No. 96-006

Cessna 208 Caravan

ZK-SFA

10 nm north-east of Blenheim

29 January 1996

Abstract

At 1627 hours on Monday 29 January 1996, ZK-SFA a Cessna 208 Caravan, collided with heavily wooded terrain on the eastern slopes of Mount Robertson, 10 nm north-east of Blenheim. The aircraft had departed from Wellington on a scheduled flight to Picton Aerodrome (Koromiko). The five passengers lost their lives in the accident, but the pilot survived. Causal factors identified were: descent under a cloud layer; misidentification of terrain features; loss of "positional awareness"; insufficient forward visibility; the high speed of the aircraft; and the pilot's decision making. Safety issues identified included: the need to develop company operating procedures that ensure aircraft do not stray into high terrain; taking the necessary steps to ensure pilots use all the available resources for accurate navigation under VFR; and the documenting of recommended airspeeds and aircraft configuration for VFR flight with reduced visibility. Three safety recommendations were made to the operating company.

Transport Accident Investigation Commission

Aircraft Accident Report No. 96-006

Aircraft type, serial number and registration:	Cessna 208 Caravan 1, 208-00051, ZK-SFA
Number and type of engines:	One Pratt and Whitney PT6A-114
Year of manufacture:	1985
Date and time:	29 January 1996, 1627 hours*
Location:	10 nm north-east of Blenheim Latitude: 41° 22.1′ S Longitude: 174° 02.5′ E
Type of flight:	Scheduled Air Transport
Persons on board:	Crew: 1 Passengers: 5
Injuries:	Crew: 1 Serious Passengers: 5 Fatal
Nature of damage:	Aircraft destroyed
Pilot-in-Command's Licence:	Commercial Pilot Licence, (Aeroplane)
Pilot-in-Command's age:	24
Pilot-in-Command's total flying experience:	1937 hours 322 hours on type
Information sources:	Transport Accident Investigation Commission field investigation.
Investigator in Charge:	Mr K A Mathews

* All times in this report are in NZDT (UTC + 13 hours)

Synopsis

The Transport Accident Investigation Commission was notified of this accident at 1855 hours on 29 January 1996. Mr K A Mathews was appointed Investigator-in-charge (IIC) and investigation into the circumstances of the accident was commenced in Blenheim the following morning.

The aircraft was on a scheduled VFR flight from Wellington to Picton Aerodrome (Koromiko) when it collided with terrain 7 nm east of Koromiko, 10 nm north-east of Blenheim. The five passengers lost their lives, and the pilot received serious injuries, in the accident.

1. Factual Information

1.1 History of the flight

1.1.1 On the day of the accident, the pilot reported for duty at Wellington Airport in time to plan and prepare for a scheduled morning return flight to Picton Aerodrome, near Koromiko, at 0750 hours in ZK-SFA, a Cessna 208 operated by Soundsair. The flight was delayed due to unsuitable weather conditions for VFR flight, and subsequently departed from Wellington at 1226 hours when the weather conditions improved. The flight was completed uneventfully and the aircraft returned to Wellington at 1325 hours.

1.1.2 The pilot completed a second return VFR flight to Picton Aerodrome, in ZK-LAL a Partenavia P68B, departing from Wellington at 1415 hours and returning at 1526 hours. This flight was also completed uneventfully.

1.1.3 A third return VFR flight to Picton was scheduled for the pilot, in ZK-SFA, with a planned departure time of 1610 hours. After returning to Wellington the pilot prepared the Cessna 208 for the flight, and departed from Wellington at 1612 hours. On board were the pilot and five passengers.

1.1.4 After take-off on runway 16 the aircraft was turned right to intercept the desired track and climbed to a cruise altitude of 2600 feet, according to the radar plot of the flight. This altitude was unverified[1] and the pilot recalled cruising at 2500 feet. At approximately 1622 hours the pilot contacted Woodbourne Tower on VHF radio and reported, "Sierra Foxtrot Alpha is fifteen DME with six POB, request clearance through your zone on track to the Koromiko valley". Woodbourne Tower responded, "Sierra Foxtrot Alpha enter the zone on track Koromiko QNH 1004".

1.1.5 The pilot read back the clearance correctly and asked Woodbourne Tower, "how does it look just directly towards the Koromiko valley from there? I'm anticipating going VFR on top of a layer". Woodbourne Tower responded, "the cloud that you are probably on top of at the moment ends around Tuamarina and its probably down to around about 2000 feet through the valley". The pilot replied, "ah roger, so it all breaks up by about Tuamarina?" Woodbourne Tower confirmed this was so and added, "you might just drop a bit south in the north sector (of the Control Zone)." The pilot replied, "Sierra Foxtrot Alpha, thanks". This RTF exchange ended at around 1623 hours.

[1] Prior to using an aircraft's Mode C transponder data for separation purposes, controllers shall verify the accuracy of Mode C data by checking that the level readout varies by no more than 300 feet from the level reported by the pilot.

