Aircraft Accident Investigation

Report 821-1004

Cessna 411A VH-AYE
Archerfield, Queensland
5 January 1982

BUREAU OF AIR SAFETY INVESTIGATION

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Reprographics Pty Ltd
Cessna 411A VH-AYE
Archerfield Airport
Queensland
5 January 1982

The Secretary to the Department of 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 the Bureau of Air Safety Investigation
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Contents

Figure 1. Photograph of Cessna 411A VH-AYE taken by Reprographics Pty Ltd at Archerfield, QLD on 31 December 1981.

Accident Investigation Report

CESSNA 411A VH-AYE, OPERATED BY REPROGRAPHICS PTY LTD, AT ARCHERFIELD, QUEENSLAND ON 5 JANUARY 1982

Synopsis

At 1201 hours Eastern Standard Time (EST) on 5 January 1982, shortly after taking off from Runway 10 Left at Archerfield Airport, Cessna 411A aircraft, registered VH-AYE, crashed into an annex attached to a Thiess Contractors workshop located in Kerry Road, Archerfield. The accident site was 455 metres east-north-east from the departure end of the runway.

The pilot and four workmen taking their lunch break in the annex were killed. The aircraft and the annex were destroyed by impact forces and the following explosion and fire.

The accident occurred during a test flight following corrective maintenance. The aircraft had completed a periodic inspection on 23 December 1981 but, during the next 10 days, a problem was experienced with the control of the left hand propeller. Following maintenance on 4 January to rectify the problem, the pilot elected to test fly the aircraft prior to its intended use for endorsement training at 1500 hours on the day of the accident.

The accident was reported to the Air Safety Investigation Branch, Queensland Regional Office, Department of Transport, immediately after it occurred and the investigation began the same day. After notification of the accident, control of the investigation was assumed by Central Office, Air Safety Investigation Branch, and a Special Investigation was initiated.

Note: The Air Safety Investigation Branch, Department of Transport, became the Bureau of Air Safety Investigation, Department of Aviation, in May 1982.

1. Factual Information

1.1 HISTORY OF THE FLIGHT

On 23 December 1981 Hawker Pacific Pty Ltd at Archerfield Airport completed a periodic inspection on Cessna 411A VH-AYE. The aircraft was not flown during the next week because the weather in the Brisbane area was unsuitable for aerial survey. On 30 December it was arranged that Mr D. Hooton, a Townsville-based, company pilot would fly VH-AYE on a local survey flight. Mr Hooton had flown Reprographic's GAF Nomad VH-SFR to Archerfield for servicing and agreed to conduct the survey flight in VH-AYE with Mr M. Smith as navigator/camera operator.

After filing a flight plan it took Mr Hooton some time to get the aircraft underway because of a number of small problems with it. During the preflight inspection he carried out a drain check of the aircraft fuel tanks. There was no evidence of any water in the fuel. Eventually the aircraft taxied just before 1100 hours and was cleared for take off at 1105

hours. During the take off roll the left hand propeller oversped and the pilot abandoned the take off. He taxied the aircraft back to the Hawker Pacific hangar and reported the problem to the Aviation Manager for Reprographics, who was oversighting the servicing of VH-SFR.

A ground run was conducted and the propeller appeared to function correctly. The aircraft taxied again at about 1124 hours and was cleared for take off at 1129 hours. Again the left hand propeller oversped during the take off roll, the take off was abandoned and the aircraft returned to the hangar.

The propeller governor was removed from the left hand engine and sent to G.B. Ditchmen Pty Ltd for inspection. The unit was checked visually, but not bench tested, and a new gasket was fitted to the cover. It was returned to Hawker Pacific and refitted to the aircraft. At about 1750 hours the aircraft was cleared for a fast run along the runway to check the left hand propeller and governor. The results were satisfactory but the aircraft was not flown.

On 31 December it was intended to have all three company aircraft, i.e. GAF Nomad VH-SFR, Cessna 411A VH-AYE and Beech Baron VH-AEA, airborne together so that some publicity photographs could be taken from another aircraft. Difficulties were experienced arranging a camera aircraft and the exercise was cancelled. Some photographs were taken of the aircraft on the ground.

At about 1210 hours the Nomad taxied for its return flight to Townsville and was followed by the Cessna 411A with Mr J. O'Brien, the Managing Director of Reprographics, in command. It was his intention to take his brother for a short local flight.

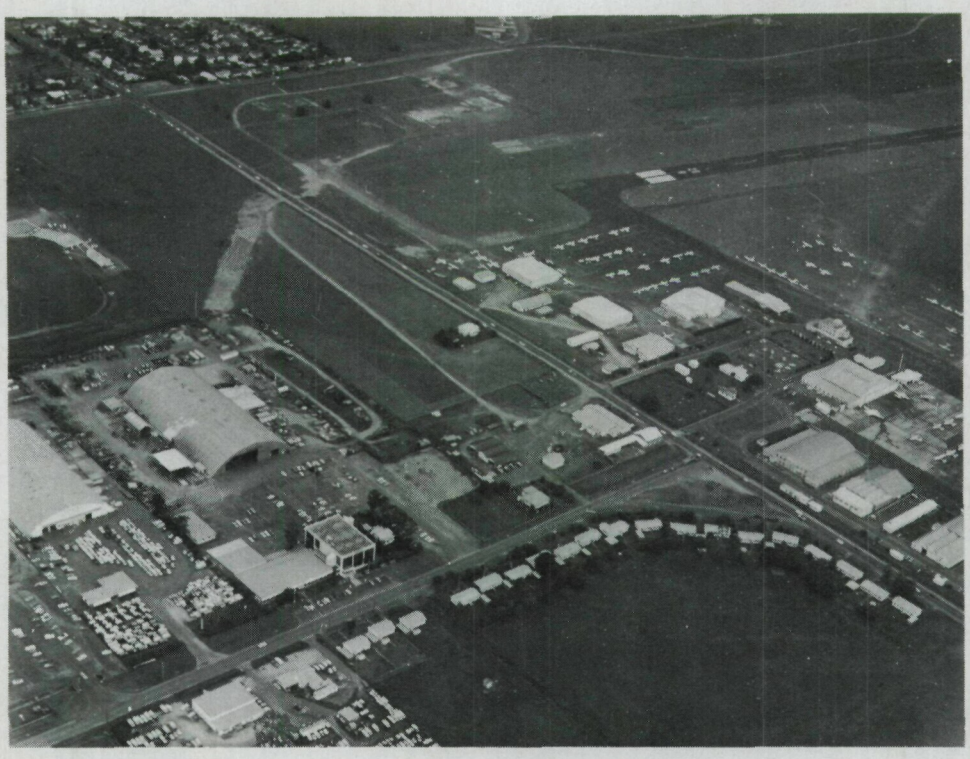
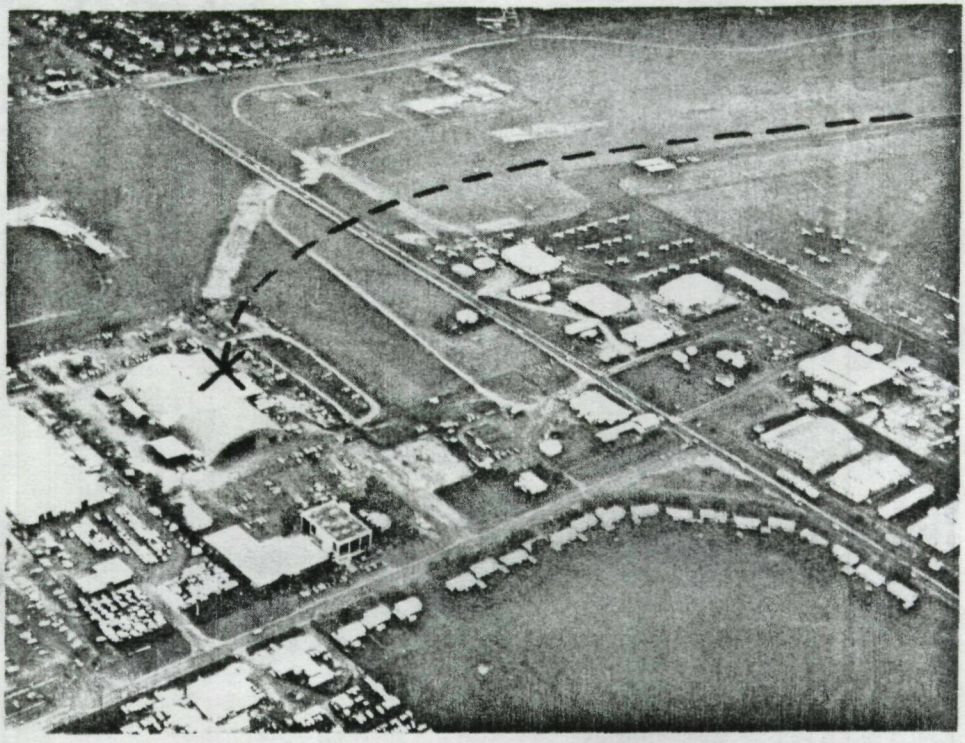


Figure 2. Aerial view of the accident locality, facing south west, showing the departure end of Runway 10L, the approximate flight path of Cessna 411A VH-AYE and the accident site.

CORRIGENDA

The photograph at Figure 2, page 2 should be replaced by the illustration below.



While waiting for take off clearance Mr O'Brien advised Archerfield Tower that the aircraft had a governor problem and the Cessna returned to the Hawker Pacific hangar. After discussing the problem, it was decided that the governor would be removed for further examination. This was to be done on 4 January 1982 by Rex Aviation Pty Ltd who were on stand down for the Christmas/New Year holidays.

On 2 January, despite the arrangements made on 31 December, Mr O'Brien decided to attempt an aerial survey flight as the weather was suitable. He arranged for Mr M. Smith, the navigator/camera operator, to meet him at Archerfield. A flight plan was submitted for a survey flight in the Brisbane area. After starting both engines Mr O'Brien experienced some problems with the control of the propellers. He tried various checks then decided to attempt a take off. The aircraft was cleared for take off at 1012 hours but the take off was abandoned because of propeller control difficulties. Mr O'Brien taxied the aircraft back to the hangar and left it there.

