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Air Safety Investigation Branch

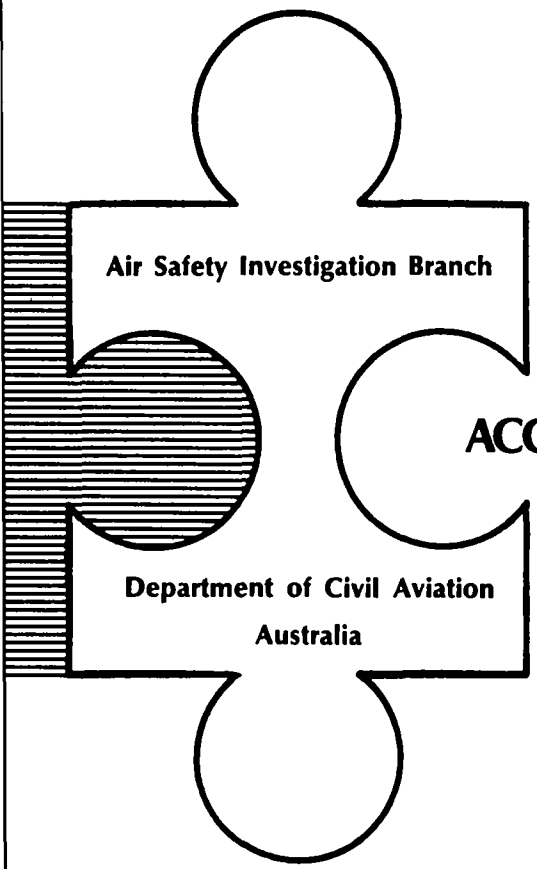
Department of Civil Aviation

Australia

ACCIDENT INVESTIGATION REPORT

Collision Accident near Moorabbin, Victoria Beech D50B Aircraft VH-RCN and Bell 47G-3B-2 Helicopter VH-BLM 19 October 1970

SPECIAL INVESTIGATION REPORT 70-6



ACCIDENT INVESTIGATION REPORT

Collision Accident near Moorabbin, Victoria Beech D50B Aircraft VH-RCN and Bell 47G-3B-2 Helicopter VH-BLM 19 October 1970

The investigation of this aircraft accident was authorised by the Director-General of Civil Aviation pursuant to the powers conferred by Air Navigation Regulation 278.

Prepared by:
Air Safety Investigation Branch Melbourne

April, 1972

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THE ACCIDENT

At approximately 1418 hours Eastern Standard Time on 19 October, 1970, a Beech D50B aircraft, registered VH-RCN, and a Bell 47G-3B-2 helicopter, registered VH-BLM, collided in flight four miles north-west of Moorabbin Airport, Melbourne, Victoria. The twin engined Beech aircraft was approaching Moorabbin Airport in the course of a flight from Essendon via Point Ormond. The helicopter was approaching Moorabbin Airport, also via Point Ormond and the collision occurred outside controlled airspace. Following the mid-air impact, both aircraft crashed in a built-up residential area in the suburb of Moorabbin, causing relatively minor damage to houses and property in the vicinity. The two occupants of the Beech D50B aircraft and the three occupants of the Bell helicopter were killed and both aircraft were destroyed by the collision and ground impact.

1 - Investigation

1.1 HISTORY OF THE FLIGHT

The Beech D50B aircraft VH-RCN was owned by South Australian and Territory Air Services Pty. Ltd. and was operated by Nicholas Skyways Pty. Ltd. The aircraft was based at Moorabbin and was equipped as an aerial ambulance. During the morning and early afternoon of 19 October, 1970, VH-RCN was engaged on a series of flights within the State of Victoria for the transportation of hospital patients and, as was the usual practice, a nursing sister was carried on these flights.

The flight plan submitted at Moorabbin by the pilot prior to commencement indicated that the aircraft was to operate under the Instrument Flight Rules generally throughout the series of flights including the return to Moorabbin but that, on three short sectors, the Visual Flight Rules were to be observed. The earlier sectors having been completed, the aircraft, at 1403 hours, commenced to taxy at Essendon for the return flight to Moorabbin. The pilot and the nursing sister were the only occupants of the aircraft. The pilot indicated to Essendon Air Traffic Control that an airways clearance under the Visual Flight Rules would be acceptable and he was issued with a clearance requiring that he track via Station Pier and cruise at an altitude of 2,000 feet.

The aircraft became airborne from Runway 26 at 1411 hours and called Melbourne Departures on the frequency 118.9 mc. The pilot was instructed to turn left and "track initially direct Brooklyn". Shortly afterwards he was advised to pass west of the Flemington Racecourse then direct to Point Ormond. At 1416 hours the pilot reported over Point Ormond and was advised "Change to 118.1 entering Moorabbin zone". There was no further communication with the aircraft.

The Bell 47G-3B-2 helicopter, VH-BLM, was owned and operated by Jayrow Helicopters and was also based at Moorabbin Airport. On 19 October, 1970 it was engaged on an aerial patrol of power lines between Keilor and the Geelong area. Two employees of the State Electricity Commission were carried on the aircraft. Before departing Moorabbin the pilot had prepared and submitted a flight plan which indicated that the aircraft would operate under the Visual Flight Rules and which specified a SARTIME (time for the initiation of search and rescue procedures) of 1600 hours.

