of the pilot of the Dove would have been divided between controlling the aircraft; visually navigating in order to orbit Bankstown Airport; visually observing traffic; and conducting checks on radio communication and navigation equipment. The evidence indicates that VHF communication checks were conducted; the Sydney VOR was selected; it is probable that the Sydney NDB had been selected; a communication check on HF was completed only seven seconds prior to the collision and, during this seven seconds the HF equipment was turned OFF and a VHF transmitter selected. It is thus apparent that the time available for visually observing other traffic was limited and it is probable that visual scanning for other aircraft was only intermittently undertaken.

## 2.7 Summary

When each aircraft departed from Bankstown Airport the crews had the opportunity to overhear the intended movement of the other. Additionally, the timing of the clearances for take-off allowed a longitudinal separation considerably in excess of the minimum required for operations in visual conditions. Nevertheless, the independently conducted flight paths of the two aircraft converged to the collision point.

The rules of the air are prescribed in Part XI of the Air Navigation Regulations. Regulation 138(1) provides that, "when two aircraft are on converging headings at approximately the same height, the aircraft that has the other on its right shall give way". It is clear from the evidence that, in the terms of this Regulation, the Dove aircraft had the right of way and it was the responsibility of the Twin Comanche crew to give way. Nevertheless Air Navigation Regulation 137 (2) also provides that "An aircraft that has the right of way shall maintain its heading and speed, but nothing in the rules in this Division shall relieve the pilot-in-command of an aircraft from the responsibility of taking such action as will best avert collision". Additionally, Air Navigation Regulation 139(1) states that an aircraft "shall not be operated in the air in closer proximity to another aircraft than 2 000 feet horizontally and 500 feet vertically". Clearly the flight crews of both aircraft involved in this accident had responsibilities to maintain a watch for other aircraft in their vicinity and to take action for the avoidance of collision. The evidence strongly suggests, however, that neither aircraft was seen from the other during the period that they were on collision courses right up to the time of impact. The question, therefore, in need of answer is why did this "failure-to-see" occur.

During the morning of the day of the accident the pilot of the Dove aircraft had flown about two hours in another aircraft type; examination of that flight and his recent tours of duty, indicated that fatigue arising from duty should not have

been a factor. Weather was not a factor in this accident and examination of the wreckage did not disclose any aircraft malfunction or defect which might have unduly claimed his attention. The cockpit work load would have been relatively demanding for this pilot since he had limited experience on the type, he had not flown often from Bankstown Airport, and he was engaged in conducting radio communication and navigational equipment checks. The probable flight path of the Dove, as determined by the investigation, suggests that, in contradiction of the pilot's stated intention and air traffic control approval, a substantial portion of the flight was conducted outside the Bankstown Control Zone. This situation may have arisen from lack of familiarity with Bankstown Airport, or it may have arisen from navigation errors induced by cockpit workload. In addition to cockpit workload, it is possible that there was some slight relaxation in the standard of look-out maintained as he was flying 500 feet above the standard circuit pattern and in an area of lower traffic density. Having regard to his overall experience it could reasonably be expected that he would have maintained a watch for other aircraft but, it is apparent that it was not sufficiently effective to avoid this collision.

Considering the possible circumstances which might have affected perception of the Dove by the crew of the Twin Comanche during the critical period of convergence, it is reasonable to assume that the pilot in the left hand seat was flying the aircraft by reference to instruments. The responsibility for visual observation then rested with the pilot-in-command in the right hand front seat assisted by the third crew member in the second row seat. If screens to simulate instrument flight for the pilot in the left hand seat were installed, these would not have been a contributing factor as visibility in the direction of the Dove's flight path would not have been restricted by such screens. However, if screens were being placed in position during the climb, this action probably would have taken the attention of all three crew members. It may be significant in this regard that the auto-pilot was found with the pitch control selected ON and this action may have been taken to facilitate control of the aircraft whilst the screens were placed in position. The evidence suggests that on some previous flights the screens were erected during the climb when traffic conditions were assessed as suitable; at the time of this accident traffic was light. Additionally, it is possible that there was some slight relaxation of the watch for other traffic as the aircraft climbed above the circuit pattern into an area of lower traffic density.

During the morning of the day of the accident the crew had flown two flights for a total of three hours and, on the preceding day, the pilot-in-command had flown two flights for a total of 2 hours 40 minutes; thus fatigue arising from duty should not have been a factor. The examination of the wreckage of the Twin Comanche did not disclose any pre-existing malfunction or defect but the evidence related to aircraft performance suggests the possibility that an engine failure of one engine was being simulated. Although the pattern of actions within the cockpit are not precisely known, it is considered that the workload of the pilot-in-command (the instructor) would have been relatively high, and this would have extended to the third crew member because his task was to learn by observation as well as to assist in the watch for other traffic. Again, having regard to the experience of the flight crew, it could reasonably be expected that they would have maintained a watch for other aircraft, but it is apparent that it was not sufficiently effective to avoid this collision.

The cause of the accident on the basis of the evidence available was that, whilst operating in an environment where the maintenance of separation between aircraft was a pilot responsibility, neither the pilot-in-command of the Twin Comanche nor the pilot-in-command of the Dove ensured that a watch for other aircraft, adequate for avoidance of collision, was maintained.

A possible contributing factor was that, having regard to the relatively high cockpit workloads existing in each aircraft, and the fact that both aircraft were operating 500 feet above the standard circuit pattern in an area of lower traffic density, there was some relaxation in the frequency or extent of the visual observation made from each aircraft.