As planned, on 4 January it was arranged with Hawker Pacific to remove the left hand propeller governor from the engine and have it inspected by Rex Aviation. This was done and significant adjustments were made to the unit which was then bench tested within specifications. Hawker Pacific refitted the governor to the engine and gave the aircraft two ground runs in accordance with the Cessna 411 maintenance manual. These ground runs proved satisfactory.

Reprographics had arranged that on 5 January a new company pilot was to undergo endorsement training on VH-AYE. To ensure that the aircraft would be serviceable for the training Mr O'Brien decided to conduct a test flight on it. He left the company office at about 1100–1115 hours and arrived at Archerfield a short while later. He spoke briefly to a Hawker Pacific employee before starting the aircraft and taxying at about 1149 hours.

The pilot requested clearance from Air Traffic Control (ATC) to use Runway 28 Right, the sealed runway, but, because the duty runway system was 04, he was cleared to taxy to Runway 10 Left. The aircraft taxied to the holding point where a runup lasting a few minutes was conducted. At 1159 hours Mr O'Brien reported ready and a few seconds later was cleared for take off.

The take off roll appeared normal but, soon after lift off, the aircraft yawed left and the left wing dropped, apparently associated with a loss of power from the left engine. The aircraft recovered its normal attitude and climbed slowly to about 100-200 feet above ground level at a low airspeed. There appeared to be some directional instability. About 200 metres past the end of the runway, where the aircraft was still approximately in line with the runway or slightly to the left of it, the left wing lowered slowly to about 30 degrees of bank. The rate of roll then increased and the angle of bank quickly rose to nearly vertical. The nose of the aircraft fell to about 45 degrees below horizontal and the Cessna descended into the roof of the annex to the Thiess workshop. Immediately after impact there was an explosion followed by the outbreak of a fire.

1.2 INJURIES TO PERSONS

Injuries	*Crew*	*Passengers*	*Other*
Fatal	1	—	4
Serious	—	—	—
Minor/None	—	—	—

1.3 DAMAGE TO AIRCRAFT

The aircraft was destroyed by impact forces and the following explosion and fire.

1.4 OTHER DAMAGE

The annex into which the aircraft crashed, and its contents, were also destroyed by the impact forces and the following explosion and fire.

1.5 PERSONNEL INFORMATION

1.5.1 Flight crew

The pilot-in-command, and only occupant of the aircraft, was James Joseph O'Brien, aged 31 years, the holder of Private Pilot Licence number 118933. The licence was valid to 30 April 1982 and endorsed for Cessna 411 aircraft. The pilot did not hold any instrument or instructor ratings. The approved group endorsements on his licence were 'constant speed or variable pitch propeller, retractable undercarriage and pressurisation system'.

Mr O'Brien also held an Aircraft Radiotelephone Operator Certificate of Proficiency and a Flight Radiotelephone Operator Licence valid to 30 April 1982.

The pilot's flying experience could not be accurately determined because of incomplete log book entries and company records. Two log books belonging to Mr O'Brien were obtained following the accident. These were a U.K. log book in which the entries commenced in 1969 and continued to December 1978 and an Australian Department of Transport log book, commencing in August 1979 and current at the time of the accident. A resume of Mr O'Brien's flying experience, based on his log books, the D.o.T. pilot history file and company records, follows:

Mr O'Brien commenced his flying training with a dual flight at Bristol, England, on 3 July 1969. His next flight was not until 22 March 1972 at Archerfield. His training continued spasmodically until 16 April 1974 when Private Pilot Licence number 309082 with area restrictions was issued to him. Mr O'Brien then began conversion training on the Cessna 310 aircraft and his licence was endorsed for this type on 17 July 1974.

At about this time Mr O'Brien moved to Papua New Guinea and was flying in the right hand seat of Cessna 310 VH-ACB with commercial pilots acting as pilot-in-command. The aircraft was operated and being purchased by Austral Aerial Surveys Pty Ltd which later became Reprographics Pty Ltd. During this time Mr O'Brien logged the full duration of each flight as copilot time.

After his return to Brisbane in about July 1975 Mr O'Brien obtained an endorsement on the Piper PA28 aircraft and then undertook the navigation training necessary to remove the area restrictions from his licence. This occurred on 22 October 1975.

For the next three years Mr O'Brien flew regularly as pilot-in-command on VH-ACB. On 21 March 1977 his licence number was changed to 118933 when D.o.T. amended the pilot licensing system. In September 1978 he obtained an endorsement on the Cessna 411 after training in VH-AYE, which was being operated by Reprographics. Mr O'Brien flew VH-AYE extensively through November and December 1978 as pilot-in-command.

The last entry in Mr O'Brien's U.K. log book was for December 1978. At this point there were 20 blank pages remaining in the book. The last grand total recorded was 685 hours 13 minutes. This was followed by two flights totalling 6 hours 35 minutes.

Mr O'Brien's second log book was commenced in August 1979. The Summary of Previous Log Book was apparently completed and signed by him and the following hours were claimed:

(1) Day	— Command	:	702.1 hrs
(2)	— In Command Under Supervision (ICUS)	:	153.0
(3)	— Dual	:	25.6

(4)	— Copilot	: 1201.6
(6) Night	— ICUS	: 18.7
(8)	— Copilot	: 27.5
	TOTALS (1)–(8)	: 1513.9

(NOTE: The actual total of columns (1)–(8) is 2128.5)

Following the accident the operator could not provide any records to support the hours claimed by Mr O'Brien for the period not included in these two log books. An ex-company pilot who flew with Mr O'Brien during the period 19 April to 8 August 1979 provided a statutory declaration that Mr O'Brien had flown approximately 302 hours in command of VH-AYE. No evidence was obtained of any flying experience accrued between December 1978 and April 1979.

Mr O'Brien's flying on VH-AYE continued until November 1979. From then until May 1980 Mr O'Brien only logged eight flights; the first six in VH-AYE and the last two in Beech Baron A56TC VH-AEA which had been acquired by Reprographics in November 1979. His licence was endorsed for the Beech Baron on 16 May 1980. The last entry in the log book, at the time of the accident, was for 25 May 1980.

Following the accident Reprographics completed the log book entries from company trip records. These showed that Mr O'Brien's last flight as pilot-in-command in VH-AYE was on 2 September 1980. After that he had only flown six flights in VH-AEA up to the day of the accident. The last flight in VH-AEA was logged for 5 October 1981.

From the final entry in Mr O'Brien's current log book, his claimed grand total of flying at the time of the accident was 2306 hours, of which 509 hours were logged in VH-AYE.

According to records obtained from another ex-company pilot, Mr O'Brien flew in VH-AYE on 9 May 1981 on a 50 minute survey flight in the Brisbane area. Mr O'Brien was acting as navigator/camera operator but on completion of the photography he asked the pilot-in-command for the landing. Because the camera sight prevented the aircraft being flown from the right hand seat, they changed seats and Mr O'Brien conducted the landing at Archerfield.

No evidence was obtained of Mr O'Brien flying VH-AYE between 9 May 1981 and his attempted flight on 31 December 1981.

The last dual training he undertook was reported to be in the company Nomad in September 1981. Mr O'Brien was not endorsed on the aircraft and the company pilot giving the instruction was not approved by D.o.T. to do so. Nevertheless, the opportunity was taken to give Mr O'Brien some asymmetric practice. The last reported training that Mr O'Brien had in the Cessna 411A was in September 1980 on a route flight to northern Queensland with the same pilot.

No reliable evidence was obtained of Mr O'Brien's current flying ability or of his experience of engine failures in flight.

1.5.2 Air Traffic Controllers

At the time of the accident there were three Air Traffic Controllers on duty at Archerfield. They occupied the positions of Surface Movement Controller (SMC), Aerodrome Controller (ADC) and Supervisor/Officer-in-Charge/Co-ordinator. All three controllers were appropriately licensed and qualified for the positions they occupied.

1.6 AIRCRAFT INFORMATION

1.6.1 History and documentation

Cessna 411A aircraft, serial number 411-0288, was manufactured by the Cessna Aircraft Company, U.S.A., in 1968. It was imported into Australia as a used aircraft in 1974 and

entered on the Australian register as VH-AYE on 30 January 1975, when the Certificates of Registration and Airworthiness, numbered 8611, were issued.

On 29 September 1978 a change of interest in the aircraft was effected and the Certificate of Registration was amended to show the owner as Beneficial Finance Corporation Ltd, Brisbane. The holder of the certificate was shown as Reprographics Pty Ltd, under a leasing agreement with the owner.

Both certificates were valid at the time of the accident.

Maintenance Release number 78988 was issued by Hawker Pacific Pty Ltd, Archerfield, on 23 December 1981. It was to remain in force until 22 December 1982 or 4585 hours 35 minutes total aircraft time in service. In the maintenance requirements section it contained an entry recommending an engine oil change at 4535 hours. This entry included a note to use straight oil in the left hand engine and dispersant oil in the right hand engine.

The original of the maintenance release was normally carried in the vinyl pocket next to the circuit breaker panel in the aircraft cockpit. It was sighted by Mr D. Hooton, the pilot of VH-AYE on 30 December 1981, and at that time contained no other entries than those described previously. The original maintenance release was not recovered after the accident so that it is not known whether any entries had subsequently been made in the 'endorsements' section or in the 'daily inspection certifications and aircraft time in service' section.

Following importation of the aircraft, its airframe hours were recorded on 23 January 1975 as 2650 total airframe hours — time in air. The total airframe hours at the time of issuing the maintenance release on 23 December 1981 were recorded as 4485 hours 35 minutes. The last major inspection was completed by Hawker Pacific at Archerfield on 20 February 1981. The time in service between the major inspection and the accident, according to the records, was 292 hours 25 minutes.

All appropriate airworthiness directives and modification requirements had been complied with.

There were no airframe, engine or accessory defects recorded in the aircraft documentation at the time of the accident.

1.6.2 Engines and propellers

The aircraft was fitted with Continental GTSIO-520-C, 6-cylinder, opposed, fuel injected, turbocharged engines. These engines contained gearing which reduced the propeller speed to three quarters that of the engine. The reconditioning period for these engines was 1300 hours in service.