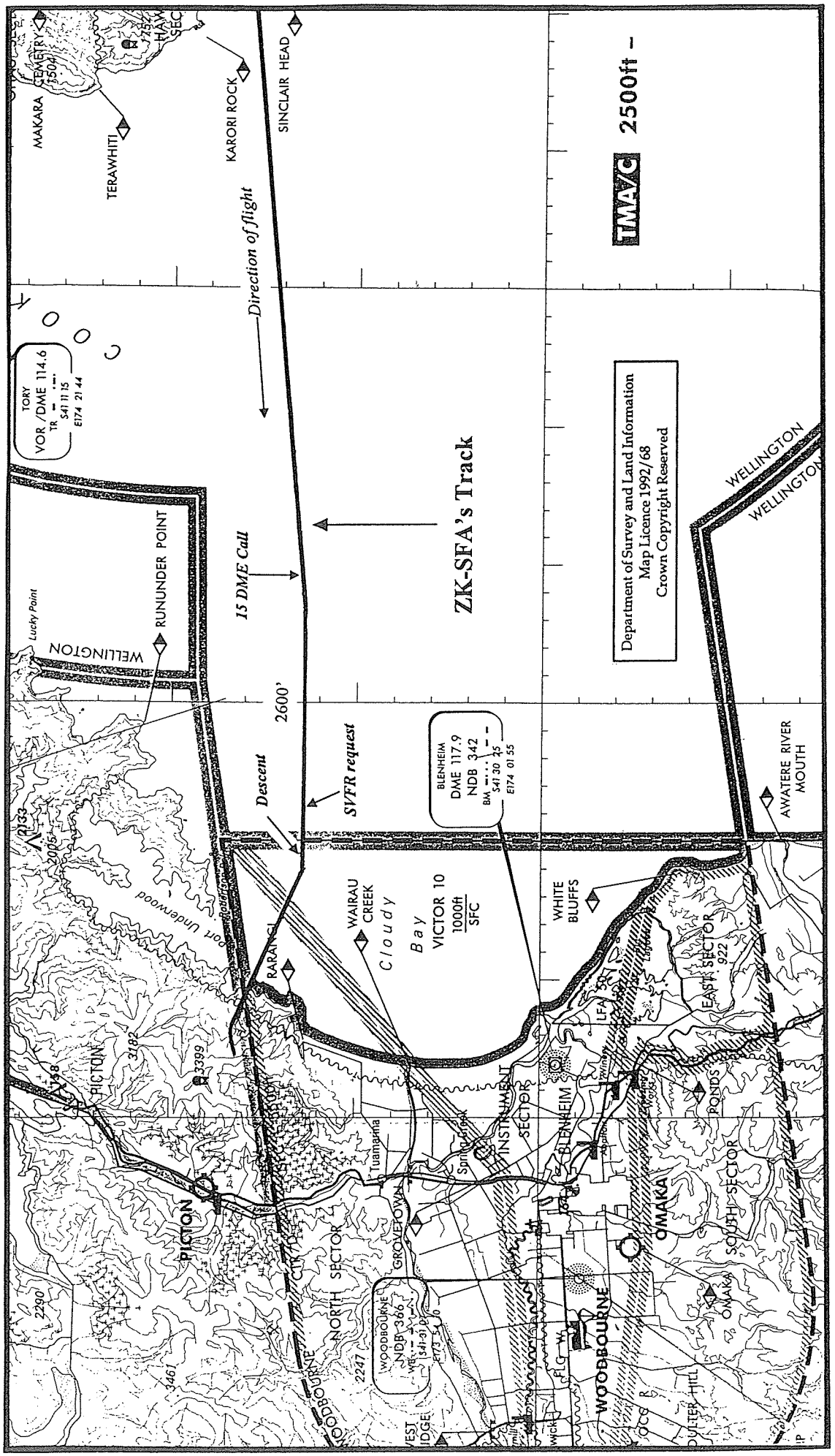


Diagram of ZK-SFA's track

1.1.6 Approximately 1½ minutes later the pilot contacted Woodbourne Tower again and asked, "due to that cloud request Special VFR through the zone". Woodbourne Tower duly authorised the pilot to operate under "Special VFR" in the Woodbourne Control Zone, and the pilot acknowledged the clearance. This was the last RTF communication received from ZK-SFA.

1.1.7 The radar plot indicated that the aircraft commenced a descent at 1625 hours, about 3½ nm from the coast. The aircraft altered its heading some 23° to the right and continued on this new heading, crossing the coast 2 nm north-east of Rarangi. It descended to 1400 feet (according to the radar plot and unverified) and its ground speed increased from around 150 knots in the cruise to 173 knots.

1.1.8 The pilot recalled seeing a layer of "stratiform" cloud ahead, and decided to descend and track beneath the cloud to the southern end of the Koromiko valley, and then up the valley to Picton Aerodrome. He was anticipating a descent to between 1000 feet and 1200 feet and at that point there was nothing about the weather conditions and visibility to cause him concern. He expected the descent to be routine and believed he was tracking as planned. Apart from "turning slightly to the north", after passing 15 DME, the pilot could not recall making a significant turn (see paragraph 1.18.5). As the descent progressed under the cloud layer the pilot became aware of clouds beneath him, and hills to his left and ahead of the aircraft. Then realising that he was north of Rarangi and his planned track, and rapidly approaching rising terrain, the pilot applied full power and at the same time initiated a left climbing turn to the south, towards lower ground. Shortly afterwards the aircraft collided with steeply rising, heavily wooded terrain on the eastern slopes of Mount Robertson. (See diagram).

1.1.9 The Soundsair agent at Picton Aerodrome was expecting ZK-SFA to arrive at about 1640 hours. When the aircraft had not arrived by 1645 hours, and the pilot had not made contact with the agent via RTF, the agent contacted the company in Wellington to confirm that the flight had departed. At about 1655 hours the agent telephoned Woodbourne Tower to see if they had contact with the aircraft or knew its whereabouts, and to inform the Tower that the aircraft had not arrived at Picton Aerodrome. Soundsair's General Manager also telephoned Woodbourne Tower and confirmed that the aircraft was overdue. This resulted in SAR action being initiated by Woodbourne Tower at about 1710 hours.

1.1.10 A weak ELT signal in the vicinity of Mount Robertson was picked up by searching aircraft, and the Life Flight Trust rescue helicopter from Wellington subsequently determined ZK-SFA's position. The helicopter's crew were initially unable to locate the actual wreckage due to cloud surrounding the area. Some ten minutes later the cloud lifted sufficiently for the helicopter to locate the wreckage and for a paramedic, on board the helicopter, to determine if there were any survivors. The pilot was found to be the only survivor and he was flown directly to Wellington Hospital.

1.1.11 There were no eyewitnesses to the accident, which occurred in daylight, 12 nm on a bearing of 035°T from Woodbourne NDB, latitude 41° 22.1′ S, longitude 174° 02.5′ E, at an elevation of 1700 feet.