The power line patrol was completed in the vicinity of the State Electricity Commission Keilor Terminal Station situated within the Melbourne Control Zone approximately 3 miles west of Essendon Airport. At 1402 hours, the pilot, in communication with Melbourne Approach Control, on the frequency 124.7 mc., was instructed "Depart Keilor on direct track to Moorabbin at one five zero zero". Shortly afterwards he was given a special weather report which indicated the passage of a weak front through Moorabbin at 1350 hours and he was advised that the front should be to the east of Moorabbin by the time of his arrival.

At 1412 hours Melbourne Approach Control asked "BLM are you just passing Point Ormond" and the pilot advised that he was just approaching Point Ormond. He was then advised "Clear of the control zone – clear to close this frequency". There was no further communication with the helicopter.

At approximately 1418 hours the two aircraft were observed by witnesses on the ground to be on flight paths which converged at an angle of some 40 degrees, with the Beech aircraft overtaking and on the left of the helicopter. Following the collision of the two aircraft, numerous pieces of wreckage from each fell onto buildings and properties in the area. The main wreckage of the helicopter crashed inverted on to a dividing fence between two houses in the Melbourne suburb of Moorabbin and the Beech aircraft, which had lost a major portion of the starboard mainplane in the

collision, crashed in a steep nose down attitude into a narrow lane between two other houses, some 1,350 feet to the south-east of the position of the helicopter.

1.2 INJURIES TO PERSONS

Injuries	Crew	Passengers	Others
Fatal	1 (VH-BLM) 2 (VH-RCN)	2 (VH-BLM)	–
Non-Fatal	–	–	–
None	–	–	

1.3 DAMAGE TO AIRCRAFT

Each aircraft was virtually destroyed by the collision and subsequent ground impact. A small fire which occurred in the main wreckage of the helicopter was brought under control by the persons first on the scene at that point.

1.4 OTHER DAMAGE

The main wreckage and numerous smaller pieces of wreckage from each aircraft caused relatively minor damage to several residences, outbuildings and fences in the area.

1.5 FLIGHT CREW INFORMATION

The pilot-in-command of VH-RCN, Peter Raymond Stone, was 30 years of age and held a valid commercial pilot licence endorsed for the aircraft type. His total flying experience amounted to 2,710 hours of which 203 hours had been gained on the Beech 50 type of aircraft since the type had been endorsed on his licence on 13 July, 1970. He held a valid first class instrument rating.

The pilot-in-command of VH-BLM, Brian James Cruikshank, was 25 years of age and held a valid commercial helicopter pilot licence endorsed for the Bell 47G-3B-2 type of helicopter. His rotary wing aircraft flying experience amounted to 1,244 hours of which 1,159 hours had been gained on Bell 47 type helicopters. He also held a valid private pilot licence for fixed wing aircraft and had flown a total of 74 hours in fixed wing aircraft. He did not hold any class of instrument rating.

1.6 AIRCRAFT INFORMATION

VH-RCN Beech model D50B Twin Bonanza, Serial No. DH-232 was constructed in the U.S.A. by the Beech Aircraft Corporation in 1959 and was imported into Australia in 1965 as a used aircraft which had then flown a total of 1735 hours. The aircraft was a twin engined, low wing, all metal cabin monoplane and was fitted out as an aerial ambulance. There was a current Certificate of Airworthiness for the aircraft.

At the time of this accident, VH-RCN had flown a total of 6,110 hours since new, of which 1,873 hours had been flown since the aircraft last underwent a major inspection. The aircraft was operating under a current maintenance release and had flown 70 hours since that document was issued on 18 September, 1970.

There was no evidence of any defect in the aircraft, its engines, or components except that some small holes were found to be burnt in the outer casing of the heat exchanger of the combustion type cabin air heater. This defect could have permitted some products of combustion to enter the cabin of the aircraft. The cabin heater had been installed when the aircraft was new and had been overhauled at the time of the last major inspection of the aircraft. The operator's maintenance manual required an external check of the heater system after each 100 hours of aircraft operation and a complete overhaul every five years. The aircraft records indicated that maintenance had been carried out on the heater in accordance with these requirements.

VH-BLM Bell model 47G-3B-2 helicopter, Serial No. 6680, was constructed in the U.S.A. by the Bell Helicopter Company in 1968 and was imported into Australia as a new aircraft. It had been operated by Jayrow Helicopters since new. There was a current Certificate of Airworthiness for the aircraft.

Records maintained in respect of the aircraft indicate that, the helicopter had flown a total of 1,528 hours. The maintenance release was current and there was no evidence of any defect in the aircraft, the engine or the aircraft components.

The helicopter was powered by a single engine and the aircraft fuselage aft of the cabin section was of open truss tubular construction. It was fitted with three side-by-side seats with the seat for the pilot being that on the left hand side.