Engine serial number 150378-5-C was fitted to the left hand position in February 1981 and, according to the log book entries, had completed 292 hours in service since reconditioning. Time in service since new was not recorded.

Engine serial number 155176-9-CR was fitted to the right hand position in August 1978 and, according to the log book entries, had completed 1148 hours time in service since reconditioning. Time in service since new was not recorded.

The engines were fitted with Garrett-Airesearch turbocharging systems which automatically controlled the manifold pressure (MP) to a maximum of 34.5 inches of mercury (34.5'' Hg) up to 16 000 feet altitude. Above this altitude the maximum manifold pressure was controlled to 2.2 times atmospheric pressure.

While the turbochargers were normally changed with the engines and had the same hours-in-service life, in this case the left hand turbocharger was fitted on 8 August 1980 and had completed 343 hours in service since remanufacture.

The aircraft was fitted with McCauley, 3-blade constant speed, fully feathering propellers.

Propeller serial number 725108 was fitted to the left hand position and propeller serial

number 728255 was fitted to the right hand position. Both propellers were last overhauled in August 1978 and were due for overhaul at 4937 airframe hours. Time in service since new was not recorded.

The propellers were operated by engine oil pressure and controlled by governors fitted to each engine. Governor serial number 752826 was fitted to the left hand engine and governor serial number 860886 was fitted to the right hand engine.

1.6.3 Maintenance

VH-AYE was maintained in accordance with the requirements of Air Navigation Order (ANO) 100.5.1. Appendix 4. This system of maintenance required that the aircraft undergo a daily inspection before the first flight of each day the aircraft was operated and a periodic inspection every 12 calendar months or every 100 hours in service, whichever occurred first.

In addition to the daily and periodic inspections the aircraft log book statement contained an attachment which detailed inspection schedules additional to those in Appendix 4. These schedules required inspection of various systems at each periodic inspection.

It was also required by ANO 100.5.1 that the aircraft undergo a major inspection every three years.

From the time the aircraft was obtained by Reprographics in 1978 it was normally based at Archerfield and maintained by Hawker Pacific. During the 12 month period preceding the accident the aircraft underwent a major inspection and several periodic inspections. On 20 February 1981 a major inspection was completed by Hawker Pacific. The aircraft was flown for about 28 hours up to the end of February and then remained on the ground at Archerfield until early May when it was flown to Darwin for a survey contract expected to last several months. On 9 June a 100 hourly inspection was completed by Darwin General Aviation Pty Ltd. The aircraft continued to be used regularly and on 10 August Darwin General Aviation completed another 100 hourly inspection.

The survey continued until 16 September when the exhaust system on the right hand engine failed in flight, causing damage to the engine and its mounts. A precautionary landing was conducted at Elliott in the Northern Territory where the full extent of the damage was assessed. The aircraft remained at Elliott while approval was obtained to conduct the necessary repairs and parts were obtained and manufactured. The repairs were completed over the next six weeks and during 3-5 November VH-AYE was ferried back to Archerfield via Alice Springs.

Following some further corrective maintenance the aircraft was flown for approximately 40 hours before it became due for a 100 hourly inspection in mid December. The inspection began on 14 December at Hawker Pacific but was delayed by the need to recondition five cylinders on the left hand engine and also the difficulty experienced in obtaining some replacement exhaust system parts. Reconditioning of the cylinders was necessary because of low compression, even though the engine had only operated for 292 hours since overhaul. The cylinders were deglazed and the valves and seats refaced before refitting to the engine. The inspection was completed on 23 December.

During the period May-December 1981 the aircraft suffered from a number of partial engine failures when the left hand engine became normally aspirated at high altitude, i.e. the turbocharging system failed. Following such an occurrence in June the pressure ratio controller was replaced but the problem recurred several times after that. The last reported failure was on 7 December during a flight in the Brisbane area.

After the return of the aircraft from Elliott, on at least two occasions, pilots reported that the maximum RPM of both engines were low. Hawker Pacific adjusted the propeller governors to correct this problem.

1.6.4 Weight and balance

It was not possible to accurately determine the weight and balance of the aircraft at the time of the accident because of the extent of fire damage and the possible movement of items on board the aircraft during the impact. Based on the most probable circumstances and conditions, however, the following approximate weight has been determined.

Item	*Weight (kilograms)*	*How established*
Aircraft including full fuel, full oil, 5 seats, RC10 camera with mount, magazine and drift sight.	2756.5	Aircraft weighing summary dated 11 May 1981.
Pilot	83	Post mortem report
Baggage, including 3 spare film magazines, maps and charts, personal equipment, filter case, tools, sundry items.	50	Estimated by investigator
Total	2889.5 kg	

Some deduction is necessary for the fuel used during ground runs and abandoned take offs since the last refuelling was conducted at Archerfield on 10 December. The aircraft tanks were full on completion of this refuelling. Based on Mr Hooton's assessment that on 30 December the aircraft would have consumed up to 45 litres of fuel, and allowing a further 25 litres consumption up to the time of the accident, a deduction of approximately 48 kg, i.e. 70 litres at 0.69 specific gravity, would seem appropriate. The estimated weight of the aircraft, to the nearest 10 kg, was 2840 kg.

The maximum take off and landing weight permitted by the Approved Flight Manual was 2948 kg.

There was no evidence to suggest that the aircraft was loaded so that the centre of gravity was outside the limits given in the Approved Flight Manual.

1.7 METEOROLOGICAL INFORMATION

Prior to attempting this flight the pilot apparently did not obtain, nor was he required to obtain, any aviation weather forecasts.

Archerfield Tower was equipped with an Automatic Terminal Information Service (ATIS) which broadcast continuous information concerning meteorological conditions and operational procedures currently applicable, and was updated as circumstances changed. Between 1118 hours and 1342 hours the ATIS information was: 'Archerfield Terminal Information Charlie. Runway zero four, left hand circuit, wind, a light north easterly, QNH one zero one one (millibars), cloud two oktas (eighths) base three thousand (feet). Make departures and full stop landings runway zero four right, touch and go landings runway zero four centre or left'. When the pilot requested taxying clearance he indicated that he had received this information.

A post accident analysis of the synoptic situation, provided by the Bureau of Meteorology, indicated that at 0900 hours on the day of the accident a 1015 millibar high pressure system extended a weak ridge along the central and northern Queensland coast resulting in a moist easterly/north easterly air stream about much of Queensland. Although there were no Bureau observers stationed at Archerfield, the following conditions, applicable at the time of the accident, were interpolated from records from other stations:

Wind North easterly/5 to 10 knots

Weather	Haze
Cloud	2 OKTAS Cumulus base 3500 feet
Temperature	30 degrees Celsius
Dew point	20 degrees Celsius
QNH	1012.5 millibars

Witness information including photographs taken immediately after the accident indicated that the weather was fine and the sun was shining through the scattered cloud.

1.8 AIDS TO NAVIGATION

Not applicable to this accident.

1.9 COMMUNICATIONS

The flight was to be conducted within the Archerfield Control Zone and communications were to be maintained with Archerfield Tower. Communications available were Archerfield Surface Movement control on 119.9 MegaHertz (MHz) and Archerfield Aerodrome Control on 118.1 MHz.

The communications were recorded on magnetic tape and a transcript of the relevant portion of this tape is included at Appendix A.

1.10 AERODROME INFORMATION

At the time of the accident Archerfield Airport was a Government aerodrome consisting of three sets of parallel runways. All the runways except 10L/28R had a prepared natural surface of rolled grass and earth with bitumen sealed ends. Runway 10L/28R had a bitumen sealed surface for its full length.

A diagram of the aerodrome layout is contained at figure 3.

At the time of the accident the duty runway for departures, i.e. taking off, was 04 Right. Because of the short length and/or type of surface of all runways except 10L/28R, the pilots of twin-engined aircraft generally requested the use of the sealed runway for take off. The dimensions and condition of Runway 10L/28R applicable at the time of the accident were:

Runway length	:	1328 metres
Runway width	:	30 metres
Strip width	:	150 metres
Slope	:	0.4 per cent down to the west
Direction	:	096/276 degrees Magnetic
Surface strength	:	Unrated
Obstructions	:	Nil
Surface condition	:	Smooth and dry
Elevation	:	75 feet AMSL

1.11 FLIGHT RECORDERS

The aircraft was not fitted with any cockpit audio or flight data recorders. There is no requirement for Australian registered aircraft of this category to be so equipped.

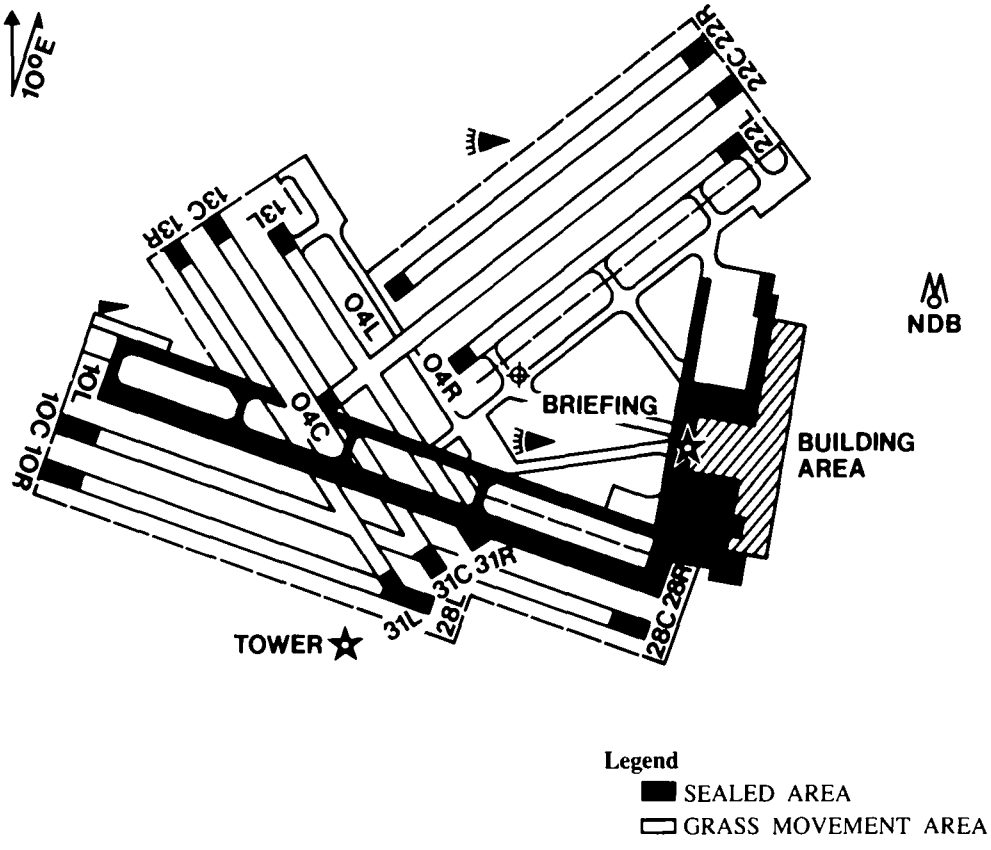


Figure 3. Aerodrome layout — Archerfield Airport

1.12 WRECKAGE AND IMPACT INFORMATION

The first point of impact was a ventilator cowl on the roof of the annex. The aircraft then collided with the galvanised iron roofing and steel supporting structure. It came to rest inside the annex, intermingled with the roofing and structure.