1.2 Injuries to persons

	Fatal	Serious	Minor/None
Crew:	0	1	0
Passengers:	5	0	0
Other:	0	0	0

1.3 Damage to aircraft

1.3.1 The aircraft was destroyed.

1.4 Other damage

1.4.1 A number of trees were destroyed by the aircraft in the impact sequence.

1.5 Personnel information

1.5.1 The pilot in command, male, aged 24 years, held a New Zealand Lifetime CPL (A) and a Class 1 medical certificate valid until 21 March 1996, with no restrictions. The CPL (A) included a "C" category Instructor Rating, and an Instrument Rating which had last been renewed on 20 August 1995. His total flying experience at the time of the accident was 1936.7 hours. Flight time in Cessna 208 aircraft amounted to 321.8 hours. His total flight time in the 90 days preceding the accident was 189.6 hours, which included 177.2 hours in the Cessna 208 aircraft type. His total flight time in the 30 days preceding the accident was 72.6 hours. This included 68.6 hours in the Cessna 208 aircraft type.

1.5.2 The pilot began flying with Soundsair on 11 July 1995 following an initial period of some weeks on ground assigned duties only. Prior to joining Soundsair he had been flying Britten-Norman BN2A and Cessna 172 type aircraft for a company based at Kaikoura, essentially on tourist and charter work. By 26 July 1995 he had completed his type rating training on the Cessna 208, and a VFR Regulation 76 check on 11 August 1995. On 20 August 1995 he completed an IFR Regulation 76 check and Instrument Rating renewal flight test in the Cessna 208. On 31 August 1995 he had completed his Partenavia P68B type rating training and VFR Regulation 76 check.

1.5.3 Supervised line flying followed his conversion to the Cessna 208, and the pilot was required to become familiar with IFR freight only operations in the Cessna before progressing to VFR passenger operations. On 26 October and 1 November 1995 the pilot underwent VFR route familiarisation training between Wellington and Picton Aerodrome, and circuit training at Picton. This comprised some 3.3 hours. The company's Chief Pilot also carried out two "snap checks" of the pilot over that route on 21 November and 21 December 1995. At the time of the accident the pilot had flown the route some 128 times, and 13 times in the seven day period prior to the accident.

1.5.4 The pilot was known within the company to have been well versed with the current CAA Rules and Regulations, and company requirements.

1.5.5 His cumulative flight time in the seven days preceding the accident was 19.3 hours, 15.3 hours in ZK-SFA, and on 27 January 1996 he had been rostered off duty. On the day of the accident he reported for duty at 0700 hours.

1.5.6 The pilot was reported by company staff to have been his usual self and in good spirits before the accident. The pilot had no recollection of feeling unduly concerned with the progress of the flight.

1.6 Aircraft information

1.6.1 ZK-SFA, Cessna 208 Caravan 1, serial number 208-00051, was constructed in 1985 in the United States by the Cessna Aircraft Company. It was fitted with a Pratt and Whitney PT6A-114 engine. The aircraft was purchased new and imported to New Zealand in 1985 with an accumulated flight time of 53 hours. It was issued with a New Zealand Certificate of Airworthiness on 20 November 1985.

1.6.2 At the time of the accident, the following times in service had been accumulated:

Airframe, 9515.8 hours in service since manufacture.

Engine, serial number PCE 17056, 1470.9 hours since overhaul

Propeller, Hartzell HC-B3MN-3, serial number GB-61, 1467.8 hours since overhaul.

1.6.3 The most recent scheduled maintenance carried out on ZK-SFA was a 200 hour inspection on 1 January 1996. Maintenance Release number A104937 was issued, valid until 1 July 1996 or 9547.0 hours, whichever occurred first. The aircraft was approved for Air Transport operations, and it had been issued with a non-terminating Certificate of Airworthiness.

1.6.4 The aircraft was equipped and certified for flight in instrument meteorological conditions (IMC).

1.6.5 The aircraft records indicated that ZK-SFA had been maintained in accordance with the appropriate maintenance schedules.

1.6.6 On the accident flight, the take-off weight as stated on the load sheet was 2761 kg, 829 kg below the maximum permitted take-off weight of 3590 kg. The centre of gravity was within the approved limits.

1.7 Meteorological information

1.7.1 The Meteorological Service of New Zealand Ltd provided an aftercast of the weather conditions prevailing in the area during the day, and at the time of the accident. The conditions were determined to be as follows:

> The synoptic situation showed that a weakening depression was slow moving to the east of East Cape, and a shallow anticyclone was centred to the south of the Chatham Islands and extended a ridge onto the South Island of New Zealand.
>
> The surface wind flow over the Cook Strait area was southeasterly about 10 knots. The air was stable and the flow was greatly affected by the orography. The actual wind directions varied, from northeast at Kaikoura, easterly at Woodbourne, southeast at Cape Campbell and southwest at Wellington airport. The upper winds were light up to 30,000 feet, tending easterly above 10,000 feet and northerly above about 20,000 feet.
>
> The atmosphere was moist at sea level, and during the morning Wellington Airport was affected by low cloud with a base down to 200 feet at times. A satellite picture retrieved just before 1400 hours showed low cloud was covering most of the outer Marlborough Sounds, with a tongue of cloud extending north from Cook Strait. The cloud tended to dissipate over the water during the afternoon but persisted over parts of the Sounds. The low cloud cleared from Wellington about 1300 hours.
>
> Woodbourne was sufficiently far inland to be unaffected by the low cloud, but a main cloud base of about 3500 feet was reported during the morning and most of the afternoon. The cloud base lowered to about 2000 feet between 1600 and 1700 hours.
>
> A series of satellite pictures retrieved during the afternoon, and centred on Cook Strait, showed the low cloud over Cook Strait decreasing. They also showed cloud covering the south and southeastern slopes of Mount Robertson, as expected in a southeast flow. This cloud continued to cover Mount Robertson and the surrounding area at the time of the accident. The sea temperature was about 17° C and the dew point depression was two or

three degrees lower, giving a cloud base in the area of Mount Robertson of between 700 and 1000 feet, with patches lower. Because of the air's stability it tended to flow around Mount Robertson, with only a small amount of forced uplift, rather than rise to heights at or above the mountain's peak of 3400 feet. The cloud was around 1000 to 2000 feet thick, with tops estimated to be between 3000 and 3500 feet. Cloud layers were likely in the conditions existing at the time.