### 3 – Conclusions

1. The flight crews of both aircraft involved in this accident were appropriately qualified and licensed.
2. At the time of the accident there was a current Certificate of Airworthiness for each of the two aircraft involved. There is no evidence of any defect in either aircraft which could have contributed to this accident.
3. Each aircraft was loaded within safe limits.
4. The weather conditions were better than the minimum prescribed for visual flight, and they 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 operating in an area not subject to air traffic control directions for separation and the pilots-in-command were each responsible for securing separation from other aircraft based upon their own visual observations.
6. When the Twin Comanche aircraft, VH-WWB, became airborne from Bankstown Airport the longitudinal separation behind the Dove aircraft, VH-WST, was better than the minimum prescribed for successive take-offs at this airport in visual meteorological conditions.
7. During its flight the Dove aircraft, VH-WST, was operated outside the limits of the Bankstown Control Zone, contrary to the pilot-in-command's notified intentions and the terms of air traffic control approval.
8. The aircraft collided at a height of approximately 1 500 feet over a position 3 225 metres on a bearing of 017 degrees True from the reference point of Bankstown Airport. This collision point is within the Bankstown Control Zone.
9. At initial impact the angle between the longitudinal axes of the aircraft was approximately 57 degrees, the Twin Comanche – Dove true airspeed ratio being 1:1.28.
10. The collision occurred when the flight paths of the two aircraft converged, the Twin Comanche, VH-WWB, being to the left of the Dove aircraft, VH-WST. During at least the final 20 seconds of flight the constant angle, in the horizontal plane, of the Dove from the heading of the Twin Comanche was about 74 degrees to the right, and the constant angle of the Twin Comanche from the heading of the Dove was about 49 degrees to the left.

### Cause

**The cause of the accident was that, whilst operating in an environment where the maintenance of separation between aircraft was a pilot responsibility, neither the pilot-in-command of the Twin Comanche nor the pilot-in-command of the Dove ensured that a watch for other aircraft, adequate for the avoidance of collision, was maintained.**

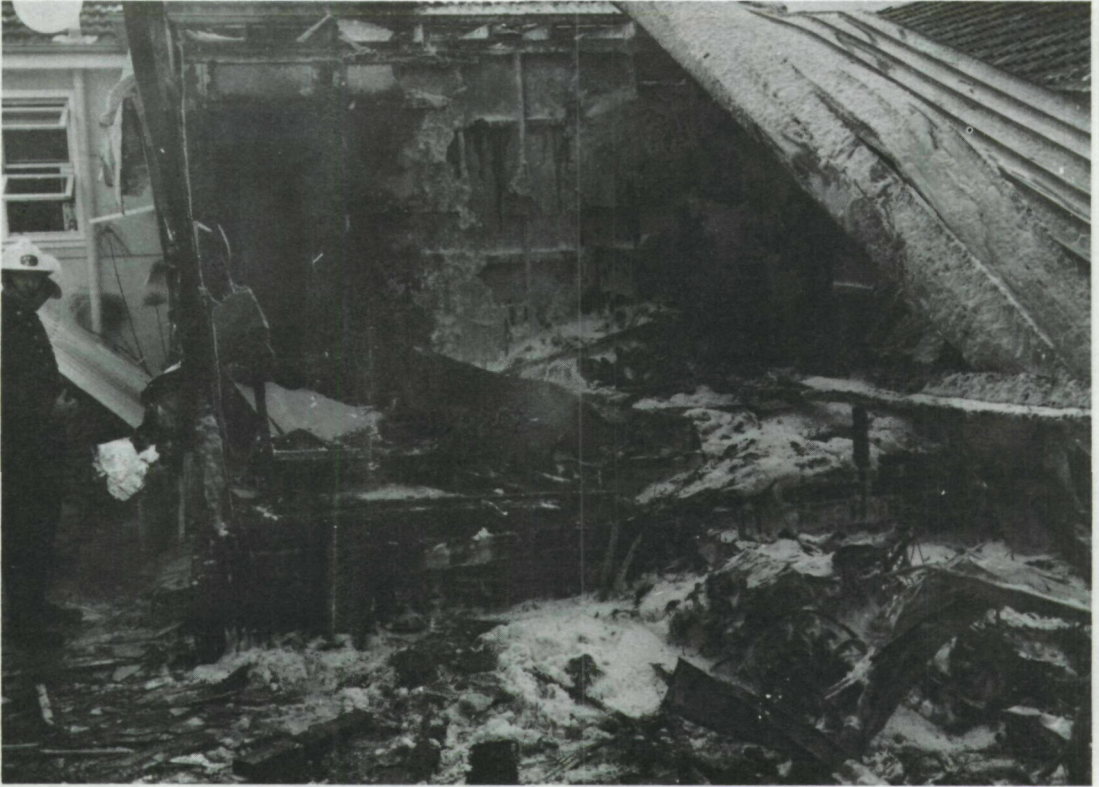


Above: Impact Site of Main Wreckage, DH104 VH-WST.



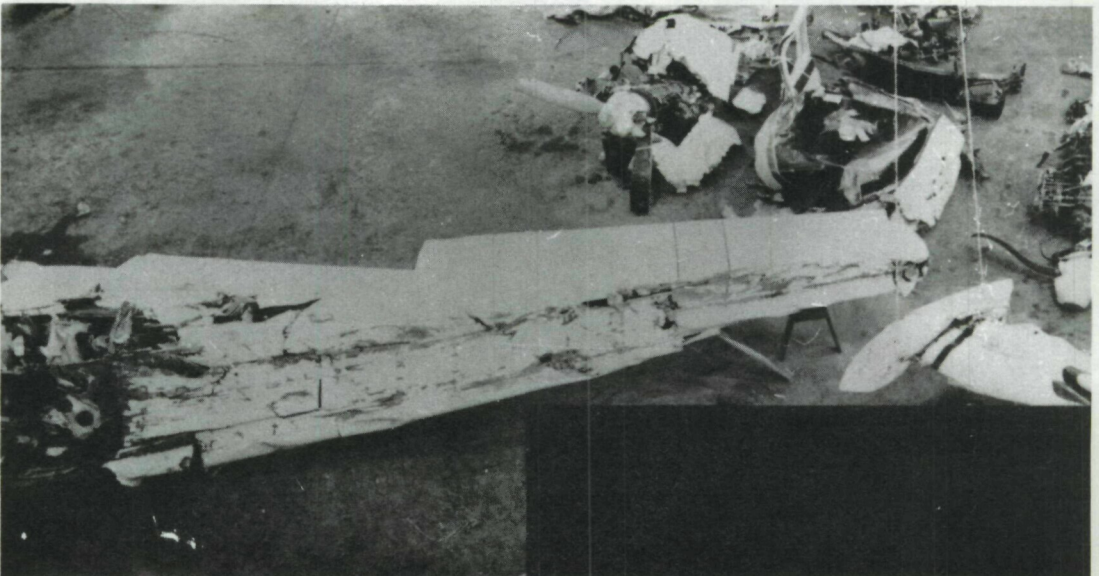
Right: Main Wreckage of PA30-160B VH-WWB.