Hazard Lighting Each of the aircraft was equipped with two anti-collision beacons. On the Beech aircraft they were fitted to the top of the vertical stabiliser and to the underside of the fuselage. On the helicopter, one was fitted on the under surface of the cabin and the other on the upper surface of the fuselage truss approximately 10 feet aft of the rotor mast. Anti-collision beacons are permitted to incorporate shielding, within defined limits, to prevent propeller reflections and all of the beacons on these two aircraft had some degree of such shielding.

Loading The maximum permissible gross weight for Beech D50B, VH-RCN, was 6,300 pounds and it has been calculated that, at the time of the last take-off from Essendon, the gross weight was 5,514 pounds. The gross weight at the time of the accident was approximately 5,471 pounds. There was no baggage or freight carried in the aircraft and it has been calculated that the centre of gravity was within the specified limits throughout the flight.

The maximum permissible gross weight for the Bell 47G-3B-2 helicopter, VH-BLM, was 2,950 pounds, and the gross weight of the helicopter at the time of its last take-off has been calculated at approximately 2,889 pounds. The gross weight at the time of the accident was approximately 2,738 pounds. Approximately 50 pounds of survey equipment was carried as external load on the undercarriage litter of the helicopter. It has been calculated that the centre of gravity was within the specified limits throughout the flight.

1.7 METEOROLOGICAL INFORMATION

A weak, cold front passed across Moorabbin Airport at 1350 hours and across Essendon Airport at 1355 hours. The front was accompanied by fracto-stratus cloud with a base ranging from 700 feet at Moorabbin to 1,500 feet at Essendon. The low stratus cloud was mainly confined to the frontal area and persisted only in fragmentary patches after the passage of the front. A post-analysis by the Bureau of Meteorology indicates that, at the time of the accident, the cloud base in the area between Essendon and Moorabbin was approximately 2,500 feet with fragmentary cloud patches at 1,000 feet to 1,500 feet and the visibility was in excess of five miles.

It has also been determined that, in the vicinity of the accident site, rain had been falling but had ceased several minutes prior to the time of the collision and there was overcast cloud above the level of the two aircraft.

1.8 AIDS TO NAVIGATION

Both aircraft were operating in accordance with the procedures applicable to visual flight and the use of navigation aids was not a factor in the accident.

1.9 COMMUNICATIONS

There were no reported communications difficulties and the radio equipment in each of the aircraft operated normally throughout the flights.

The last communication with VH-RCN was at 1416 hours when the pilot reported "Point Ormond" to Melbourne Departures Control on the frequency 118.9 mc. and was instructed "change to 118.1 entering Moorabbin zone". After this communication and before entering the Moorabbin Secondary Control Zone, the standard entry procedure required that the pilot should listen on frequency 120.9 mc. when approximately 5 miles from the control zone to receive from the Automatic Terminal Information Service the landing information then current. At the control zone boundary the pilot was required to listen on the Moorabbin Aerodrome Control frequency 118.1 mc. and then proceed in the circuit in accordance with the landing information or any subsequent directions transmitted to him. This aircraft was fitted with two VHF communications transceivers and two VHF receivers for use with navigation aids but which may also be used for communications reception on appropriate frequencies. During the examination of the aircraft wreckage it was noted that a frequency of 118.1 mc. was selected on the No. 1 transceiver and a frequency not applicable to the Melbourne area on the No. 2 transceiver. One VHF NAV receiver was selected to the Automatic Terminal Information Service frequency, 120.9 mc.

The helicopter VH-BLM, during its transit of the Melbourne Control Zone communicated with Melbourne Approach Control on a frequency of 124.7 mc. As the aircraft approached Point Ormond it was advised "Clear to close this frequency" and the acknowledgement of this transmission was the last communication with the aircraft.

The pilot of the helicopter was required to observe the same procedure, on entry to the Moorabbin Control Zone, as was the pilot of VH-RCN. At an appropriate position, frequency 120.9 mc. would be selected and, having received the landing information, the single VHF transceiver fitted to the aircraft would then be tuned to 118.1 mc. for communication with Moorabbin Aerodrome Control. Examination of the aircraft wreckage confirmed that the VHF transceiver was tuned to 118.1 mc. The aircraft was also fitted with one HF transceiver but no communications relevant to the occurrence were made on this frequency band.

1.10 AERODROME AND GROUND FACILITIES

These were not a factor in this accident.

1.11 FLIGHT RECORDERS

Flight recorders were not carried by either aircraft nor was there any requirement for this equipment to be carried.

1.12 WRECKAGE

The wreckage of the two aircraft was spread over an area approximately 3,000 feet by 1,500 feet, with the main wreckage of VH-RCN located some 1,350 feet to the south-east of the main wreckage of the helicopter. The wide distribution of major components from each aircraft indicated quite clearly that each had become uncontrollable following the collision.