There was unlikely to have been any turbulence in the stable light flow. The outside air temperature was about 16° C at 2000 feet, and the relative humidity was around 75%.

1.7.2 The aerodrome forecast (TAF) for Woodbourne, valid throughout the period, read:

> Surface wind variable at 3 knots; visibility 30 km; rain showers; scattered cloud at 2000 feet; broken cloud at 3000 feet; becoming between 0700 and 1000 hours, wind 080° at 10 knots; 2000 foot wind 160° at 25 knots.

1.7.3 Woodbourne Aerodrome Terminal Information Service (ATIS) "Golf" was issued at 1415 hours, and included:

> Expect twin NDB approach circling runway 07, surface wind 040° 13 knots, visibility 45 km, broken cloud 3500 feet, temperature 21, dew point 14, QNH 1005, forecast 2000 foot wind 140° 12 knots.
>
> Woodbourne ATIS "Hotel" was issued at 1625 hours, and included:
>
> Expect twin NDB approach circling runway 07, surface wind 030° 15 knots, visibility 45 km, broken cloud 2000 feet, temperature 21, dew point 14, QNH 1004, forecast 2000 foot wind 140° 12 knots.

1.7.4 The pilot had been supplied with the appropriate weather briefing documents, and the company's agent at Picton Aerodrome had informed the company of the conditions prevailing in the Koromiko valley during the day. The agent said that the conditions had remained clear in the valley throughout the day, and a southerly wind of 12 knots was blowing. Cloud could be seen on the tops of the ranges located to the east, around Mount Robertson, but they did not extend into the valley. The conditions to the east improved as the day went on, and by 1600 hours extensive blue sky could be seen above the clouds on the ranges to the east.

1.7.5 A local pilot operating from Picton at the time of the accident reported that there was a light easterly flow in the Marlborough Sounds, and the Sounds and Cook Strait were clear of cloud. He said there was extensive orographic cloud on the eastern slopes of Mount Robertson, rising to about 4000 feet and covering the mountain top. The cloud stretched from Port Underwood to about Tuamarina, and Blenheim, Picton and the Koromiko valley were clear. The cloud extended about four nautical miles into Cook Strait.

1.7.6 A Rarangi resident, who was driving from Tuamarina to Rarangi at the time of the accident, said that there was thick "mist or fog" in the area around Rarangi, especially in the hills to the north and along the coast, and it was "low to the ground". The resident described the "mist or fog" as being "thick like smoke", and initially thought there was a grass fire burning, as the tops of the hills and mountains were "clear" and "in sunshine". The resident thought the conditions "were odd."

1.7.7 The rescue helicopter pilot said that there was a general layer of cloud on the eastern slopes of Mount Robertson with a patchy base of 800 to 1000 feet, and tops at 4000 feet. The wind was from the southeast at about 10 knots, and the cloud was funneling up Mount Robertson and spilling to the lee side of the ranges. The cloud prevented free access of the helicopter to the

site, and extended from Port Underwood to about 1½ nm south of the site, and a few miles out to sea. Blenheim and the Koromiko valley were clear.

1.7.8 The pilot reported that during the accident flight the only cloud he had encountered was "stratiform" cloud extending out from the eastern slopes of the Mount Robertson area to approximately the site of the Blenheim NDB/DME. He had no recollection of noting Mount Robertson itself. He was satisfied the weather conditions ahead were suitable for descent to a safe height below the cloud layer. He elected not to fly above the cloud layer because his impression of the cloud ahead led him to conclude it may not be legal or safe to do so.

1.7.9 The pilot said that during the descent he encountered a sloping cloud base and that layers of cloud which formed beneath the main base had obscured horizon information and other identifiable terrain features.

1.8 Aids to navigation

1.8.1 Navigation aids that were available to be utilised on the flight were, Woodbourne NDB and Blenheim NDB/DME, and Wellington NDB and VOR/DME. The aircraft was equipped with an avionics suite enabling all of these aids to be used. It was not equipped with a GPS.

1.8.2 The aircraft was continuously within radar coverage. Recorded radar information was retrieved for the accident flight, and the pilot's two previous flights, and the data plotted. In addition to position information the data included time, altitude and groundspeed.

1.8.3 As the accident flight was conducted under VFR, the available aids to navigation were not required to be utilised. Nevertheless, it was a common practice under VFR to make use of these aids, and the pilot had been monitoring the DME, as indicated by his "fifteen DME" call to Woodbourne Tower. The pilot however could not specifically recall monitoring the DME, or other flight instruments, after his initial call to Woodbourne Tower.

1.9 Communications

1.9.1 The aircraft was equipped with two King KX165 VHF transceivers.

1.9.2 Routine taxi and departure communications took place at Wellington airport. At 15 nm DME from the Blenheim NDB/DME the pilot made contact with Woodbourne Tower and received clearance through the Woodbourne Control Zone. At the request of the pilot the clearance was subsequently amended to a "Special VFR" clearance by Woodbourne Tower, permitting the pilot to operate in the Control Zone with a minimum visibility of 1500 metres and a cloud ceiling of 600 feet.

1.10 Aerodrome information

1.10.1 Not applicable.

1.11 Flight recorders

1.11.1 The aircraft was not equipped with either a cockpit voice recorder or a flight data recorder. Under the terms of the current legislation, such recorders were not required to be fitted to the aircraft.