The front of the wreckage was resting on the concrete floor of the annex with the tail section about four metres above the floor supported by the buckled roofing and structure. The only major items separated from the bulk of the wreckage were the wingtip fuel tanks, the nose wheel and lower nose gear leg but these were located within a few metres. A large proportion of the wreckage was consumed by the post-impact fire. All the wreckage was affected by the fire.

The degree of disruption to the building caused by the impact, the following explosion and subsequent fire-fighting and rescue activities made it difficult to accurately assess the impact marks and to determine the aircraft attitude at impact. It was estimated that the aircraft was tracking on approximately 025 degrees magnetic, descending at about 25

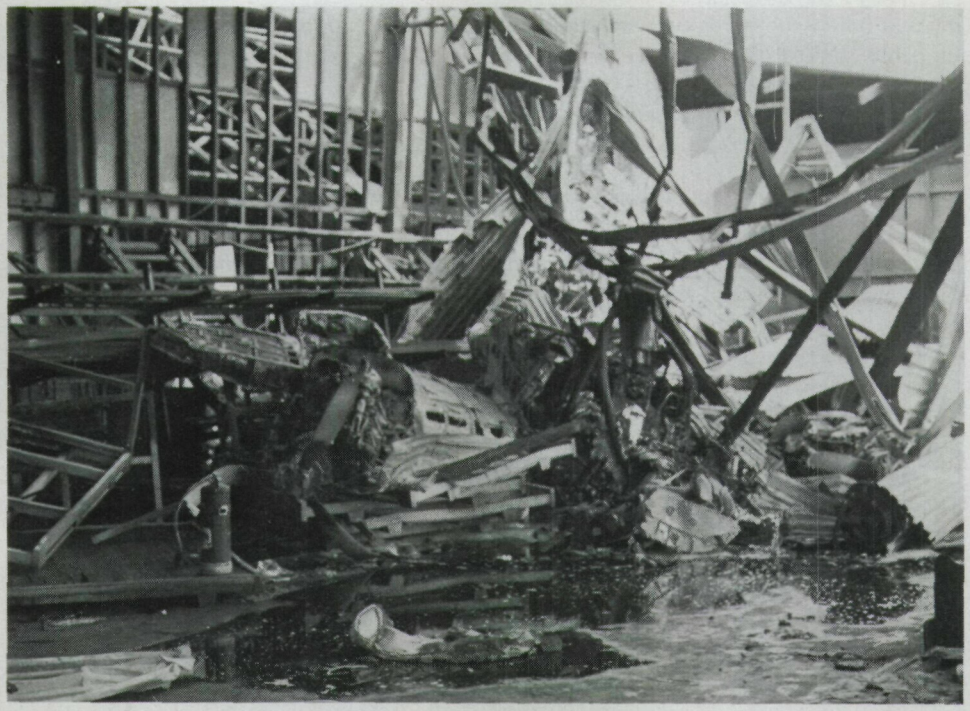


Figure 4. General view inside the annex showing the aircraft wreckage interspersed with the building structure. The aircraft is facing towards the viewer with the cockpit area near the centre of the photograph.

Figure 5. View towards the east of the outside of the annex. The remains of the vertical stabiliser can be seen in the centre of the photograph.

degrees below the horizontal and yawed approximately 25-30 degrees to the left. It was probably banked to the left but there was insufficient evidence to estimate the angle of bank.

Eyewitness evidence supported the above estimations of the impact attitude.

At the time of impact the landing gear was extended although the retraction cycle had commenced and the landing gear doors were partly open. The wing flaps were up, the engine cowl flaps were open and both propellers were turning.

A detailed examination was conducted on the remains of the airframe, engines and systems. The primary flight control systems were found to be intact and correctly fitted but the cable tensions could not be checked because of the wreckage deformation. The flight control lock was not present in the remains of the cockpit. The rudder, elevator and aileron trim systems were intact and set in the neutral positions.

The engine control systems were intact except for the right hand propeller control which had a cable broken at impact. The cockpit control pedestal was destroyed by fire. The control levers were still attached to their respective cables.

The fuel selector cables were correctly routed from the cockpit selectors to the valves. The left hand selector was in the left main tank position but the valve was midway between the left main and left auxiliary tank detents. The right hand selector was in the right auxiliary tank position but the valve was in the right main tank position. The attachment points of both selector cable, outer casings had been affected by fire.

The fuel system was badly affected by impact and fire. Those fittings and lines remaining were correctly connected. Some samples of liquids were obtained from the system.

The cockpit instrument panels were partially consumed by fire and no reliable indications or switch positions could be determined. The circuit breaker panel on the left hand side of the cockpit was also partially consumed by fire.

The landing gear actuator motor and gearbox were intact and in about the mid position. The main landing gear was down and the doors were partly open. All pushrods were intact. The upper part of the nosegear asssembly, which was still attached to the fuselage following the impact, was destroyed by fire.

Both engines and propellers, both turbochargers and their controllers and other miscellaneous items were removed for detailed examination.

1.13 MEDICAL AND PATHOLOGICAL INFORMATION

The pilot's last medical examination for his pilot licence renewal was on 11 April 1980. He had no known medical history of significance. On the day of the accident he was apparently in good health and good frame of mind.

The pilot's body was located in the approximate area of the aircraft cockpit but there were no significant findings in respect of its position in relation to the aircraft controls. The bodies of the other four victims were in the vicinity of the table where they had been taking their lunch break, adjacent to the left wing of the aircraft wreckage.

Autopsy examinations were conducted on all the deceased. In respect of the pilot no signs of any significant pre-existing disease or of a possible medical cause for the accident were found. He had not suffered from any traumatic injury, there were no significant toxicological results and death was the result of asphyxiation and incineration.

1.14 FIRE

Immediately following the impact there was an explosion and a fire broke out. The fire engulfed the aircraft and the whole interior of the annex was affected by the flames. One

witness reported that when the aircraft flew into the roof she saw the outer ends of the wings break off and fold back. After the accident the main fuel tanks, i.e. the wingtip tanks, were found detached from the rest of the wreckage. These tanks had a total capacity of 386 litres and had been nearly full. The auxiliary wing tanks had a total capacity of 378 litres and were probably also close to, if not full.

The fuel for the explosion and initial fire was provided by the aircraft's fuel load. Ignition could have been caused either by hot engine components, short circuiting in the aircraft electrical system or short circuiting of electric cables within the building. The fire was sustained by the consumption of the aircraft structure, the building and its contents. Approximately 40 hand extinguishers were used by workmen before the D.o.T. fire tender arrived. This unit was subsequently supported by three appliances from the local fire brigade.

Rapid action prevented the fire spreading into the main workshop which was a timber framed, large 'igloo' type hangar, containing earthmoving equipment undergoing repair.

1.15 SURVIVAL ASPECTS

Initially there was some confusion amongst Departmental personnel because they had not seen the aircraft crash into the building. The fire tender was turned out for the explosion and fire in the Thiess building and it was just over two minutes after the accident before the Airport Fire Service had confirmation that an aircraft was involved. In addition, one of the eyewitnesses operated a fire alarm in a building on the airport and this added to the confusion. There was some difficulty in gaining access to the site because of the wire fences located in the area.

Despite the initial problems the D.o.T. fire tender arrived at the scene in less than five minutes and was joined shortly thereafter by the civil emergency services.

The fire destroyed the seat belt available for use by the pilot. It was not determined if the pilot had used the seat belt and if so, whether it had prevented any traumatic injuries.

There was no evidence of any aircraft structural failure that affected the survivability of the accident.

1.16 TESTS AND RESEARCH

1.16.1 Engines

Both engines sustained damage from impact forces and fire. They were removed from the wreckage and conveyed to an approved workshop where they were subjected to a complete strip examination. As far as could be determined there was no evidence of pre-existing damage or defects in the engines and their ancillary equipment that would have prevented the engines from developing normal power.

The lack of damage to the crankshaft-gear, dowel pin on the left hand engine indicated that the engine was operating at low RPM at the time of impact.

The damage to the crankshaft-gear, dowel pin on the right hand engine was consistent with the engine operating at high RPM at the time of impact.

1.16.2 Engine controls

The centre console in the cockpit was consumed by the post impact fire and the position of the engine controls in the quadrant could not be observed. However, the remains of the control levers were still attached to the control cables. It was noted that heat from the fire had caused the inner cables to seize in their outer casings and therefore the distances between the cable eye end and the outer cable attachment nut indicated the post impact/pre-fire position of the engine controls.

These distances were measured and another Cessna 411 was used to simulate the engine control positions using these distances. The subsequent control lever positions obtained, expressed as a percentage of the full forward travel of the levers, were as follows:

Throttles:	left hand 73 per cent
	right hand 100 per cent
Propeller control:	left hand 98 per cent
	right hand 98 per cent
Fuel mixture:	left hand 54 per cent
	right hand 100 per cent

1.16.3 Propellers

Both propellers sustained damage from impact forces and fire. They were removed from the engines and conveyed to an approved workshop where they were subjected to a complete strip examination. As far as could be determined there was no evidence of pre-existing damage or defects in the propeller assemblies that would have prevented their normal operation. Both propeller low pitch latches were engaged.