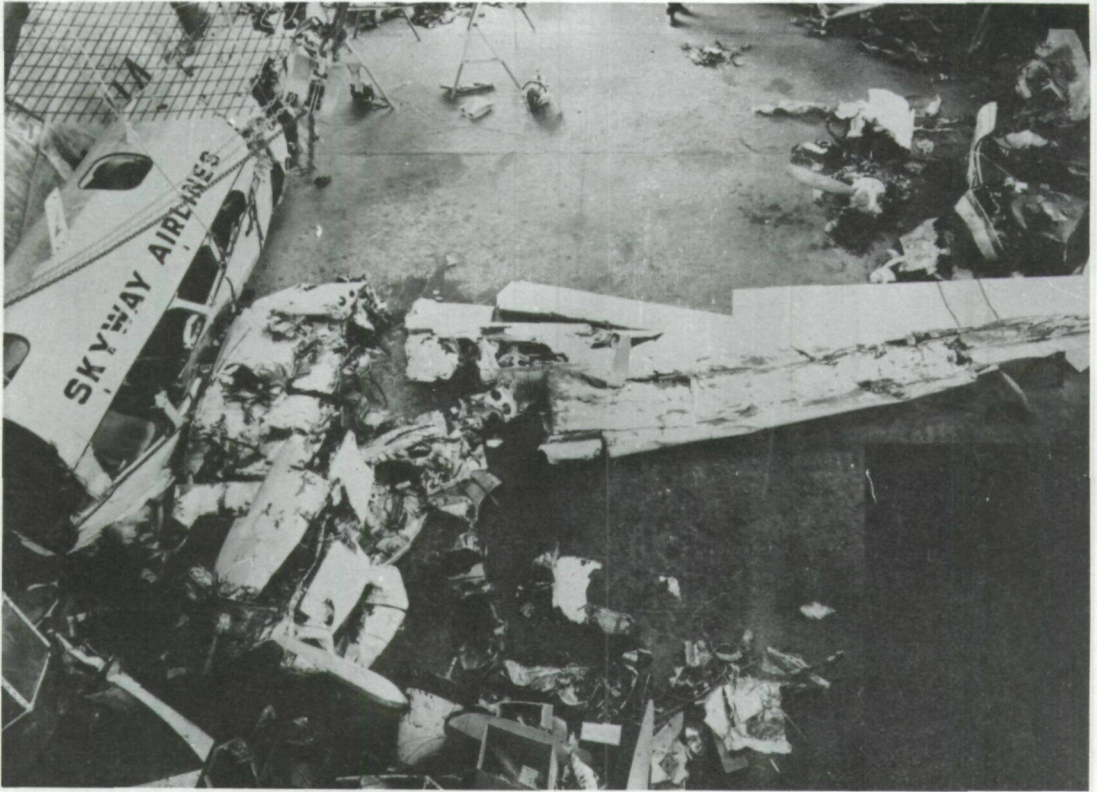
**APPENDIX A (Continued)**



Above: Impact Site of Main Wreckage PA30-160B VH-WWB, Showing Damage to Residence.

Below: DH104 Port Wing Tip and PA30-160B Starboard Wing Tip; Approximate Positions at First Contact.



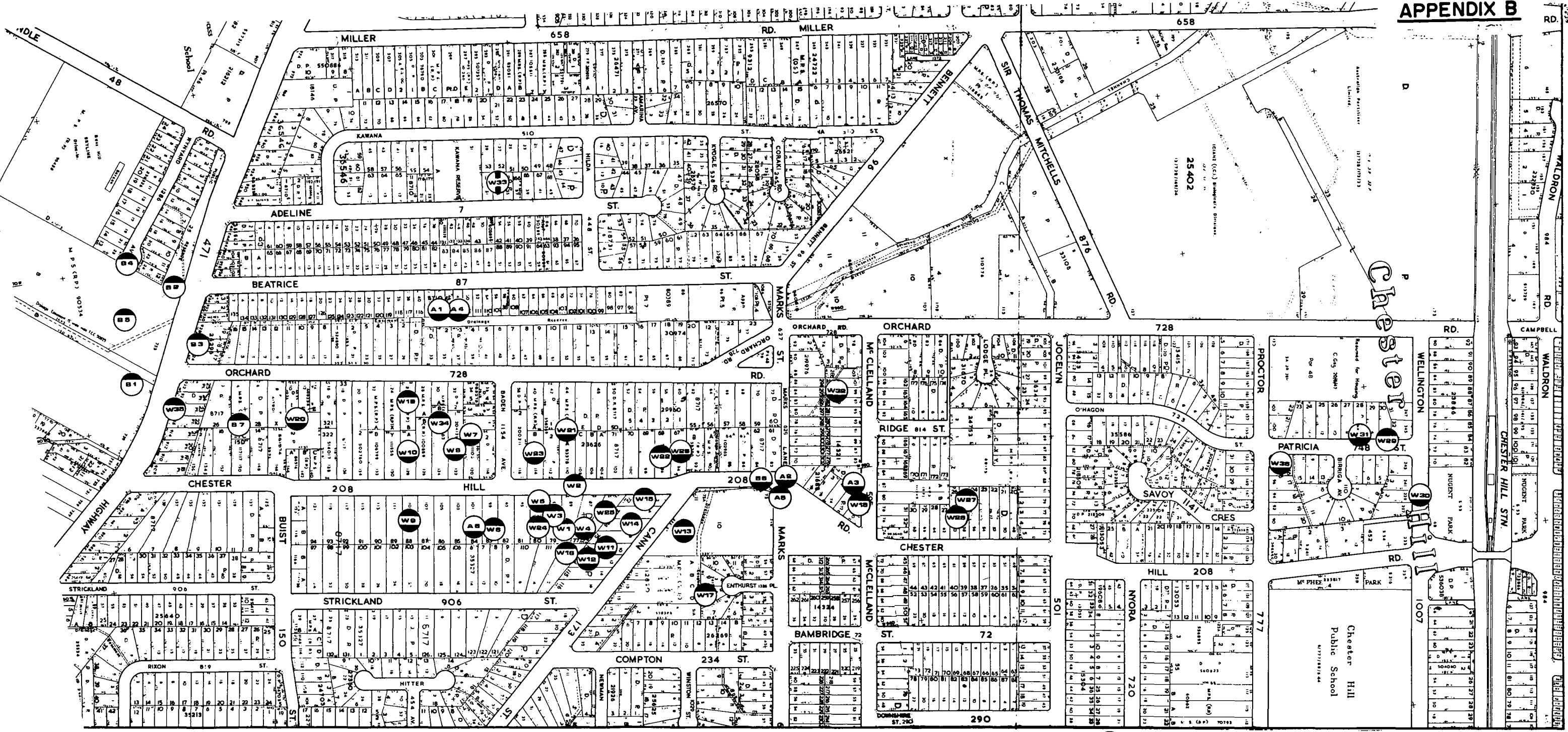


Above: DH104 Port Wing  
Centre Section.