All the pieces of wreckage of each aircraft were examined and, having regard to the locations in which the wreckage items were found, it was concluded that the major damage incurred by VH-RCN, at the time of the collision, was a loss of the complete No. 1 blade and outer portion of No. 3 blade of the starboard propeller, detachment of the starboard upper engine cowl, loss of most of the outer section of the starboard wing and aileron, complete loss of the starboard horizontal stabilizer and elevator, damage to the upper section of the fin and rudder and breakage of some cabin windows and the windscreen. Some components, including the starboard engine, became detached in the period of post-collision uncontrollable flight and the ultimate damage resulting from ground impact was a crumpling of the forward fuselage, detachment of the port engine, crumpling of wing leading edges almost to the line of the main spar, severe distortion of the fuselage in the cabin area and a 90 degree bending to the left of the rear fuselage forward of the empennage. The aircraft was in a steep nose-down attitude when it struck the ground.

The main wreckage of VH-BLM came to rest lying inverted across a fence line between two adjacent residences. Substantial damage had occurred to virtually all components of the helicopter and a number of components were found in other locations within the overall wreckage distribution. One rotor stabiliser tube and weight and the outboard section of one rotor blade were detached in the collision and severe damage was caused to the rotor mast, head and controls and to the remaining rotor blade and stabiliser tube. Several other lesser components became detached as a result of the collision or subsequent period of uncontrollable flight.

All the wreckage recovered was removed to Moorabbin Airport and there assembled into a three dimensional layout with a view to determining the relative positions of the two aircraft at the time of impact. It was significant that there was no evidence of collision damage on the port side of the Beech D50B aircraft.

It was established that the damage to the No. 1 blade of the starboard propeller of VH-RCN was the result of impact with a main rotor blade of the helicopter, initially when the rotor mast was forward and to the right of the propeller and a second strike which occurred when the rotor mast was to the rear and to the right of the propeller disc. The evidence also suggested that damage to the No. 3 blade resulted from rotor blade impact when the rotor mast was almost abeam of the propeller disc. The angle of the rotor strike marks on the propeller blades supports a proposition that the starboard mainplane of VH-RCN passed under the main rotor and above the transmission gear box of the helicopter. Impact marks on the main spar of the Beech aircraft were also consistent with the wing severance having resulted from impact with the rotor mast. Other evidence indicated that, following impact between the rotor and the propeller blades, the front of the helicopter struck the starboard engine bulkhead of the Beech aircraft and then moved inwards and rearwards along the side of the fuselage. In the vicinity of the tailplane of VH-RCN, the helicopter was tilted at about 45 degrees and the port fuel tank struck the tailplane of the aircraft in an upward and rearward direction. At about this time the helicopter main rotor severed the tip of the fin of VH-RCN.

1.13 FIRE

There is no evidence that the Beech aircraft was subject to any in-flight or post impact fire. There was a small fire at the helicopter main wreckage area and this was extinguished by the local residents who first reached the scene.

1.14 SURVIVAL ASPECTS

This was a non-survivable accident.

1.15 TESTS AND RESEARCH

Mode of Impact The three dimensional reconstruction of the wreckage of the aircraft enabled the mode of impact at the point of collision to be determined. Taking into consideration the nature and location of the damage which resulted from the collision, the most likely airspeeds of the helicopter and of the Beech aircraft and the probable rates of rotation of both the propeller and main rotor, it was concluded that the flight paths of the

two aircraft were converging at an angle of approximately 40 degrees, with the helicopter ahead and to the right of VH-RCN. Based on the relative speeds of the two aircraft, such an angle of convergence would result in the aircraft approaching each other along a constant line of bearing approximately 20 degrees to starboard of the flight path of the Beech aircraft and 120 degrees to port of the flight path of the helicopter. A plan view of the calculated final section of the relative flight paths is at Appendix A to this report. It was not possible to determine if there was a relative vertical movement between the two aircraft, but there is some evidence to suggest that VH-RCN was banked slightly to port at the time of the collision.

Cockpit Visibility A cockpit visibility study of the Beech D50B aircraft was conducted to determine the limits of the field of view from the pilot seat. Having regard to the known flight paths of the two aircraft at the time of impact, this study was limited to measuring the field of view forward and downward from directly ahead of the pilot to an angle of 33 degrees in azimuth to starboard. The windscreen of VH-RCN was of three segments consisting of a centre panel joined to two outer curved panels by opaque joining strips 1-7/8 inches in width. Immediately above the cockpit coaming at the bottom of the centre windscreen panel, there was a housing containing the aircraft magnetic compass and three air inlet vents. A person of similar stature to the pilot of VH-RCN was seated in the pilot seat of a virtually identical aircraft and it was apparent that, because of binocular vision, the windscreen joining strips caused little restriction to vision from that position, except in the area where the lower portion of the left hand windscreen joining strip and the compass/vent housing overlapped. Visibility ahead of the pilot was unrestricted by the aircraft structure to angles down to approximately 8 degrees below the horizontal. Turning in azimuth to the right, this maximum declination angle decreased slowly until at 19 degrees to the right the limit of downward view was approximately 5.5 degrees. At angles of azimuth of 20 degrees or greater to the right, there was a restriction of forward/downward visibility caused by the housing above the cockpit coaming and the overlapping windscreen joining strip. This restriction amounted to some 5 degrees of visibility in the vertical plane and it follows that a pilot of the stature used in the tests, would not be able to detect, from the normal seated position, objects within that azimuth sector below an angle of approximately one half degree below the horizontal.