1.16.4 Propeller governors

The propeller governors were removed from the engines and found to be in an operable condition. The governors were radiographed after removal to record their internal condition prior to functional testing. They were then given a detailed external examination and functional check on the test rig in an approved workshop.

To confirm the first results the governors were sent to another approved workshop for testing. Some discrepancies were noted between the two sets of results so the governors were returned to the original workshop for another test. Following the functional checks the governors were stripped down for an internal examination. The results of the various tests follow:

Left hand governor. Test results showed that the LH governor was within test specifications except for:

(a) Maximum governed RPM

(b) Unfeather RPM

(c) Relief valve pressure

There was a variation in the maximum RPM as determined by the three tests. On the first and third tests the maximum governed RPM was in excess of the specification; on the second test it was lower. The difference in results can be attributed to the different criteria used by the workshops. As this setting is dependent upon the matching of the propeller and governor after installation, the maximum governed RPM is not a critical test bench parameter.

All tests established that the unfeather RPM setting was high. The subsequent internal examination of the governor revealed no mechanical discrepancies. Despite the high setting the propeller would have unfeathered correctly if selected.

The pressure relief valve setting was slightly above the maximum limit.

None of these discrepencies would have affected the normal governing action of the unit.

Right hand governor. The first test on the RH governor indicated that it was within test specifications except for the relief valve pressure which was slightly below specification and that the feather and unfeather RPM were significantly below specification. The third test confirmed that the unfeather RPM was low.

As previously discussed the maximum governed RPM is finally adjusted after the governor is fitted to the engine. The relief valve pressure setting would not affect the normal operation of the governor.

Regarding the feather/unfeather function, physical examination and the radiograph revealed that there was contamination and damage to the unit due to the breakage of the oil line from the unfeather accumulator and burning of the oil. Because of this damage and contamination of the RH governor the test results must be treated with caution.

1.16.5 Turbochargers

The exhaust tail pipes were removed from both turbochargers in situ and the turbines were found to be undamaged and rotated freely. In the outlet duct of the left hand turbocharger there was a 13 gram deposit of lead-like material which was removed for analysis. Subsequent tests showed the material to be mainly lead with some bromine and traces of a number of other elements. The deposit was typical of normal combustion products. It did not interfere with the operation of the turbocharger and there was no evidence of a similar deposit elsewhere in the left hand engine or anywhere in the right hand engine.

The manufacturers of the turbocharger commented that they had never before observed such a deposit in this location but as it consisted mainly of lead it had originated outside the turbocharger which contains no lead parts.

The left hand turbocharger was fitted to the aircraft in August 1980 following remanufacture in the USA. According to the engine records it operated for about 50 hours until the engine was changed in February 1981. It then operated for about 290 hours to the time of the accident. The build up of the deposit was not detected by the routine maintenance checks conducted during this time.

The reason for non-detection of the deposit was the use of improper inspection procedures employed by the maintenance organisations involved. Instead of removing the exhaust tail pipe, as required in the attachment to the maintenance schedule, the maintenance organisations used an extended mirror and torch inside the exhaust pipe to inspect the turbine wheel. This technique was used because of the difficulty experienced in removing the exhaust tail pipe when the turbocharger was installed in the engine nacelle.

1.16.6 Turbocharger controllers

The turbocharger controller from the right hand engine could not be functionally tested because of the extensive post-impact fire damage. A detailed strip examination found that all sections of the controller were complete and there was no evidence of any pre-accident damage or malfunction.

The turbocharger controller from the left hand engine was also fire damaged but to a lesser degree. The controller was bench tested by the manufacturer's representative who found that the pressure ratio controller was not operating. A strip examination revealed the apparent presence of a sealing compound on the diaphragm, the evacuated bellows assembly had lost its vacuum and there was damage to the bellows assembly consistent with improper maintenance. The first two anomalies were subsequently proved to have resulted from post impact fire. It was not possible to determine the circumstances surrounding the apparent improper maintenance.

The pressure ratio controller takes over control of the turbocharger above 16 000 feet altitude.

The other two sections of the controller, the absolute pressure and rate of change sections, were found to be functioning correctly.

1.16.7 Exhaust pipes

Sections of damaged exhaust pipe from both engines were subjected to metallurgical examination to determine whether the material was hot or cold at impact. There was no positive evidence to suggest that cold working of either exhaust system had occurred and the results of the examination were inconclusive.

1.16.8 Fuel and oil samples

A number of samples of liquids were collected from various locations in the engines and airframe. Because of contamination by fire fighting agents the results of analytical tests of these samples were inconclusive.

1.16.9 Landing gear operation

The landing gear motor and gearbox were recovered intact from underneath the cabin floor and found to be in the mid travel position. The landing gear handcrank, used for manual lowering of the landing gear, was found to be unstowed but not in the engaged position.

The landing gear motor was tested electrically and found to operated normally. The gearbox also operated normally.

Examination of the main landing gear and doors indicated that the retraction cycle was in progress at the time of impact. Retraction cycle timing tests on another Cessna 411 gave an average inflight retraction time of 11-12 seconds from selecting up to the in-transit light extinguishing.

1.16.10 Engine response to throttle movement

An inflight test was conducted in a Cessna 411 to determine the engine response to throttle movement. The test was conducted at 4000 feet above mean sea level with the aircraft climbing at 100 knots indicated air speed and full power set on both engines, i.e. 34.5 inches MP and 2400 (propeller) RPM.

One throttle was then slowly retarded until a change of indication occurred on its associated tachometer. The manifold pressure reading was then recorded as 11 inches. A further reduction to 10 inches, i.e. the throttle nearly closed, resulted in a 50 RPM drop in the tachometer indication.

The test was repeated using a more rapid retardation of the throttle which resulted in the throttle being virtually closed before a change occurred in the tachometer indication.

When practising asymmetric flying on this type of aircraft, the throttle is usually set at about 12 inches manifold pressure to simulate the zero thrust output of a feathered propeller.

1.16.11 Theoretical performance

Using information from the original certification flight test report, the following performance figures were calculated. The meteorological conditions pertaining at the time of the accident and the physical dimensions and condition of the runway were allowed for in the calculations. It was assumed that lift off was completed with both engines at full power; after lift off three cases were considered i.e. full, half and zero power from the left hand engine. The calculations were based on the landing gear remaining down, the flaps up, the engine cowls open, a gross take off weight of 2840 kg and, in the case of zero power output from the left hand engine, the left hand propeller windmilling.

The results obtained were:

Take off run: 473 metres

Time from start of take off to lift off: 19.4 seconds

Climb from lift off to over end of runway at minimum control speed (Vmc): 92.5 knots
Distance: 855 metres
Time: 18.2 seconds

	Rate of climb	*Height above runway end*
Full power, both engines	1474 feet/minute	453 feet
Half power, left engine	820 feet/minute	253 feet
Zero power, left engine	145 feet/minute	44 feet

The above calculations do not allow for degradation of performance because of age of the airframe and engines or the capability of the pilot handling the controls. These factors could result in a degradation of performance by as much as 50 per cent.

From the transcript of the ADC tape the total time of the accident flight was estimated to be 56 seconds. Based on the preceding calculated performance the time interval from over the end of the runway to impact was 18 seconds. The distance travelled, from the reconstruction of the flight path based on eye witness evidence, was 530 metres.

1.17 ADDITIONAL INFORMATION

1.17.1 Engine controls and instrumentation

There was a significant difference in the layout of the engine controls and associated instrumentation between Cessna 411A VH-AYE and Beech Baron VH-AEA. The different layouts are shown in figures 6 and 7 and described below.

Cessna 411A VH-AYE. From the left hand side of the centre console the engine controls were arranged in the order of throttles, propeller control levers, fuel mixture control levers. The levers were fitted with standard shaped knobs. The throttle levers were longer than the propeller control levers and the tops of the throttle knobs were approximately five centimetres higher than the tops of the propeller control knobs with all levers in their full forward position.

The engine instrument grouping was located on the right hand side of the centre instrument panel, to the right of the centre console.

The left hand (vertical) row of dual engine instruments in order from the top were manifold pressure gauges, tachometers, fuel flow meters.

Beech Baron VH-AEA. From the left hand side of the centre console the engine controls in order were propeller control levers, throttles, fuel mixture control levers. The levers were fitted with standard shaped knobs. The throttle levers were longer than the propeller control levers and the tops of the throttle knobs were approximately one centimetre higher than the tops of the propeller control knobs, with all levers in their full forward position.

The engine instrument grouping was located on the centre instrument panel immediately in front of the engine controls. The top (horizontal) row of dual engine instruments in order from the left were tachometer, manifold pressure gauges, fuel flow meters.

Relationship of engine controls and instrumentation. With an engine operating the primary relationship between engine controls and instrumentation is:

Throttles — manifold pressure gauges

Propeller control levels — tachometers

Fuel mixture control levers — fuel flow meters.

Changes in the setting of an engine control will be indicated by a change of the associated instrument reading.