Below: DH104 Aft Fuselage  
Section.







SCALE  
Scale of Chains.  
Scale of Feet.

MUNICIPALITY OF BANKSTOWN

LEGEND : DH 104 (circle with dot)  
PA 30 (circle with horizontal line)  
UNKNOWN (circle with vertical line)

PA 30 - DH 104  
WRECKAGE DISTRIBUTION

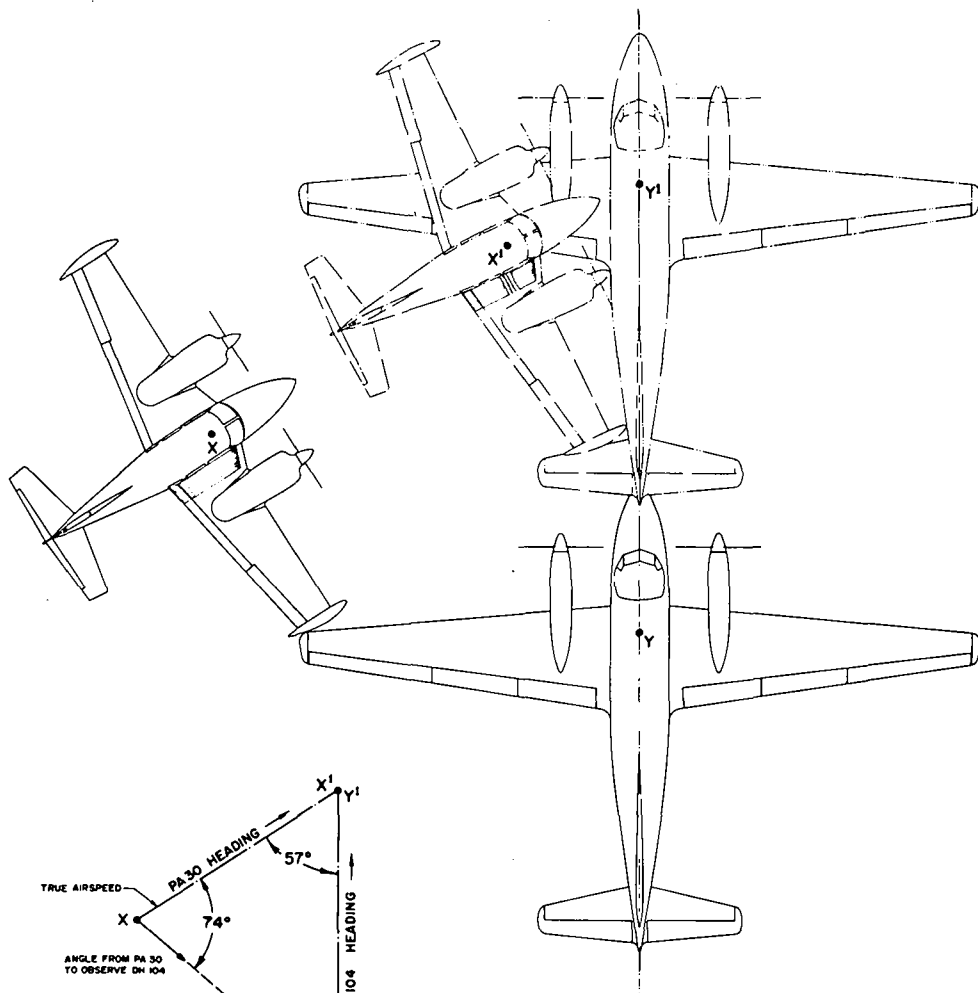
APPENDIX B (Continued)

Index to legend

A1	PA30	Main impact site of basic aircraft structure
A2	PA30	Portion of instrument panel, portion of fibre-glass fuselage nose, small section of wing panel
A3	PA30	Portion of fibre-glass fuselage nose
A4	PA30	Starboard engine upper rear nacelle panel Starboard fuel cell access panels
A5	DH104	Port wing skin rear of engine
A6	PA30	Portion of engine cowling, forward end
B1	DH104	Starboard engine and propeller
B2	DH104	Port landing gear assembly
B3	DH104	Port engine oil cooler
B4	DH104	Port engine and propeller
B5	DH104	Port engine starter motor
B6	PA30	Nose gear door
B7	DH104	Fuselage from nose to cabin rear door, starboard mainplane, and port mainplane to port engine bearer
W1	DH104	Fin and rudder, various sections of port mainplane
W2	DH104	Top cowl from port engine
W3	DH104	Starboard tailplane and elevator, rear fuselage bulkhead inspection door
W4	PA30	Starboard panel mounted air outlet control
W5	PA30	Aft section (150 mm) of the starboard wing tip fuel tank
W6	DH104	Airscreen and door (normally located near wing leading edge junction of port engine outboard side)
W7	PA30	Portion of port engine generator drive pulley
W8	PA30	Nosewheel steering bell-crank, port wing tip fuel tank less the forward end
W9	DH104	Port tailplane and elevator, elevator mass balance, section of starboard tailplane spar, section of port mainplane spar, three items of radio equipment
W9	PA30	Port wing tip fuel tank forward end, port propeller spinner with pitch change cylinder, radio equipment
W10	DH104	Radio equipment

APPENDIX B (Continued)