Anti-Collision Beacons The characteristics and operation of the anti-collision beacons fitted to the aircraft were closely examined. Each of the aircraft was fitted with two anti-collision beacons, and these types of beacons conformed to the specifications laid down in FAR 23.1297 and 23.1401 as to colour, flashing characteristics and light intensities. The respective selector switches were so damaged by impact forces that it was not possible to determine their selected positions at the time of impact. The lamps of each beacon were examined to determine whether or not there was stretching of the filaments which would indicate that they were hot when subjected to shock loads. It was possible to conclude that the filaments of each of the beacons fitted to the helicopter, and the upper beacon fitted to VH-RCN were illuminated at the time of the air impact. The filaments of the lower beacon of the Beech aircraft had been destroyed but the upper and lower beacons on this aircraft operated in parallel from a single switch.

The distance at which a standard anti-collision beacon is discernible varies considerably depending upon the visibility and other ambient meteorological conditions and whether it is observed under daylight or darkness conditions. A calculation was therefore undertaken, reconciling the known characteristics of the beacons involved with the visibility conditions pertaining at the time of the collision. It was calculated that the maximum distance at which a standard anti-collision beacon could be sighted under these conditions was 1.2 miles.

Discernment of the Helicopter Consideration was also given to the question of whether or not the helicopter itself would have been visible to the pilot of the Beech aircraft at any time prior to the collision.

The structure of this type of helicopter presents a very small and diffuse visual target, the nucleus of which is the power plant and fuel tanks located amidships. Forward of this nucleus, the cabin is a perspex bubble and on the aft side the structure is an openwork beam supporting the tail rotor and the small tail surfaces. For the purpose of deciding the range at which such an aircraft would be visible it is reasonable to consider the cabin fairing and occupants, power plant and fuel tanks as presenting a solid target having a diameter of 6.5 feet.

The accepted threshold of resolution for a good average eye viewing a black dot against a uniform white background occurs when the target subtends an angle of 1 minute of arc at the eye of

the observer. This standard presupposes that the eye is correctly focused for the distance of the target and that the observer is looking directly at the target. The range at which an object of a given size is detectable visually diminishes rapidly as the object is located further from the direct line of vision and, for a target positioned as little as 10 degrees from this line, the threshold of perception does not occur until the angle subtended by the target has increased to approximately 8 minutes.

Had the ideal conditions obtained, the pilot of the Beech aircraft could probably have detected the helicopter at a maximum range of 3.7 miles. However, if in his visual scanning his line of sight had not reached a point of fixation within 10 degrees of the position of the helicopter, the range at which he would have detected its presence would have been reduced to 0.46 miles or less, even under theoretically perfect conditions.

In fact, the conditions for observing the helicopter in the area of the collision were very much poorer than the ideal as contrast would have been diminished by:

(a) atmospheric attenuation; and

(b) the variegated background against which the helicopter would have been viewed.

For these reasons it is considered that the maximum range at which the helicopter could have been detected visually by the pilot of the ambulance aircraft would certainly have been considerably below the 3.7 miles referred to above.

2 - Analysis

Neither aircraft was fitted with a flight data recorder and it was not therefore possible to determine precisely their respective flight paths. There is some evidence, however, which may be used in estimating the probable flight paths of the two aircraft. In the case of the helicopter, with its limited glide capability when operating at 1,500 feet, the consideration of emergency landing areas would favour operation along the shoreline in the situation of Port Phillip Bay being on the right hand side and densely populated Melbourne suburbs on the left. This was, in fact, the required standard operating practice of the operator concerned. The flight path of the helicopter immediately prior to the collision suggests that the pilot probably followed the shoreline until in the vicinity of Brighton Beach and from this point turned inland and tracked towards Moorabbin on a heading of approximately 095 degrees magnetic. The Beech aircraft was required by the terms of its amended airways clearance to track to the west of Flemington Racecourse thence direct to Point Ormond. The collision point is consistent with this aircraft having operated to Point Ormond in accordance with the clearance terms and thence on a constant heading of 135 degrees magnetic to complete the flight from Point Ormond to Moorabbin.

There is no accurate means whereby the height of the two aircraft at the time of collision may be established. The helicopter was cleared to operate through the Melbourne Control Zone at an altitude of 1,500 feet and there is no evident reason for it to be at other than this altitude when it left the control zone approaching Point Ormond. A helicopter is permitted to fly over a city, town or populous area at a height not below 1,000 feet, so that, at the time of the collision it would be expected that VH-BLM would be at an altitude not above 1,500 feet and not below 1,000 feet. It would seem most likely that, being still four miles from his destination, the pilot would have remained at or near 1,500 feet. There would have been no restriction, however, preventing the pilot from climbing to a maximum height of 2,000 feet had he deemed this necessary for some consideration of weather, safety or convenience.