1.12 Wreckage and impact information

1.12.1 ZK-SFA was found to have struck the trees at a high forward speed, in essentially a nose level attitude with some left bank applied. The aircraft was in controlled flight at the time, and sliced through a number of trees, some measuring up to 40 cm in diameter, before impacting the 28° slope. The aircraft broke-up extensively during the impact sequence and came to rest upright, having rotated through some 80° to the left. The heading at impact was 205°M, 65° left of the aircraft's last track plotted by radar.

1.12.2 The fuselage sustained severe compression damage and broke aft of the wings. The cockpit and engine nacelle were destroyed by compressive forces and the engine was separated from the aircraft. The engine sustained severe impact damage, but showed that it had been delivering power at the time of the event. The propeller was destroyed, but showed signs of having power on at impact. It had not been feathered. Both wings were sliced through just outboard of their respective strut attachment points, and the right horizontal stabilizer was entirely separated from the empennage. All of the aircraft was accounted for at the site, and the wreckage was confined within an area some 60 metres square.

1.12.3 The flying controls were examined at the site and continuity established as far as practicable, given the disruption which had occurred. The flaps were in the retracted position.

1.12.4 Little useful information was gained from the instrument panel, except that the position of the engine controls and fuel selectors suggested that they were in their normal position for flight, and the flaps were selected "up". The subscales on both altimeters were set to the correct QNH of 1004 hPa. The CDI of the HSI was selected to 235°.

1.13 Medical and pathological information

1.13.1 There was no evidence of any pilot impairment as the result of medical unfitness, fatigue or environmental factors.

1.14 Fire

1.14.1 Fire did not occur.

1.15 Survival aspects

1.15.1 The impact forces were such that the forward half of the aircraft suffered extreme crush and distortion damage. Injuries were also sustained by occupants as the result of intrusion of trees into the cabin area during the final impact. The pilot was the only survivor. His survival cannot be explained solely by the maintenance of a "habitable space" in the pilots' seats, as these areas were severely damaged, and the other front seat occupant (a passenger) sustained fatal injuries.

1.15.2 The rear of the passenger cabin was spared much of the deformation and intrusion damage experienced by the forward area of the cabin.

1.15.3 The trauma to the aircraft occupants was consistent with high speed flight into hilly, wooded terrain, and there were no identifiable factors that would have improved the survivability of this accident.

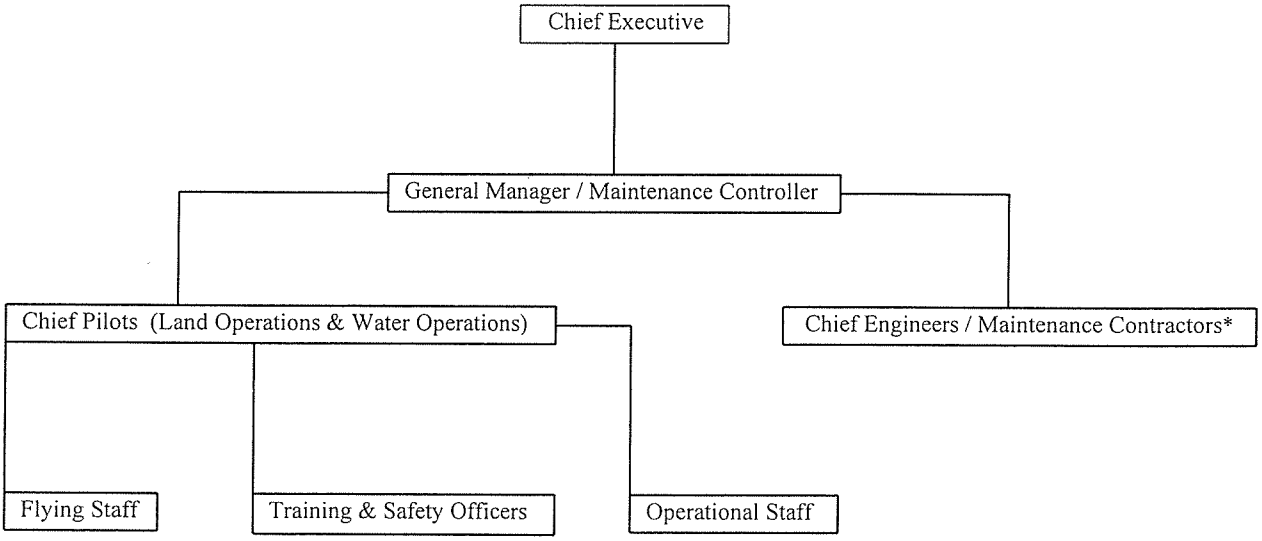
1.16 Tests and research

1.16.1 Not applicable

1.17 Organisational and management information

1.17.1 The company was structured as follows:

Soundsair Company Structure



These positions contracted to outside organisations*

1.17.2 Not unusually for a company of Soundsair's size some individuals occupied more than one position in the organisational structure, for example, the General Manager was also the Chief Pilot for water operations, and the Maintenance Controller. He was responsible for most of the day-to-day running of the organisation, and was assisted by the Chief Pilot for Land Operations.

1.17.3 In order to help retain pilots long term the company had introduced a system which bonded new employees for twelve months. The pilot advised that although bonding had been discussed with him no formal document had been prepared for him to endorse. The company also had a "shadow" Chief Pilot who would take over that position in the event the existing Chief Pilot left the company.

1.17.4 The company required the pilots it employed to have a minimum experience level of 1200 hours total flying time, including 800 hours command experience, and display positive personal attributes. The preferred minimum level of experience however was 1500 hours.

1.17.5 The company advised that to help remain competitive in the aviation market place it had adopted a novel system of remuneration for its line pilots. Pilots were not paid a retainer but were paid on a "per nautical mile" basis, there being a set rate for each route. However, if pilots could not complete a route due to weather or other considerations they were still paid for having flown that route. Generally the pilots felt happy with this system as usually there was sufficient work to give them a reasonable income. The company did recognise though that this could create problems when there was an occasional downturn in business, and were looking at introducing a retainer system in addition to the per nautical mile rate.