W10	PA30	Air selector box from fuselage nose
W11	DH104	Section of rudder trim tab and port mainplane leading edge
W11	PA30	Starboard propeller spinner nose cap
W12	DH104	Section of port engine cowl, fuselage tail cone
W13	DH104	Section of port wing
W13	PA30	Fuselage panel from fibre-glass nose to windshield, oil filler access cover
W14	DH104	Upper section of passenger door
W15	DH104	Section of port engine cowl, umbrella
W16	DH104	Portion of wing skin
W17	DH104	Lower fuselage section from rear locker to tail cone
W18	DH104	Sections of port engine cowl
W19	DH104	Radio equipment
W20	PA30	Port propeller
W21	PA30	Cabin door
W22	DH104	Port fuselage skin rear of passenger door
W23	PA30	Starboard wing tip fuel tank less aft section
W24	DH104	Section of port engine top cowl
W25	DH104	Port engine lower left cowl
W26	PA30	Inspection door
W27	DH104	Portion of perspex
W28	DH104	Engine cowl panel
W29	DH104	Port fuselage skin rear of passenger door, perspex
W30	PA30	Sections of fibre-glass from fuselage nose
W31	PA30	Interior lining, page from Operations Manual
W32	PA30	Personal papers (ref. instrument rating)
W33	—	Pieces of perspex
W34	DH104	Radio equipment
W35	DH104	Port engine electrical wiring loom
W36	PA30	Pieces of perspex



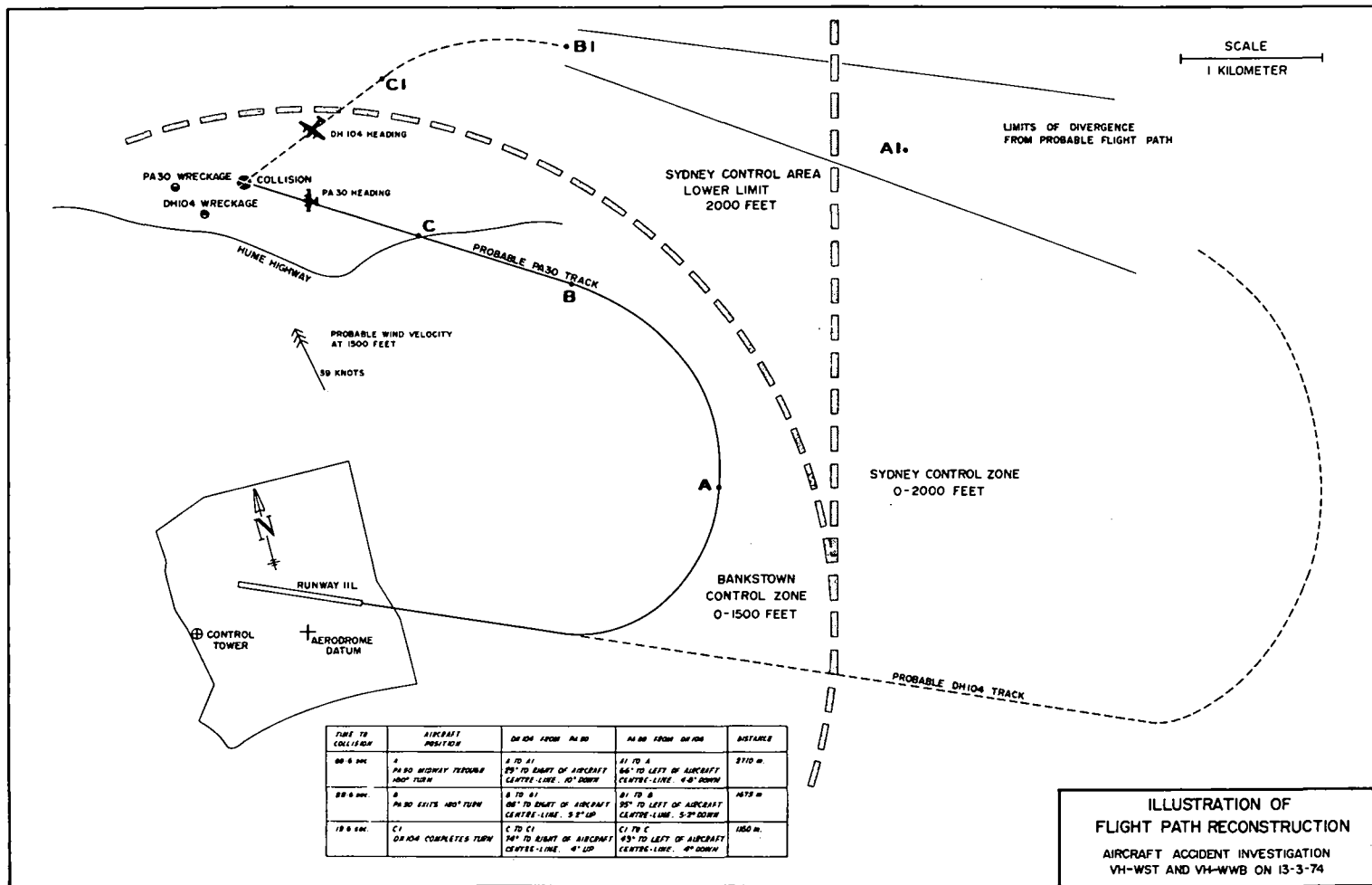
RATIO DH104 TRUE AIRSPEED TO PA 30 TRUE AIRSPEED =  $\frac{\text{DISTANCE } XX'}{\text{DISTANCE } YY'} = 1.28$