The Beech aircraft was cleared to operate within the Melbourne Control Zone at an altitude of 2,000 feet and there was no amendment to this altitude clearance. Although the pilot did not advise his altitude when he reported at Point Ormond, there is again no evident reason why he would not be at the assigned altitude of 2,000 feet at this time. Having regard to the prescribed minimum height of 1,500 feet for flight over a city, town or populous area, and since 1,500 feet would be about the normal height for an aircraft to enter the circuit area prior to completing a landing circuit, it seems likely that, at the point of collision, the Beech aircraft would have been operating at a height close to 1,500 feet.

The evidence of eyewitnesses to the occurrence displayed considerable divergence and the spatial location of the point of collision could not be determined on this basis alone. However, the consideration of this evidence in conjunction with the location and distribution of the wreckage and the probable flight paths of the aircraft indicates that the most probable point at which the aircraft collided was on a bearing of 295 degrees magnetic, 4.3 miles from the reference point of Moorabbin Airport at an altitude of approximately 1,500 feet.

The area in which the collision occurred is one mile north-west of the boundary of the Moorabbin Control Zone and approximately five miles south-east of the southern boundary of the Melbourne Control Zone. The overlying airspace above 2,000 feet altitude and below Flight Level 400 (40,000 feet indicated on standard altimeter setting) lies within the Melbourne Control Area and the airspace below 2,000 feet forms portion of the Melbourne Flight Information Zone.

Whilst they were operating in the Melbourne Control Zone, separation between the two aircraft was provided by Air Traffic Control by the use of radar and there was no requirement for the aircraft to be provided with traffic information in respect of each other, nor was there a requirement for them to be on a common radio frequency.

Pilots of aircraft operating in flight information zones are not subject to air traffic control supervision or separation and are responsible for ensuring their own separation from other aircraft. The primary means whereby this separation is monitored by the pilot of a VFR aircraft is visual observation. Traffic information provided by the Flight Service Centre or derived from overhearing transmissions between other aircraft and the Centre supplements visual observations and assists pilots in their appreciation of the overall traffic situation at any given time.

The air traffic system provides that, in flight information zones, a traffic information service will be given to those aircraft operating in the instrument flight rules category and, in other circumstances, information of known traffic may be provided when requested by a pilot. The helicopter was operating under the visual flight rules and, although the pilot of the Beech aircraft had submitted a flight plan for flight under the instrument flight rules, he was operating, at his request, in accordance with a visual flight clearance. There was no traffic in the area which should have been the subject of direct notification to either aircraft and, as they were operating on different frequencies prior to the collision, there were no recorded transmissions from either aircraft which could have been intercepted by the other pilot. Neither pilot requested traffic information from any source. It is apparent, therefore, that the only means by which either pilot could have become aware of the presence of the other aircraft was by visual observation.

Each of the pilots bore a responsibility to ensure that his aircraft remained clear of other aircraft. In the case of the helicopter pilot, his attention would almost certainly be concentrated forward and downward as the helicopter approached its terminal aerodrome. The evidence relating to the mode of impact indicated that the aircraft approached each other on a constant line of bearing some 120 degrees to the left of the helicopter. The area from which the Beech aircraft approached, being some 30 degrees behind the abeam position, would be scanned by the helicopter pilot at most very occasionally. The planned speed of the helicopter was 60 knots and of the Beech aircraft 150 knots, while the relative flight paths of the two aircraft were such that they would be converging at a speed in the region of 110 knots. Under these circumstances it is improbable that the helicopter pilot would have visually cleared the area of approach of the Beech aircraft during the very short time in which he could have been expected to see that aircraft approaching.

Analysis of the evidence regarding the flight paths of the two aircraft indicates that, when the Beech aircraft was to the west of Flemington Racecourse, the helicopter had already reached Point Ormond and was probably tracking south along the shore of Port Phillip Bay. The distance between the two aircraft was then approximately 7 miles and it would not have been physically possible for the pilot of the Beech aircraft to see the helicopter at that distance. As the Beech aircraft approached Point Ormond, the helicopter would have been in the vicinity of Brighton Beach and the distance between them would have diminished to approximately 3.2 miles. At this time, the probable bearing of the helicopter relative to the pilot of the Beech would have been 19 degrees to his right and approximately 1.5 degrees below the horizontal if the height differential had been maintained. The range was such that, under theoretically perfect conditions and neglecting the consideration of limitations on cockpit visibility, it may have been just possible for the pilot of the Beech to detect the helicopter. Conditions were far from perfect, however, and it is very probable that, in the ambient weather conditions, the helicopter could not be seen from the Beech aircraft at this time. As already stated, the rotating beacon of the helicopter would probably not have been visible to the Beech pilot until the range had reduced to 1.2 miles and this again neglects the consideration of limitation on cockpit visibility.