Company route operating procedures

1.17.6 When flying to Picton Aerodrome in southerly conditions, or periods of low visibility, it was the company's operating procedure, as detailed in their Operations Manual, to enter the southern end of the Koromiko valley, near Tuamarina, and fly up the valley to the aerodrome. As the aircraft would need to fly through the Woodbourne Control Zone, a clearance from Woodbourne Tower was required.

1.17.7 It was normal procedure for company aircraft to cross the coastline between Rarangi and Wairau Creek, on track to the southern end of the Koromiko valley. This ensured the aircraft remained clear of the higher ground, and Mount Robertson, extending to the north from Rarangi.

1.17.8 In the event that it was not possible to land at Picton Aerodrome, Woodbourne Aerodrome was the preferred alternate.

1.17.9 Rarangi is situated 6½ nm north of the Blenheim NDB/DME. A former Chief Pilot advised that he had instructed company pilots to monitor their DME and remain inside 6½ nm from the DME, in conditions of reduced visibility, to ensure their aircraft did not stray into the area of higher terrain north of Rarangi. This procedure however was not contained in the company Operations Manual. This Chief Pilot left the company in September 1995. He had been responsible for training most of the company pilots including the pilot involved in the accident.

Company weather minima

1.17.10 The company Operations Manual stated that VFR flights were not permitted to proceed if the available meteorological information, for the route and at the destination aerodrome, indicated that the weather was below a ceiling of 1000 feet, and/or the visibility was less than 5000 m. Single engine aircraft were not permitted to operate VFR above more than 4/8 of cloud cover. Operation to lower minima under Special VFR (SVFR) was permitted however, in the Woodbourne and Wellington Control Zones when cleared by Air Traffic Control, allowing a ceiling of 600 feet and a visibility of 1500 m.

1.17.11 Neither the company Operations Manual nor the aircraft's Flight Manual contained any guidelines on how to configure the aircraft when operating under VFR in reduced visibility. High performance aircraft, such as the Cessna 208, when operating with a minimum visibility of 1500 m, could cover that distance quickly at normal cruising speeds (eg: 19 seconds at 150 knots). The Operations Manual did state that there was a need for pilots to operate conservatively under VFR in "bad weather", and the former Chief Pilot, and the current Chief Pilot, said pilots were instructed to fly at reduced airspeeds of around 110 to 120 knots with some flap lowered, as appropriate, when operating in such conditions. This was also fundamental to "bad weather" flying, and taught during pilot training. The pilot advised that he was familiar with the aircraft's "bad weather" configuration, and that it was his usual practice to slow the aircraft down to an appropriate speed when confronted with such conditions.

Selection of altitudes

1.17.12 The company Operations Manual stated that for route flying with single engine aircraft it was desirable to select a higher altitude rather than a lower one, as this gave more time to handle any emergencies that might occur, and radar monitoring was available, if necessary, to assist in determining an aircraft's position.

CAA auditing

1.17.13 Soundsair was audited by CAA on 21 November 1995. The deficiencies recorded included: Operations Manual and the Operators Maintenance Manual needed to be reviewed and rewritten to reflect current responsibilities and procedures, and to include appropriate procedures pertaining to incorporating the CAR's which had, or were about to, come into effect, the need to put in place a Quality Assurance System, incorrect reference to an approved MEL for the Cessna 208, a Radio Station Licence overdue, a NO SMOKING placard missing from an aircraft, and a static dispenser missing.

1.17.14 Soundsair's Air Service Certificate was valid from June 1994 until June 1996, and authorised the company to conduct air transport services.

1.18 Additional information

1.18.1 The pilot's two earlier return flights between Wellington and Picton Aerodromes were carried out in meteorological conditions suitable for VFR flight, but in conditions worse than the accident flight. These were completed successfully.

1.18.2 The radar plot of the first flight showed the aircraft had climbed to an altitude of 1500 feet after departing from Wellington, descended to a minimum altitude of 500 feet crossing Cook Strait, for a short period, and then climbed back to 1300 feet. The aircraft crossed the coast 5.7 nm north of the Blenheim NDB/DME, 0.8 nm south of Rarangi, and then tracked to Tuamarina before turning into the Koromiko valley.

1.18.3 The radar plot of the second flight showed the aircraft had climbed to an altitude of 1500 feet, where it remained for the duration of the flight. The aircraft crossed the coast at Rarangi, and then tracked slightly north of Tuamarina before turning into the Koromiko valley.

1.18.4 The radar plot of the accident flight showed the aircraft had climbed to an altitude of 2600 feet, remained there until the pilot commenced a descent, altered heading to the right and crossed the coast 2 nm north-east of Rarangi, descending. Had the aircraft not turned to the north-west, but continued on its previous heading, it would have crossed the coast at Rarangi.

1.18.5 Although the pilot could not specifically remember making a turn to the right shortly after he commenced the descent, he did advise that he had some recollection of turning toward what appeared to him to be a distant familiar feature on the coastline

2. Analysis

2.1 The accident flight began as a routine event, and was conducted by an experienced pilot who was familiar with the route, in a well maintained and serviceable aircraft. Apart from a localised area of cloud, the conditions for visual flying were good, and had improved as the day progressed. The destination aerodrome, and Woodbourne, had clear weather conditions.

2.2 There are therefore three main events that require explanation; the decision by the pilot to descend under the cloud layer, the right turn shortly after the commencement of the descent, and the navigation of the aircraft.

The descent under the cloud layer

2.3 As the flight progressed the pilot was faced with a decision whether to fly across the localised layer of cloud that lay ahead of him, or descend beneath it. The pilot initially stated to Woodbourne Tower that he was "anticipating going VFR on top of a layer", but subsequently elected to descend and track visually beneath it, thus avoiding flying across the layer, to comply with the "not above more than 4/8 rule". The cloud layer however was "localised", and the pilot could have remained above it at a sufficient height to glide clear of it, in the event of a power loss or other emergency requiring the aircraft to descend. This may have required the aircraft to climb to a higher altitude however, with the need to subsequently lose the altitude either in the Koromiko valley or overhead the aerodrome. Alternatively, the pilot could have tracked further south around the edge of the cloud. This should not have required the aircraft to climb.