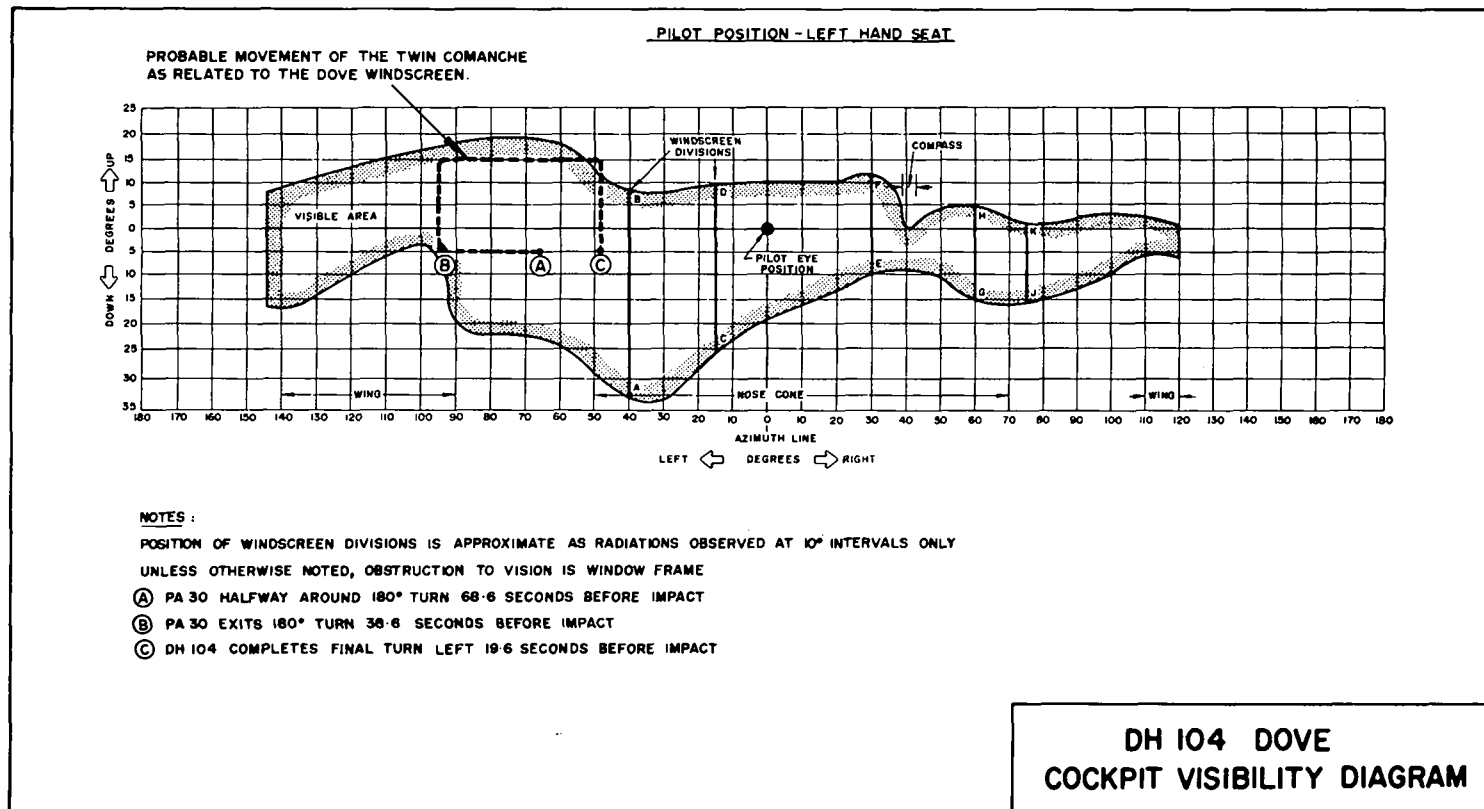
**NOTE:** RELATIVE POSITIONS WERE DETERMINED FROM IMPACT MARKS

THE VECTOR PLOT IS BASED ON BOTH AIRCRAFT BEING IN THE SAME AIR MASS. THE APPLICATION OF WIND VELOCITY DOES NOT AFFECT THE CONCLUSION.

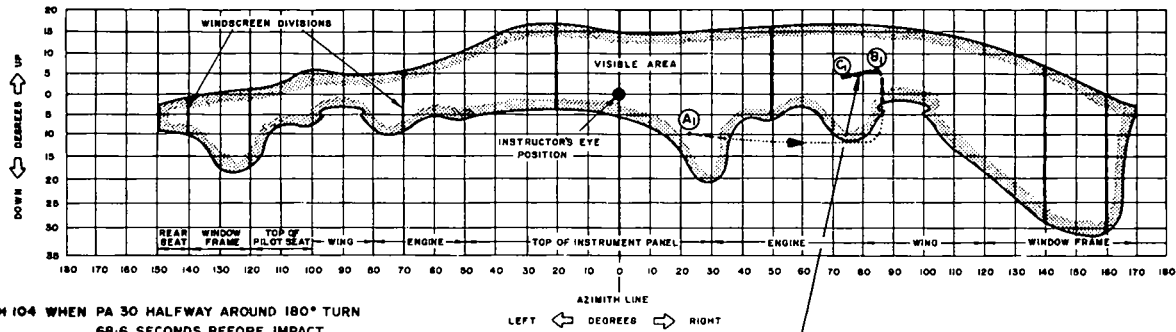
ILLUSTRATION SHOWING INITIAL IMPACT AND ONE SUBSEQUENT POSITION DURING THE IMPACT SEQUENCE

AIRCRAFT ACCIDENT INVESTIGATION  
VH-WST AND VH-WWB ON 13-3-74





**INSTRUCTOR POSITION - RIGHT HAND FRONT SEAT POSITION**

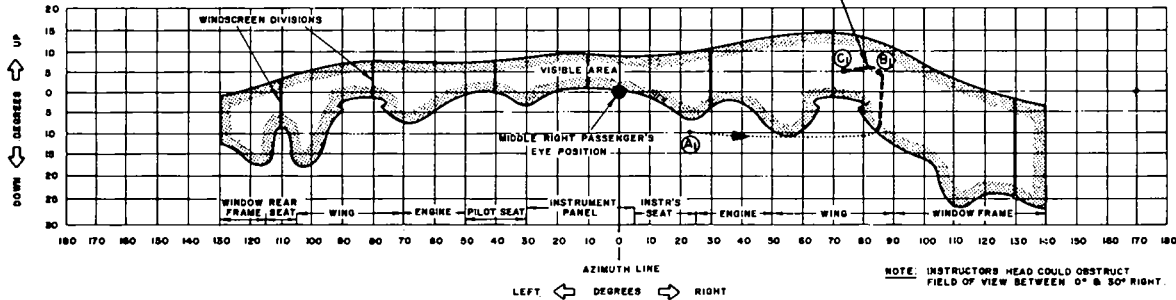


- A1) DM 104 WHEN PA 30 HALFWAY AROUND 180° TURN  
68.6 SECONDS BEFORE IMPACT.
- B1) DM 104 WHEN PA 30 EXITS 180° TURN  
38.6 SECONDS BEFORE IMPACT.
- C1) DM 104 AS IT COMPLETES FINAL LEFT TURN  
19.6 SECONDS BEFORE IMPACT.