The cockpit visibility study conducted in respect of the Beech aircraft indicated that there was a strong possibility that the helicopter could have been hidden from the view of the pilot by a

portion of the structure of that aircraft in an area covering relative bearings of 20 degrees to the right and greater, had the helicopter been slightly below the horizontal from the viewpoint of that pilot. It has been calculated, from the evidence, that the line of mutual approach was 20 degrees to the right of the flight path of the Beech aircraft but the accuracy of this calculation cannot be such as to preclude the possibility of a slightly greater angle. There is no firm evidence as to how long the two aircraft were on a line of constant bearing, but the possibility that neither aircraft altered course significantly after the helicopter left the shoreline of Port Phillip Bay, is consistent in terms of time with the approach paths which the two aircraft could have been expected to follow towards Moorabbin. It is therefore entirely possible that the helicopter would not have been visible to the pilot of the Beech due to the atmospheric conditions, until the range had reduced to at least that pertaining when the helicopter altered course away from the shoreline. Further, it is possible that throughout the remainder of the flight, the helicopter could have been hidden from the Beech pilot behind a portion of the structure of his aircraft.

Although it can be said that the rules of the air provide that an aircraft which is on the right of another aircraft or which is being overtaken has the right of way, this argument carries the presumption that the aircraft which must yield right of way is aware of the presence of the other aircraft.

There is little doubt that the pilot of the Beech aircraft did not observe the helicopter, at least until immediately prior to the collision. In the ordinary course of events the Beech pilot would be expected to maintain an adequate look out and ensure that "blind spots" or areas obscured by the aircraft structure are cleared periodically, in so far as this is possible. There is no evidence that the pilot did or did not conduct the flight in this manner, but whatever may have been the standard of the look-out maintained from the Beech aircraft, it is apparent that it was not sufficiently effective to prevent the collision.

Other factors which must be considered for their possible effect on the standard of the look-out maintained by the Beech pilot are fatigue, distraction, cockpit work load and his physical condition. Apart from a possible slight relaxation as the end of a tour of duty approached, fatigue should not have been a factor since his tour of duty had been in the vicinity of seven hours and he had not flown during the two days prior to the accident. There is no evidence of any operational cause for distraction as the examination of the wreckage did not disclose the presence of any emergency or other condition which might have been expected to claim the attention of the pilot to an extent which would have affected the look-out he maintained. Cockpit work load would certainly have been increasing as the aircraft checks and pre-landing preparations commenced but the pilot was experienced and familiar with the aircraft and the destination aerodrome and it therefore could be reasonably expected that his attention would have been distributed in an effective manner.

It was established that the cabin air heater of the Beech aircraft had deteriorated in service to the extent that products of combustion could have escaped into the cabin when the heater was operating but the extent of destruction of the aircraft was such that it could not be determined whether or not the heater was operating at the time of the collision. A post-mortem examination revealed the presence of carbon monoxide in the blood of the pilot but the level of saturation was such that, had the pilot been a smoker, it would not have been a particularly abnormal finding. In fact, the pilot was a non-smoker and, accordingly, it is concluded that there was some contamination of the cabin air but it is not considered to have been a factor in the accident.

In summary, each aircraft left the Melbourne Control Zone without knowledge of the presence or position of the other. There was no requirement that they should be given this information and when the aircraft were, each in turn, cleared from positive control, a reasonable standard of separation existed for continued operation in visual conditions. The aircraft were then operating in circumstances such that their separation depended upon visual contact of one aircraft with the other. The independently conducted flight paths of the two aircraft converged to the collision point but the pilot of the overtaking aircraft did not take avoiding action and the two aircraft collided. There is no evidence that either pilot was aware of the presence of the other aircraft at any time prior to the collision. It seems therefore that the probable cause of the accident was that the pilot of the overtaking aircraft did not see and avoid the helicopter and there was no factor of weather, aircraft serviceability or pilot disability which could be established as having contributed to the accident.

3 - Conclusions

1. The pilot-in-command of each aircraft was properly qualified and experienced for the duties being undertaken.

2. At the time of the accident there was a current Certificate of Airworthiness for each of the two aircraft involved. The combustion type cabin heater fitted to VH-RCN was defective to the extent that some products of combustion could have entered the cabin of the aircraft while the heater was operating. This defect probably did not contribute to the accident and there was no evidence of any other defect or malfunction of either aircraft which could have been a factor.

3. The weather conditions which were encountered by the aircraft were consistent with those forecast for the area and they did not present any undue hazard to either aircraft. The visibility conditions were above the minimum prescribed for visual flight and, other than by limiting the distance at which each of the pilots may have perceived the other aircraft, they did not contribute to the occurrence.

4. The aircraft collided at a position approximately 4.3 miles on a bearing of 295 degrees magnetic from the reference point of Moorabbin Airport. The collision point is not within the boundaries of a controlled airspace.