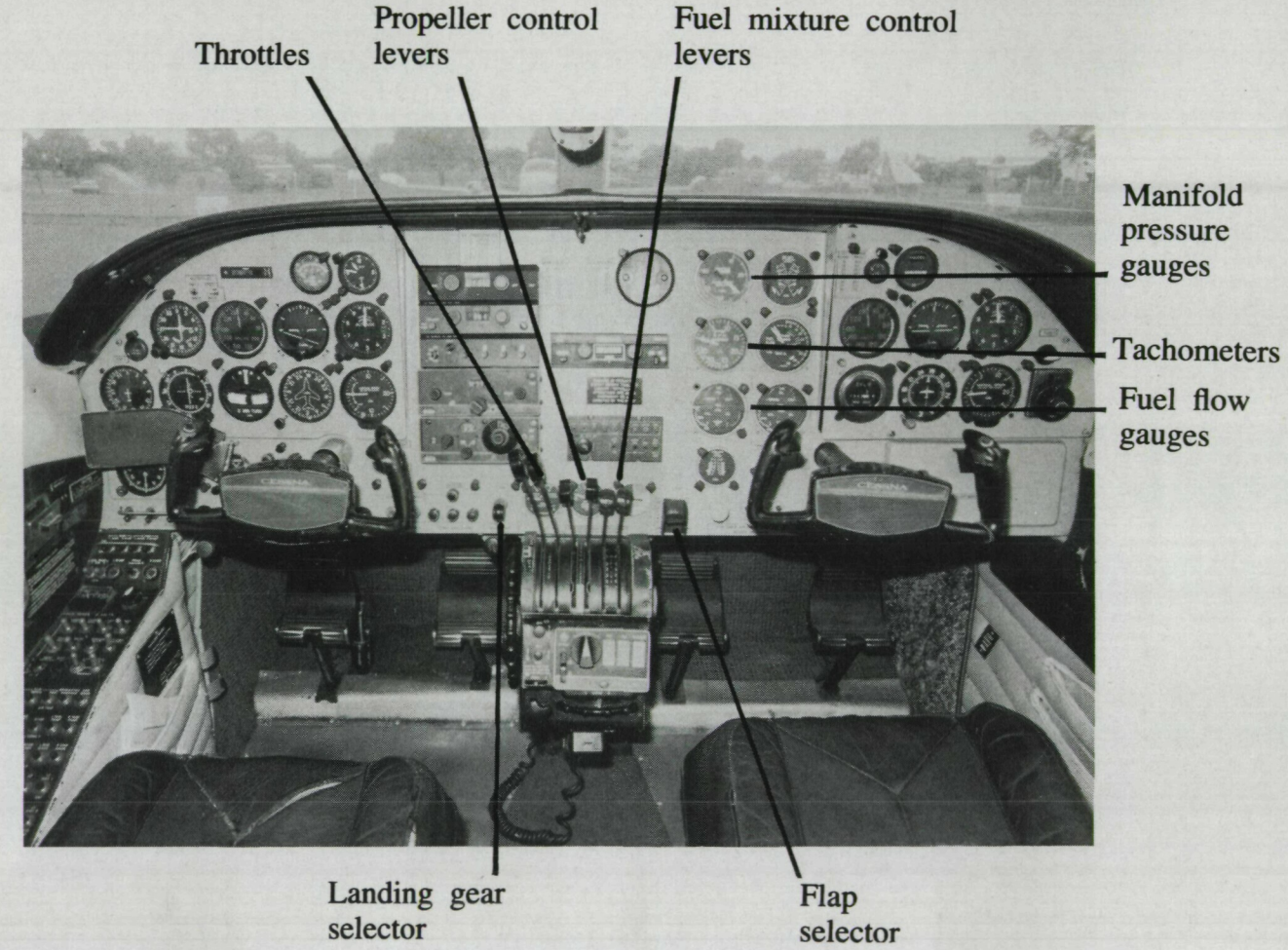


Figure 6. Cockpit Layout — Cessna 411 (similar to VH-AYE)

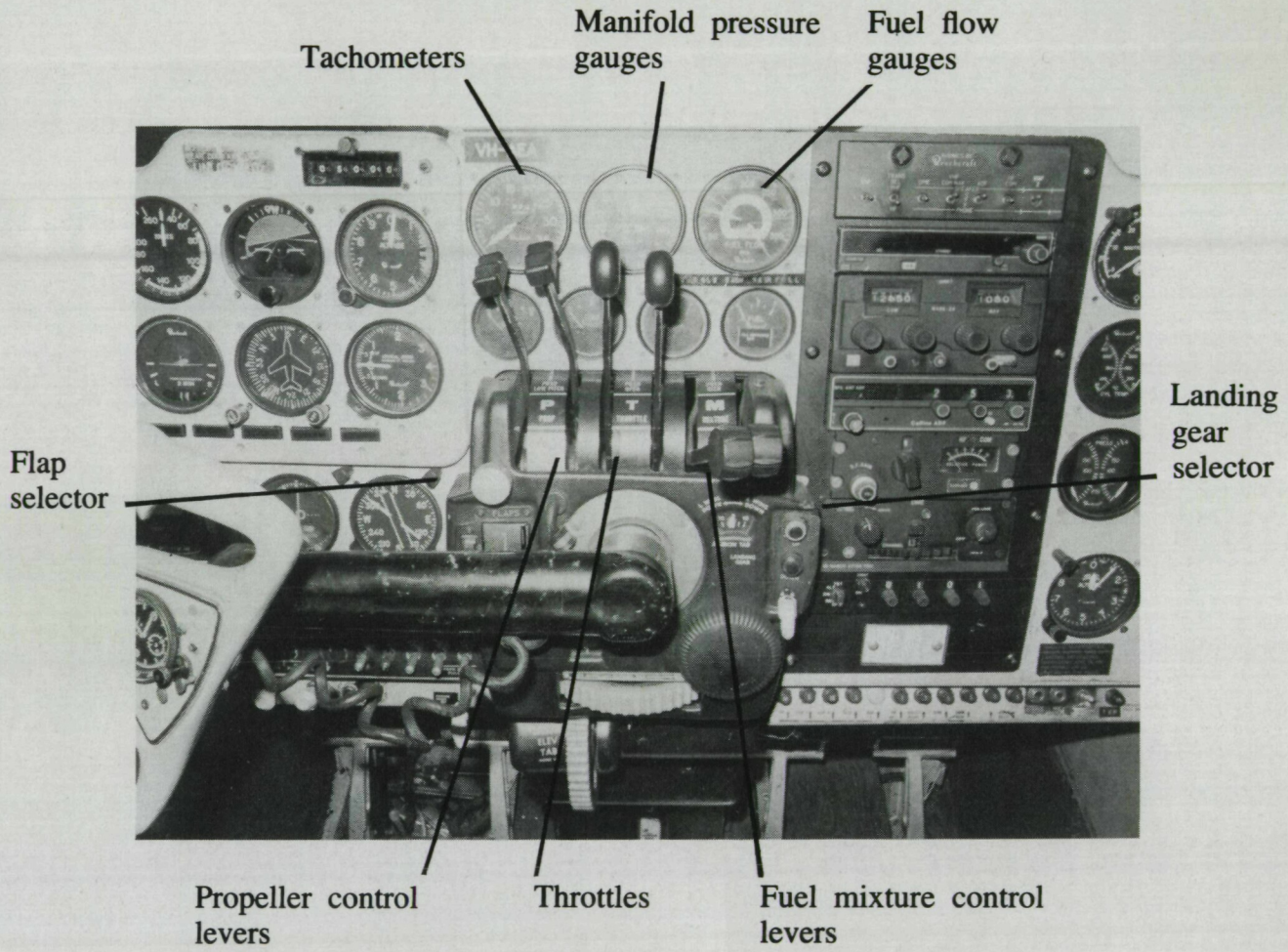


Figure 7. Cockpit Layout — Beech Baron VH-AEA

1.17.2 Landing gear selector switch

The landing gear fitted to Cessna 411A VH-AYE was electrically operated by a three position switch. The switch positions were UP, OFF (Centre) and DOWN. To operate the gear the wheel-shaped switch knob was pulled out and moved to the desired position. Figure 8 shows a typical Cessna landing gear selector switch in the OFF position.

In the OFF position the circuit to the landing gear motor is opened. This position is used during manual lowering of the landing gear to assist in preventing the inadvertent operation of the landing gear motor while the handcrank is in use.

The landing gear selector switch and the four indicator lights, located at the lower, left hand corner of the centre instrument panel, were destroyed during the accident.

The landing gear circuit breaker, located on the switch and circuit breaker console on the left hand side of the cockpit, was found to be in the down (circuit closed) position.

The landing gear selector switch fitted to Beech Baron VH-AEA was only a two position switch with UP and DOWN selections.

1.17.3 Position of landing gear and flap selectors

The position of the landing gear and flap selectors was reversed in the Cessna 411A as compared with the Beech Baron (see figures 6 and 7).

The Cessna 411A had the landing gear selector positioned on the centre instrument panel to the left of the centre console; the flap selector was to the right.

The Beech Baron had the flap selector positioned on the centre console on the left hand side and the landing gear selector on the right.

1.17.4 Witness evidence — engine noise

A number of witnesses to the accident referred to a reduction of engine noise, shortly after take off, which sounded like a 'training engine failure', i.e. as though the throttle was

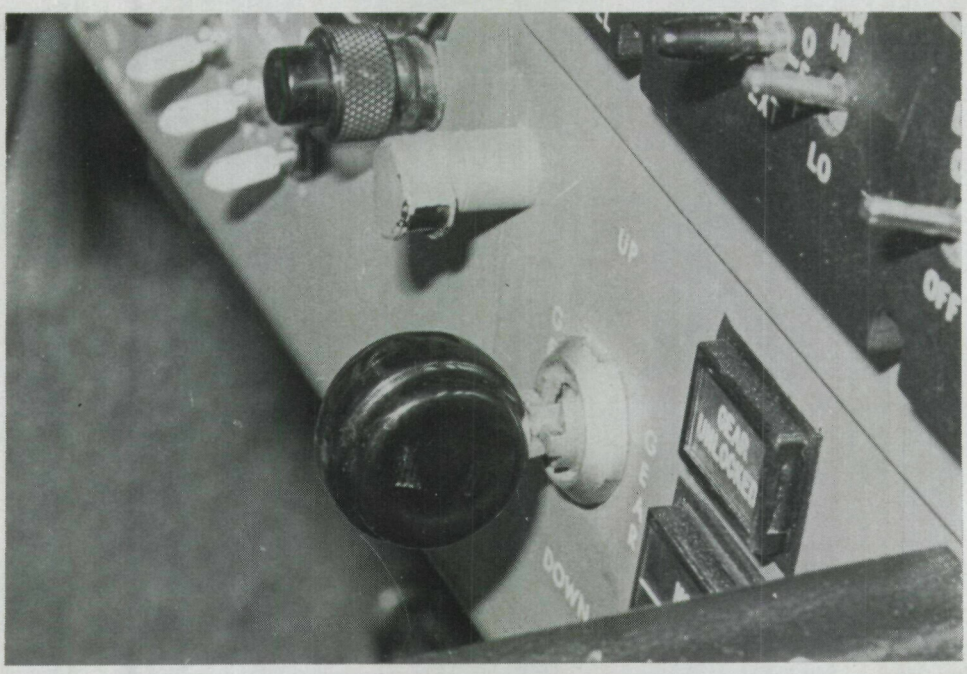


Figure 8. Typical landing gear selector switch as fitted to Cessna 400 series aircraft. Note that the switch is shown in the Off (centre) position.

pulled back rather than a sudden loss of engine power had occurred. There was also evidence given that the power was reduced on both engines just before impact. There were, however, some discrepancies between witness reports on the engine sounds thoughout the flight. Most witnesses indicated that it was the left hand engine which had lost power after take off.