**NOTE** POSITION OF WINDSCREEN DIVISIONS IS APPROXIMATE AS RADIATIONS OBSERVED AT 10° INTERVALS.

PROBABLE MOVEMENT OF THE DOVE AS RELATED TO THE TWIN COMANCHE WINDSCREEN

**RIGHT HAND SEAT POSITION, SECOND ROW**



**NOTE:** INSTRUCTOR'S HEAD COULD OBSTRUCT FIELD OF VIEW BETWEEN 0° & 30° RIGHT.

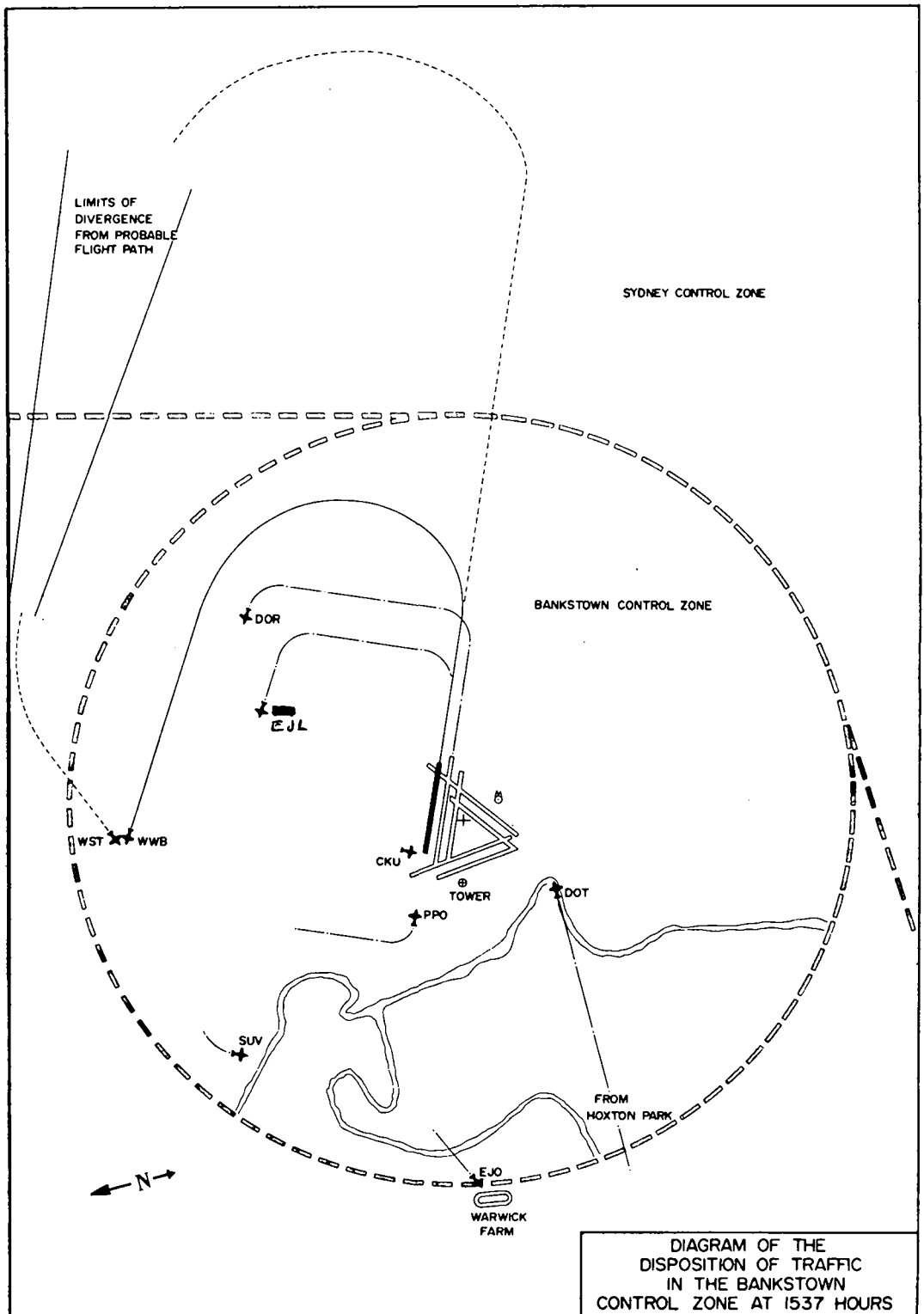
**PA 30 TWIN COMANCHE  
COCKPIT VISIBILITY DIAGRAM**

Perception Calculations

<u>Angular Subtense Of Twin Comanche from Dove</u>	<u>Maximum Angle from Centre Line of 6/6 Vision at Which Target would be Resolvable</u>	<u>Actual Angular Relation of Twin Comanche from Centre Line of Vision</u>
A1 to A – 15'	25°	60°
B1 to B – 15'	25°	95°
C1 to C – 24'	40°	49°

<u>Angular Subtense of Dove from Twin Comanche</u>	<u>Maximum Angle from Centre Line of Vision at which Target would be Resolvable</u>		<u>Actual Angular Relation of Dove from Centre Line of Vision</u>
	<u>6/6 Vision</u>	<u>6/12 Vision</u>	
A to A1 – 15'	25°	Less than 20°	23°
B to B1 – 25'	40°	Less than 25°	85°
C to C1 – 36'	50°	30°	74°

APPENDIX H



**Transcript of Communications Recorded at Bankstown  
and Sydney (Kingsford-Smith) Airports Concerning  
VH-WST and VH-WWB  
1523-1537 Hours : 13 March, 1974**

**Legend**

WST	— De Havilland DH104 Series 5 aircraft, VH-WST
WWB	— Piper PA30-160B aircraft, VH-WWB
SMC	— Surface Movement Controller/Co-ordinator, Bankstown Tower. Frequency 119.9 MHz
ADC	— Aerodrome Controller, Bankstown Tower. Frequency 118.1 MHz
DEP	— Departure Controller, Sydney Area/Approach Control Centre. Frequency 125.2 MHz
APP	— Approach Controller, Sydney Area/Approach Control Centre. Intercommunication
FS	— Flight Service Unit, Sydney. Frequency 5498 kHz
SUV	— Beech 56TC aircraft, VH-SUV