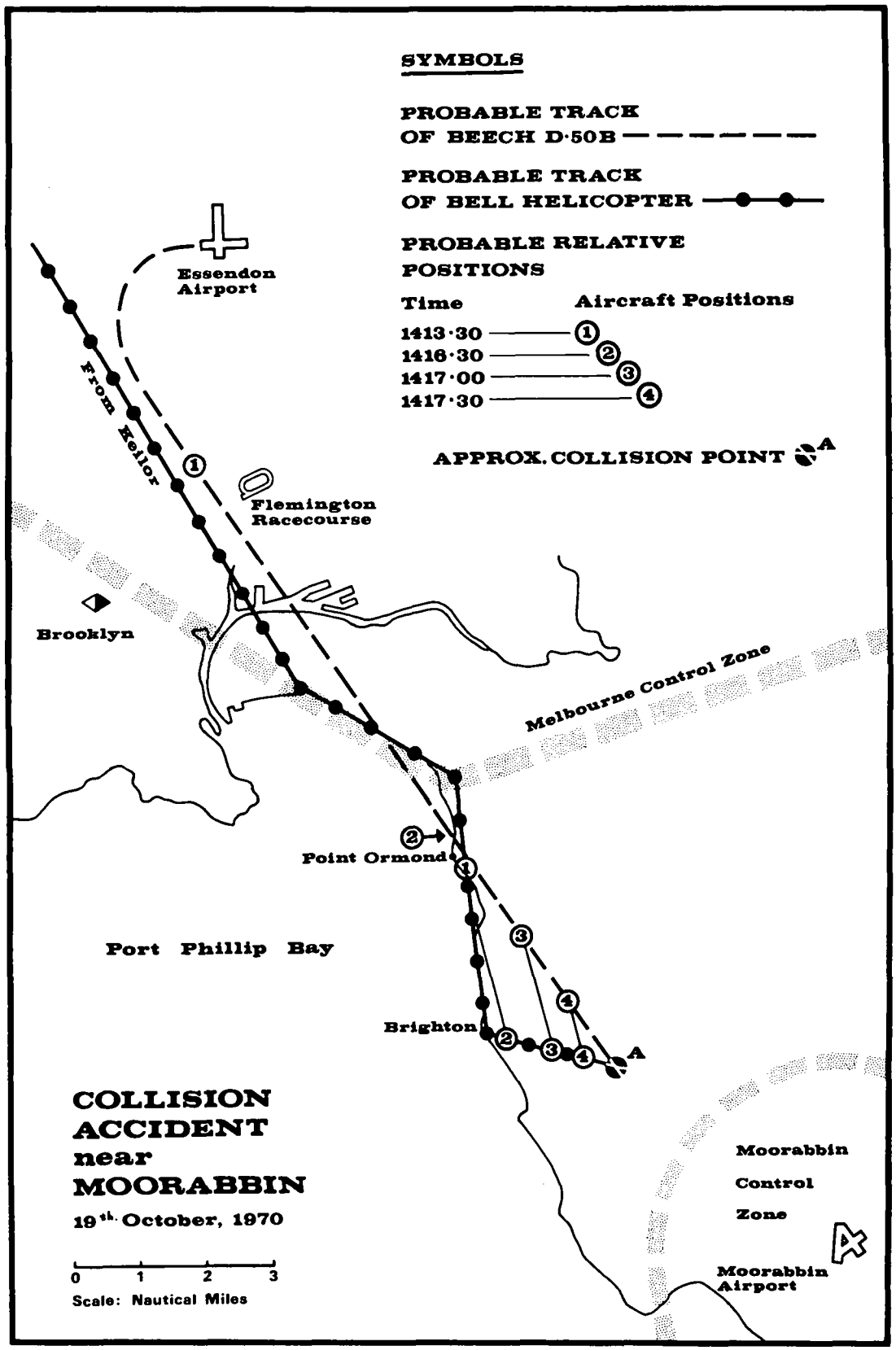
5. When the helicopter left the Melbourne Control Zone the two aircraft were separated by a distance of some 7 miles and, when the Beech aircraft left the zone approximately 3 minutes later, there was still adequate separation between the two aircraft for continued operations under visual conditions.

6. Each of the aircraft was operating in accordance with the visual flight rules. The prescribed operating procedures did not require that any traffic information be given to either aircraft with respect to the other and neither pilot requested traffic information.

7. The Beech aircraft, VH-RCN, was the overtaking aircraft. The collision occurred when the flight paths of the two aircraft converged, the helicopter being ahead and to the right of the Beech aircraft.

Cause The probable cause of the accident was that, whilst operating in an environment where the maintenance of separation between aircraft was a pilot responsibility, the pilot of the overtaking aircraft did not see and avoid the helicopter.

Appendix A


SYMBOLS
PROBABLE TRACK OF BEECH D·50B
PROBABLE TRACK OF BELL HELICOPTER
PROBABLE RELATIVE POSITIONS
Time
Aircraft Positions
1413·30
1416·30
1417·00
1417·30
APPROX. COLLISION POINT
A
Essendon Airport
From Keilor
Flemington Racecourse
Brooklyn
Melbourne Control Zone
Point Ormond
Port Phillip Bay
Brighton
Moorabbin Control Zone
Moorabbin Airport
COLLISION ACCIDENT near MOORABBIN
19th. October, 1970
0 1 2 3
Scale: Nautical Miles

Appendix B

DETAILS OF PERSONS ON BOARD

BEECH D50B VH-RCN

NAME	ADDRESS
Peter Raymond STONE	Dingley, Victoria.
Helen Isabelle LANG	Prahran, Victoria.

BELL 47G-3B-2 VH-BLM

NAME	ADDRESS
Brian James CRUIKSHANK	Ashburton, Victoria.
Henry Clifford Ridley SCOTT	Doveton, Victoria.
Donald Thomas RYAN	Doveton, Victoria.