1.17.5 Aircraft certification

The Cessna 411 was type certificated in the U.S.A. by the Federal Aviation Administration (FAA) on 17 August 1964. The basis for certification was Civil Aviation Regulation (CAR) Part 3 to amendment 3-8. The 411A model was added to the type certificate on 26 January 1967; the certification basis being identical to the 411.

The first-of-type Cessna 411 in Australia was issued with a Certificate of Airworthiness in 1965, the first model 411A following in 1975. For both aircraft, Australian certification was based on CAR 3 supplemented by additional local requirements. From a flight handling point of view FAA acceptance (in accordance with the terms of CAR 3) was endorsed by the Department as being adequate for Australian approval. With the exception of baulked landing standards no additional flight handling requirements were specified.

Flight trials, other than those necessary to demonstrate compliance with the local baulked landing standard, were not carried out in this country, as the American-Australian bilateral airworthiness agreement provides for the acceptance by one country of the other's approval, in those cases where standards are common. With regard to flight performance, the Australian requirements for small multi-engine aeroplanes specify that all engines operating take-off distance, all engines operating take off climb, one engine inoperative enroute climb and all engines operating landing distance be established and, with the exception of the enroute climb, scheduled as appropriate in the flight manual. The one engine inoperative enroute climb standard is instrumental in establishing the maximum take off weight as a certification limitation. The Cessna 411 complied in all respects with the Australian airworthiness performance standards.

The Cessna 411, in common with most other small multi-engine aeroplanes, i.e. below 5700 kg, is considered as an all engines operating aircraft during take off, initial climb, approach and landing. In fact, it is only during the enroute phase of flight that any consideration, airworthiness or operational, is given to the ramifications of engine failure. No guarantees of engine-failed performance can be stated and none are asked for, except for the enroute portion of the flight. During take off there is a critical risk period (roughly from lift off to the point where the aeroplane is cleaned up, is at or above the best single-engine climb speed and has attained a height of at least 100-200 feet) during which, should an engine fail, adequate asymmetric performance may not be achievable. This period may, depending on circumstances and the aeroplane type, be anything from 10-30 seconds but whatever the time it is considered to be an acceptable risk for the private, aerial work and charter operations of such aircraft. This philosophy is recognised internationally.

The climb capability of such aircraft, with the landing gear down, wing flaps extended and the propeller of the failed engine windmilling, is often negative. The Cessna 411 is no exception, although its level of one-engine-inoperative climb performance is better than average, compared with its contemporaries. However, if an engine fails during the critical risk period after take off, the pilot of any light multi-engine aircraft should seriously consider landing straight ahead.

2. Analysis

2.1 GENERAL

The circumstances of this accident indicate that there were two areas involved which led to the fatal impact. The first concerned an apparent loss of the power being produced by the left hand engine. Following this loss of power the aircraft failed to maintain adequate flying speed and entered the regime of loss of directional control/stalling. The investigation was directed towards establishing the cause of the apparent loss of power and the reason for the aircraft failing to maintain flying speed.

2.2 LOSS OF POWER

The apparent loss of power from the left hand engine could have been caused by a malfunction or failure of the engine, propeller or associated systems, or, it may have been induced by the actions of the pilot.

2.2.1 Mechanical failure

Examination of both engines, propellers and associated systems did not reveal any evidence of pre-existing damage, defects, malfunctions or failures which would have prevented either engine from producing normal power. Despite the considerable damage caused to the aircraft by the impact, explosion and post impact fire there was sufficient evidence remaining to conclude that a mechanical failure did not cause the apparent loss of power.

2.2.2 Pilot-induced loss of power

In the absence of any evidence of a mechanical problem consideration was given to the way in which the pilot may have induced a loss of power. The following hypothesis is based on the evidence available but it must be stressed that, without positive evidence of the pilot's actions inside the cockpit, this theory cannot be substantiated.

The purpose of this flight was to check the operation of the aircraft, in particular the functioning of the left hand propeller governor. This governor had been reported as malfunctioning on several occasions following completion of the periodic servicing in December. On the day preceding the accident the governor was removed from the engine, adjusted and refitted. The engine was then ground run, the governor operation checked in accordance with the maintenance manual and the maximum RPM adjusting screw lockwired in position.

On the morning of the accident the pilot attended his office for some time prior to proceeding to Archerfield. It was quite clear that at the time he left the office the reason for him test flying the aircraft was to check, amongst other things, the operation of the left hand propeller governor. This aspect was also raised during the brief discussion the pilot held with a Hawker Pacific employee prior to starting the aircraft.

In consideration of the time interval between taxying and requesting take off clearance, and observations of eyewitnesses, it is believed that the pilot conducted a ground check of the engine and propeller functioning before take off. The extent of these checks cannot be determined but it must be concluded that the pilot was satisfied with the results.

At this stage it is important to recall that, apart from two attempts to fly the Cessna 411 in the few days preceding the accident, there is no evidence of Mr O'Brien flying the aircraft in the previous seven months. The limited flying he had undertaken during this

period had been in the Beech Baron which had the throttle and propeller control levers reversed from the layout in the Cessna 411.

During the take off roll it is probable that the tachometer pointer for the left hand power unit was indicating higher than for the right hand. This conclusion is based on the results of the post-accident bench testing of the governors and the fact that the maximum RPM setting of the left hand governor had been made during static ground runs. With the aircraft accelerating along the runway during take off the RPM achieved would have been higher than during a static ground run. Mr O'Brien was aware that another pilot had experienced two significant overspeeds of the propeller only a few days earlier and undoubtedly was concentrating his attention on the tachometer to observe the correct functioning of the left hand propeller governor. It is believed that, if he had seen the left hand tachometer indication increasing, he would have made some effort to control this. Normally such control would be achieved by pulling back the propeller control lever. It is distinctly possible that he attempted to do this but inadvertently took hold of the throttle. Retardation of the throttle lever would have caused a corresponding loss of power from the engine but the RPM would not have changed until the throttle was nearly closed. The throttle levers in the Cessna 411 fall more readily to hand that the propeller control levers because they are considerably longer and are closer to the pilot.

Also, because of the relative positions of the control levers and engine instruments in the Cessna 411, the pilot would have no immediate visual cues that he had operated the incorrect control, if his attention was concentrated on the tachometer.

If this did occur there is little doubt that any pilot could become confused and convinced that he had lost control of the propeller. He would then attempt to shutdown the 'uncontrollable' engine/propeller.

It is therefore possible that, without any malfunction or failure, the aircraft was placed in a situation of apparently losing power from the left hand engine.

Further, it is considered unlikely that the pilot observed any problems early in the take off run. Had he done so he could have abandoned the take off while there was adequate runway remaining on which to stop the aircraft. This could have occurred at any time up to lift off. It is considered that the conditions observed by the pilot which may have led him to believe there was a problem, did not manifest themselves until approximately the point of lift off, or later.

2.3 FAILURE TO MAINTAIN FLYING SPEED

The observed flight path of the aircraft indicated that, from the approximate position of maximum altitude, i.e. at or shortly past the upwind end of the runway, the airspeed decayed until directional control was lost after which the aircraft stalled. It is possible that the initial left bank of the aircraft resulted from pilot action and, as the speed decayed, the rapid increase in bank probably occurred because the airspeed had fallen below minimum control speed. The subsequent nose drop was almost certainly caused by the aircraft stalling.

The reason for the failure to maintain flying speed was partly the high drag configuration of the aircraft. At impact the left hand propeller was unfeathered and turning, and the landing gear was still extended. Another probable reason for the low airspeed was the pilot's handling of the aircraft.

2.3.1 Extended landing gear

The normal time for retraction of the Cessna 411 landing gear, as observed during the investigation, was 11-12 seconds. The position of the landing gear as found on the wreckage of VH-AYE was approximately half way through the retraction cycle, i.e. about

5-6 seconds operation. There are several possible reasons why the landing gear was not fully retracted:

(a) Mechanical malfunction during the retraction cycle. As far as could be determined there was no evidence of any failure or defect that would have prevented the landing gear from retracting. The landing gear selector switch and most of the wiring were consumed by fire.

(b) Circuit breaker pulled. If the landing gear motor circuit breaker (CB) had been pulled, before the pilot selected the gear up, the gear would not have retracted. The most likely reason for the CB to have been out is that is was pulled during servicing. There was no evidence that this had occurred. Also, it was the pilot's responsibility to ensure that all CBs were reset during his prestart cockpit check. After the accident the circuit breaker was found to be in, i.e. the ON position.

(c) Pilot forgot to retract the gear. It is quite likely that a pilot lacking recent experience, and having little if any experience of actual engine failures, could easily forget to retract the landing gear in an emergency situation.

(d) Pilot inadvertently operated the flap selector switch. As with the engine controls, the flap and landing gear selector switches in the Cessna 411 are reversed from the arrangement in the Beech Baron. The pilot may have operated the flap selector switch from the OFF (centre) position to UP. The flap switch was destroyed in the fire.

(e) Pilot inadvertently selected the landing gear switch to the OFF (centre) position. The landing gear selector has three positions, UP, OFF (centre) and DOWN. If the pilot inadvertently selected the gear switch to OFF instead of UP the gear would not have moved.

If any of items (b), (c), (d) or (e) was applicable then the pilot must have recognised the situation shortly before impact and taken further action, otherwise the landing gear would not have been moving at impact.