## TIME (EST)

Hrs/Mins/  
Secs

FROM TO

TEXT

1523:11	WST	SMC	BANKSTOWN TOWER WHISKEY SIERRA TANGO maintenance call one two nine er one.
1523:15	SMC	WST	WHISKEY SIERRA TANGO maintenance checker reading you four.
1523:19	WST	SMC	WHISKEY SIERRA TANGO stand by
1523:23	SMC	WST	WHISKEY SIERRA TANGO say again
1523:26	WST	SMC	BANKSTOWN WHISKEY SIERRA TANGO check call number two VHF
1523:30	SMC	WST	WHISKEY SIERRA TANGO also four.
1523:33	WST	SMC	WHISKEY SIERRA TANGO.
1525:57	WWB	SMC	BANKSTOWN TOWER, WHISKEY WHISKEY BRAVO. for Bankstown received Foxtrot.
1526:16	WWB	ADC	BANKSTOWN TOWER WHISK
1526:18	WWB	SMC	WHISKEY BRAVO for Bankstown received Foxtrot.
1526:20	SMC	WWB	WHISKEY WHISKEY BRAVO time two six a half.
1526:23	WWB	SMC	WHISKEY WHISKEY BRAVO

**APPENDIX I (Continued)**

1526:25 WST SMC BANKSTOWN TOWER, WHISKEY SIERRA TANGO for Sydney we'd like to hold in the Bankstown control zone at one five zero zero while we check the radios before proceeding.

1526:36 SMC WST WHISKEY SIERRA TANGO roger and your time two six a half.

1526:38 WST SMC WHISKEY SIERRA TANGO.

1526:39 SMC DEP Taxying for Bankstown via Camden. WHISKEY WHISKEY BRAVO runway one one.

1526:44 DEP SMC WHISKEY WHISKEY BRAVO clearance seven eight cruise four thousand let me know when he's ready.

1526:48 SMC DEP Okay

1527:53 SMC WST WHISKEY SIERRA TANGO will you just advise us about one circuit before you wish to depart for Sydney and we'll arrange your airways clearance then.

1528:03 WST SMC WHISKEY SIERRA TANGO I'll hold at one five zero zero and ask for the clearance when I'm ready to depart Bankstown.

1528:09 SMC WST WHISKEY SIERRA TANGO. roger.

1530:49 WST SMC WHISKEY SIERRA TANGO is ready.

1530:51 SMC WST WHISKEY SIERRA TANGO roger hold short of runway one one left and call one one eight decimal one.

1530:58 WST SMC WHISKEY SIERRA TANGO.

1531:28 WST SMC BANKSTOWN TOWER WHISKEY SIERRA TANGO reading one one eight one.

1531:32.5 SMC WST WHISKEY SIERRA TANGO

1531:33 WST ADC BANKSTOWN TOWER WHISKEY SIERRA TANGO is ready.

1531:39 ADC WST WHISKEY SIERRA TANGO clear for take-off.

1531:42 WST ADC WHISKEY SIERRA TANGO roger and how do you read my transmission

1531:46 ADC WST WHISKEY SIERRA TANGO reading you fives.

1531:47 WST ADC Roger dee.

1531:55 WWB SMC WHISKEY WHISKEY BRAVO request airways clearance.

1531:58 SMC WWB WHISKEY WHISKEY BRAVO clearance seven eight cruise four thousand.

1532:06 WWB SMC WHISKEY WHISKEY BRAVO seven eight four thousand.

**APPENDIX I (Continued)**

1532:34 DEP SMC DEPARTURES  
 SMC DEP WHISKEY WHISKEY BRAVO is ready.  
 DEP SMC Stand by.

1532:54 DEP SMC WHISKEY WHISKEY BRAVO is IMC Departure  
 procedure maintain three thousand call one two  
 five decimal two.

1532:59 SMC DEP Roger transfer at time three five.

1533:02 DEP SMC Three five roger.

1533:30 WWB ADC WHISKEY WHISKEY BRAVO ready.

1533:36 ADC WWB WHISKEY WHISKEY BRAVO IMC Departure  
 procedure maintain three thousand.

1533:42 WWB ADC WHISKEY WHISKEY BRAVO three thousand.

1533:45 ADC WWB WHISKEY WHISKEY BRAVO line up and hold  
 position.

1533:48 WWB ADC WHISKEY WHISKEY BRAVO.

1533:58 ADC WWB WHISKEY WHISKEY BRAVO call SYDNEY  
 DEPARTURES one two five decimal two airborne  
 clear for take-off.

1534:03 SMC APP and also WHISKEY SIERRA TANGO is airborne  
 in the Bankstown Control Zone he'll be doing a  
 couple of circuits and will advise when he's ready  
 for onwards clearance to Sydney.

1534:07 WWB ADC WHISKEY WHISKEY BRAVO wilco.

1534:10 APP SMC Okay.

1534:23 WST ADC BANKSTOWN WHISKEY SIERRA TANGO  
 departing at three five climbing to one five zero  
 zero will advise when we're ready to depart.

1534:30 ADC WST WHISKEY SIERRA TANGO roger.

1535:17 SMC APP BANKSTOWN TOWER.

1535:19 APP SMC Who's the bloke turned left off one one about two  
 miles into our zone at the moment.

1535:26 SMC APP The Dove WHISKEY SIERRA TANGO I would  
 suggest.

1535:29 APP SMC Righto thank you.

1535:47 WWB DEP DEPARTURES SOUTH, WHISKEY WHISKEY  
 BRAVO airborne, Bankstown IMC Departure.  
 DEP WWB WHISKEY WHISKEY BRAVO, DEPARTURES  
 not yet identified report at the diversion point.  
 WWB DEP WHISKEY WHISKEY BRAVO.

**APPENDIX I (Continued)**

1536:58	WST	FS	WHISKEY SIERRA TANGO check call on five four nine eight.
	FS	WST	WHISKEY SIERRA TANGO, SYDNEY, check call reading you four.
1537:06	WST	FS	WHISKEY SIERRA TANGO.
1537:13.2	SUV	ADC	SIERRA UNIFORM VICTOR MAYDAY MAYDAY MAYDAY an aircraft just blown to bits in the Archerfield circuit.