2.4 Given the reported weather conditions and the pilot's knowledge of the area however, the decision to descend beneath the cloud layer was a reasonable one, had it been made sooner. Woodbourne Tower only reported what the conditions were towards Tuamarina and the Koromiko Valley. The conditions beneath the cloud layer in the high ground north of Rarangi were not suitable for VFR flight, and the pilot had no way of accurately knowing what those conditions were like. However, it was not his intention to transit the high ground to the north.

2.5 The descent was commenced close to the edge of the cloud, and the aircraft's speed increased some 20 knots during the descent. Prior to the descent the horizontal visibility was almost unlimited, but the slant visibility (forwards) would have been minimal due to the presence and proximity of the cloud layer. It would therefore have been prudent for the pilot to have descended earlier, thus ensuring he remained clear of cloud and maintained sufficient forward visibility, both slant and horizontal, taking into account the speed of the aircraft. During the descent the pilot unexpectedly encountered progressively worsening conditions, to the point where forward visibility became unacceptable. It is possible the pilot was deluded into thinking his forward visibility was greater than it was due to misleading visual references in the conditions.

2.6 At a ground speed of some 173 knots ZK-SFA would have been closing with the rising terrain at 89 m / second (292 feet / second), in conditions of poor visibility. The pilot's safety margins, and therefore his options, were diminished. Groundspeed at impact could not be established precisely, but the evidence of a relatively high speed impact, in controlled flight, indicated forward visibility was such that the pilot had insufficient time (warning) to take effective evasive action before impact occurred.

The right turn shortly after the commencement of the descent

2.7 The pilot's general recollection of events during the flight is incomplete. Although the pilot could not remember turning to the north-west shortly after he commenced the descent, and there was no reason for him to have made this turn since he had not yet crossed the coast, it is possible he did consciously turn toward what he perceived to be a familiar feature on the coastline, created as an illusion in the changing conditions. An alternative possibility, likely in the circumstances, was transitory spatial disorientation of the pilot, due to changing and misleading visual references as he descended. The pilot levelled the aircraft's wings but did not detect that he was off course, or accurately monitor the progress of the aircraft. This apparently led to a loss of "positional awareness", and there was no attempt by the pilot to regain his original track.

2.8 The pilot's attention would have been focused in endeavouring to maintain visual reference in the marginal conditions by concentrating on looking out of the cockpit, and this would have reduced his monitoring of the aircraft's instruments.

2.9 The cloud base was likely to have lowered in layers toward the rising ground, and together with the worsening conditions, might have created a "false" horizon, sloping toward the north-west. If such a "false" horizon had existed it would have aggravated the situation.

The navigation of the aircraft

2.10 The pilot had been navigating primarily by visual means, and believed he was tracking directly towards the southern end of the Koromiko valley. Had he maintained his original track he would have crossed the coast south of Rarangi and the high ground to the north, on track to Tuamarina. In the event, the aircraft crossed the coast 2 nm north-east of Rarangi.

2.11 After the 15 DME call to Woodbourne Tower, the pilot could not specifically recall monitoring the flight instruments. This could suggest from that point he became busy, or preoccupied, with the weather ahead and deciding how best to respond to it, and therefore did not continue to accurately monitor the aircraft's progress. It is also possible he misidentified a distant terrain feature, due to the conditions, and continued toward it. The radar plot shows two turns to the north-west, one slight adjustment shortly after passing 15 nm from the Blenheim NDB/DME, and another more significant turn at about 8½ nm from the NDB/DME.

2.12 The pilot had flown the route many times in the past. As a result he may have been lulled into a false sense of security, and become distracted from the task of monitoring accurately the position and track of the aircraft.

2.13 It was not a requirement, under VFR, for the pilot to make use of the aircraft's electronic navigational equipment for navigational purposes. However he was instrument rated and had flown ZK-SFA under IFR many times, so was therefore competent in the equipment's use. Although the pilot was flying by visual reference the navigational equipment held potential to assist him in determining the aircraft's position and track accurately. The use of all the navigational resources available to him, and the monitoring of an accurate heading, would have significantly reduced the likelihood of the aircraft straying inadvertently into the high ground north of Rarangi.

3. Findings

3.1 The pilot was appropriately licensed, rated and fit to conduct the flight.

3.2 The pilot was experienced and familiar with the route.

3.3 The company's remuneration system did not influence the outcome of this flight.

3.4 The aircraft had been maintained in accordance with approved maintenance schedules, and was airworthy at the time of the accident.

3.5 The aircraft had a valid Maintenance Release and Certificate of Airworthiness.

3.6 The aircraft's all-up weight and centre of gravity were within limits.

3.7 The general weather conditions were suitable for VFR flight.

3.8 A localised area of cloud lay between the pilot and his destination.

3.9 The pilot elected to descend beneath the cloud layer rather than fly above it.

3.10 The pilot did not maintain adequate forward visibility during the descent.

3.11 The pilot may have been misled in his assessment of forward visibility by an illusion of the coastline ahead.

3.12 The pilot continued into deteriorating conditions which became unsuitable for VFR flight.

3.13 The speed of the aircraft, during the descent, was not appropriate for the conditions.

3.14 The pilot's inability, in the conditions encountered, to visually monitor the aircraft's position and track accurately, led to an inadvertent loss of "positional awareness".

3.15 There was adequate navigational equipment on board the aircraft to assist in accurate navigation, and the pilot was competent in its use.

3.16 The aircraft crossed the coastline further north than the pilot expected.

3.17 The pilot was not aware the aircraft was rapidly approaching rising terrain, until shortly before the accident.

3.18 By the time the pilot recognised his precarious situation, there was insufficient time for him to take effective evasive action before impact occurred.