It was not possible to determine when the limited operation of the landing gear retraction cycle occurred. The only external evidence that the cycle had reached the half way position would have been the opening of the main gear doors by several centimetres. No eyewitness evidence was obtained to indicate any movement of the landing gear doors. Such movement would have been difficult for ground observers to detect. Wreckage examination indicated that the landing gear was retracting at impact.

No positive conclusion can be reached regarding the reason for the incomplete retraction of the landing gear.

2.3.2 Windmilling propeller

Examination of the left hand engine and propeller indicated that they were turning at impact. The propeller was not in the feathered position.

Feathering of the propellers on the Cessna 411 aircraft is achieved by pulling the propeller control levers back into the 'feather' detent. Because of the geared propeller configuration it is also necessary to pull the fuel mixture control lever back to 'idle-cut-off' to stop the fuel to the engine. Without doing this the engine can still drive the propeller, even though the propeller is feathered. Shutting off the fuel allows the engine and propeller to stop turning.

The positions of the left hand throttle and fuel mixture levers, as determined during the investigation, suggest that the pilot may have attempted to shutdown/feather the engine/propeller but had operated the throttle instead of the propeller control lever. This would have caused the engine to stop operating but the propeller and engine would have continued to rotate resulting in windmilling drag.

2.3.3 Pilot's handling of aircraft

Regardless of the cause of an engine problem on take off, the pilot's main responsibility is to maintain control of the aircraft. This is achieved by ensuring that the maximum power available is set, the aircraft is flown at the best single-engine rate-of-climb speed, the flaps and landing gear are retracted and, after identification, the propeller on the failed engine is feathered. To assist in maintaining directional control, the aircraft should be flown with five degrees of bank towards the 'live' engine.

Initially it may be necessary to descend the aircraft until the above vital actions are completed. If the aircraft still cannot be established in a positive climb, it will then be necessary to land straight ahead. Under no circumstances should the airspeed be allowed to decay to the point where control of the aircraft is lost.

From eyewitness reports and the time interval taken for the distance travelled on this flight, it is obvious that the pilot did not maintain the best single-engine rate-of-climb speed. In fact, he allowed the aircraft speed to decay below the minimum control speed and eventually lost control. If the initial bank to the left was applied by the pilot in an effort to turn back to the aerodrome, he aggravated an already critical situation. The increased lift required by turning while maintaining height would have increased the rate of decay of airspeed.

3. Conclusions

Findings

1. The pilot was correctly licensed and adequately experienced to conduct this flight.
2. There was no evidence of the pilot being incapacitated for physiological or psychological reasons.
3. The aircraft had been maintained in accordance with an approved maintenance schedule and its documentation was in order. There was evidence that the turbocharger turbine outlets had not been inspected in accordance with the schedule but this did not contribute to the accident.
4. The weight and balance of the aircraft were estimated to be within the limitations specified in the Approved Flight Manual.
5. Corrective maintenance had been performed on the left hand propeller governor on the day preceding the accident. This maintenance was required following a number of malfunctions since completion of the last periodic servicing. The maintenance had apparently corrected the problem.
6. There was no evidence of any pre-existing damage, defects, malfunctions or failures that contributed to the accident.
7. The provision of Air Traffic Control services was not a factor in the accident.
8. There were no meteorological aspects that contributed to the accident.
9. The dimensions and condition of the runway used by the aircraft were not factors.
10. This was a private category flight conducted by a private pilot licence holder to check the operation of his company aircraft following corrective maintenance.
11. The aircraft apparently functioned correctly during start up, taxy and the take off roll. At about lift off there was an apparent loss of the power being produced by the left hand engine. The cause of this loss of power was not positively determined.
12. Following the apparent loss of power the aircraft continued climbing at a low airspeed and reached a maximum height of about 100-200 feet above ground level. It commenced a gradual turn to the left. The angle of the bank then increased rapidly to nearly vertical. The nose of the aircraft dropped and it descended into the workshop. There was an explosion followed by the outbreak of fire.
13. The only area within the immediate vicinity of Archerfield, which would have been suitable for a safe landing was the aerodrome itself.
14. The accident may have been avoided if the pilot had employed the correct procedures following a reduction of power from the left hand engine.

Cause

The cause of the accident was that following a reduction of power from the left engine, the pilot failed to maintain flying speed. The cause of the reduction of power was not determined.

Transcript of Recorded Communications during the Period 0146 Hours to 0207 Hours Greenwich Mean Time on 5 January 1982 Archerfield SMC 119.9 MHz

Legend

SMC	Archerfield Surface Movement Controller (Archer Ground)	
SGQ	Piper PA31	VH-SGQ
APPROACH	Brisbane Approach Control	
AYE	Cessna 411A	VH-AYE
WCH	Cessna 150-B	VH-WCH
KDY	Cessna 172-N	VH-KDY
RQO	Piper PA28-161	VH-RQO

Symbol Decode

?	Unidentified source addressee	// //	Explanatory note or editorial insertion
———	Unintelligible word(s)	( )	Words open to other interpretation

Time	*From*	*To*	*Details*
0148:32	AYE	SMC	ARCHER GROUND ah ALFA YANKEE ECHO ah for ah circuit um received Charlie request ah runway two eight right
:59	SMC	AYE	ALFA YANKEE ECHO ARCHER GROUND taxi for change of runway one zero left, left hand circuit, hold short of runway zero four
0149:09	AYE	SME	ALFA YANKEE ECHO ah one zero left thank you
:37	WCH	SMC	——————— CHARLIE HOTEL
:39	SMC	WCH	WHISKEY CHARLIE HOTEL
0150:33	SGQ	SMC	ARCHER GROUND SIERRA GOLF QUEBEC for Coolangatta request airways clearance received Charlie
:38	SMC	SGQ	SIERRA GOLF QUEBEC time five zero half clearance not yet available will advise
:42	SGQ	SMC	SIERRA GOLF QUEBEC
:49	KDY	SMC	ACHERFIELD GROUND this is Cessna KILO DELTA YANKEE for Coolangatta received information Charlie
:50	SMC	APPROACH	SIERRA GOLF QUEBEC taxying for runway zero four
:55	APPROACH	SMC	Airways clearance to Coolangatta five thousand check South // Two stations in together //
:58	SMC	APPROACH	Roger
0150:59	SMC	KDY	STATION calling GROUND say again
0151:03	KDY	SMC	ARCHERFIELD GROUND this is Cessna KILO DELTA YANKEE for Coolangatta received Charlie
:09	SMC	KDY	KILO DELTA YANKEE ARCHER GROUND time five one
:12	KDY	SMC	KILO DELTA YANKEE
:21	SMC	SGQ	SIERRA GOLF QUEBEC clearance available
:24	SGQ	SMC	SIERRA GOLF QUEBEC go ahead
:26	SMC	SGQ	SIERRA GOLF QUEBEC clearance track Archerfield direct Coolangatta cruise five thousand
:29	SGQ	SMC	SIERRA GOLF QUEBEC five thousand
0154:06	AYE	SMC	ALFA YANKEE ECHO taxi clearance
:14	SMC	AYE	ALFA YANKEE ECHO cross runway zero four
:16	AYE	SMC	ALFA YANKEE ECHO
0157:46	RQO	SMC	ARCHER GROUND this is ROMEO QUEBEC OSCAR for circuits received Charlie
:50	SMC	RQO	ROMEO QUEBEC OSCAR ARCHER GROUND

0158:18	AYE	SMC	ARCHER GROUND ALFA YANKEE ECHO ah I'd like ah to operate in the ah circuit area at ah one five zero zero for approximately one zero minutes
0158:29	SMC	AYE	ALFA YANKEE ECHO that's okay operate in um a left hand pattern (a)round the perimeter of the field watching out for other rejoining traffic
:41	AYE	SMC	Ah ALFA YANKEE ECHO say again after perimeter of the field
:44	SMC	AYE	Keeping a watch out for traffic rejoining the circuit
:47	AYE	SMC	ALFA YANKEE ECHO wilco

APPENDIX A.2

Transcript of Recorded Communications during the Period 0158 Hours to 0204 Hours Greenwich Mean Time on 5 January 1982 Archerfield ADC 118.1 MHz

Legend

TLN	Cessna 152	VH-TLN
ADC	Archerfield Aerodrome Controller (Archer Tower)	
APPROACH	Brisbane Approach Control	
AYE	Cessna 411A	VH-AYE
KDY	Cessna 172-N	VH-KDY

Symbol Decode

?	Unidentified source addressee	// //	Explanatory note or editorial insertion
———	Unintelligible word(s)	( )	Words open to other interpretation

Time	*From*	*To*	*Details*
0159:06	AYE	ADC	ARCHER TOWER ALFA YANKEE ECHO ready one zero left
:10	ADC	AYE	ALFA YANKEE ECHO line up
:12	AYE	ADC	YANKEE ECHO
:26	TLN	ADC	Cessna TANGO LIMA NOVEMBER base runway right
:30	ADC	TLN	TANGO LIMA NOVEMBER
:55	ADC	AYE	ALFA YANKEE ECHO clear for take off
:57	AYE	ADC	ALFA YANKEE ECHO
0200:10	ADC	KDY	KILO DELTA YANKEE this frequency
:14	KDY	ADC	KILO DELTA YANKEE go ahead
:15	ADC	KDY	Are you ready
:17	KDY	ADC	KILO DELTA YANKEE ready
:20	ADC	KDY	KILO DELTA YANKEE line up runway right be ready for immediate
:23	KDY	ADC	KILO DELTA YANKEE roger
:34	ADC	KDY	KILO DELTA YANKEE runway right clear for immediate take off
:38	KDY	ADC	KILO DELTA YANKEE
:47	?	?	———
:48	APPROACH	ADC	APPROACH SIERRA GOLF QUEBEC maintain four thousand
:51	ADC	APPROACH	Maintain four thousand transfer zero four
:54	APPROACH	ADC	Roger
:56	?	?	// High pitch tone for one second //
0201:54	KDY	ADC	TOWER this is KILO DELTA YANKEE ah You've had an aircraft crash into one of your hangars
0202:00	ADC	KDY	Negative
:06	ADC	AYE	ALFA YANKEE ECHO where are you now
:18	ADC	AYE	ALFA YANKEE ECHO ARCHER TOWER

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