Causal factors

3.19 The following factors were identified as having adversely affected the safety of the flight.

* The decision by the pilot to descend beneath the cloud layer.
* Illusions, created by the conditions, producing misleading visual references.
* The pilot's misidentification of distant terrain features.
* An undetected heading error, and loss of "positional awareness".
* Insufficient forward visibility, during the later stages of the descent.
* The high speed of the aircraft.
* The decision making by the pilot: the delayed decision to descend beneath the cloud layer; continued flight into deteriorating conditions.

Contributing / influencing factors

3.20 The following were identified as potential contributory factors in the accident.

* The pilot's familiarity with the area, creating a false sense of security.
* Improved general weather conditions, causing the pilot to relax.
* A possible false horizon, created by a sloping cloud base.
* The absence of documented procedures to ensure pilots crossed the coast south of Rarangi.

4. Safety Recommendations

4.1 The company's training programme prior to the accident included discussion and demonstration of standard procedures and techniques considered to be basic knowledge to professional pilots. As a result some of these procedures were not documented in the company's manuals.

It was however recommended to the General Manager of Soundsair that he:

> Develop operating procedures that ensure pilots, when operating under VFR, do not inadvertently cross the coastline north of Rarangi when flying to Picton Aerodrome from Wellington, in southerly conditions with/or reduced visibility. These procedures to be included in the company Operations Manual (017/96); and
>
> take the necessary steps to ensure that company pilots operating under VFR use all the resources available to them for accurate navigation (018/96); and
>
> document, in the appropriate manuals, the airspeeds and aircraft configuration recommended for VFR flight in conditions of reduced visibility (019/96).

5. Safety Actions

5.1 As well as implementing the above safety recommendations the company advised that following the accident it had instituted additional measures which included developing a system of grading for its pilots according to ability and experience. A pilot's grading would determine the type of operation he could carry out.

26 June 1996

M F Dunphy
Chief Commissioner

Glossary of Aviation Abbreviations

AD	Airworthiness Directive
ADF	Automatic direction-finding equipment
agl	Above ground level
AI	Attitude indicator
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
amsl	Above mean sea level
AOD	Aft of datum
ASI	Airspeed indicator
ATA	Actual time of arrival
ATC	Air Traffic Control
ATD	Actual time of departure
ATPL (A *or* H)	Airline Transport Pilot Licence (Aeroplane *or* Helicopter)
AUW	All-up weight
^{o}C	Degrees Celsius
CAA	Civil Aviation Authority
CASO	Civil Aviation Safety Order
CFI	Chief Flying Instructor
C of A	Certificate of Airworthiness
C of G (*or* CG)	Centre of gravity
CPL (A *or* H)	Commercial Pilot Licence (Aeroplane *or* Helicopter)
DME	Distance measuring equipment
E	East
ELT	Emergency location transmitter
ERC	Enroute chart
ETA	Estimated time of arrival
ETD	Estimated time of departure
^{o}F	Degrees Fahrenheit
FAA	Federal Aviation Administration (United States)
FL	Flight level
ft	Foot/feet
g	Acceleration due to gravity
GPS	Global Positioning System
h	Hour
HF	High frequency
hPa	Hectopascals
hrs	Hours
IAS	Indicated airspeed
IFR	Instrument Flight Rules
IGE	In ground effect
ILS	Instrument landing system
IMC	Instrument meteorological conditions
in	Inch(es)
ins Hg	Inches of mercury

kg	Kilogram(s)
kHz	Kilohertz
KIAS	Knots indicated airspeed
km	Kilometre(s)
kt	Knot(s)
LAME	Licenced Aircraft Maintenance Engineer
lb	Pounds
LF	Low frequency
LLZ	Localiser
Ltd	Limited
m	Metre(s)
M	Mach number (e.g. M1.2)
°M	Degrees Magnetic
MAANZ	Microlight Aircraft Association of New Zealand
MAP	Manifold absolute pressure (measured in inches of mercury)
MAUW	Maximum all-up weight
METAR	Aviation routine weather report (in aeronautical meteorological code)
MF	Medium frequency
MHz	Megahertz
mm	Millimetre(s)
mph	Miles per hour
N	North
NDB	Non-directional radio beacon
nm	Nautical mile
NOTAM	Notice to Airmen
NTSB	National Transportation Safety Board (United States)
NZAACA	New Zealand Amateur Aircraft Constructors Association
NZDT	New Zealand daylight time (UTC + 13 hours)
NZGA	New Zealand Gliding Association
NZHGPA	New Zealand Hang Gliding and Paragliding Association
NZMS	New Zealand Mapping Service map series number
NZST	New Zealand Standard Time (UTC + 12 hours)
OGE	Out of ground effect
okta	Eighths of sky cloud cover (e.g. 4 oktas = 4/8 of cloud cover)
PAR	Precision approach radar
PIC	Pilot in command
PPL (A *or* H)	Private Pilot Licence (Aeroplane *or* Helicopter)
psi	Pounds per square inch
QFE	An altimeter subscale setting to obtain height above aerodrome
QNH	An altimeter subscale setting to obtain elevation above mean sea level
RNZAC	Royal New Zealand Aero Club
RNZAF	Royal New Zealand Air Force
rpm	revolutions per minute
RTF	Radio telephone or radio telephony

s	Second(s)
S	South
SAR	Search and Rescue
SSR	Secondary surveillance radar
^{o}T	Degrees True
TACAN	Tactical Air Navigation aid
TAF	Aerodrome forecast
TAS	True airspeed
UHF	Ultra high frequency
UTC	Coordinated Universal Time
VASIS	Visual approach slope indicator system
VFG	Visual Flight Guide
VFR	Visual flight rules
VHF	Very high frequency
VMC	Visual meteorological conditions
VOR	VHF omnidirectional radio range
VORTAC	VOR and TACAN combined
VTC	Visual terminal chart
W	West