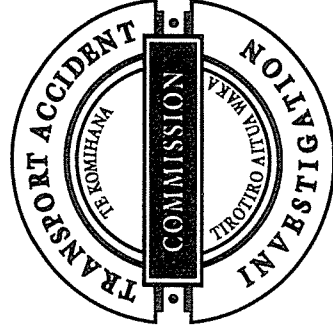




Report 95-016

Cessna 177B

ZK-DRC

Near Fohn Saddle, 15 nm south east of Big Bay

South Westland

21 October 1995

Abstract

At about 1600 hours on Saturday 21 October 1995, ZK-DRC took off from Big Bay for Alexandra. The pilot owned the aircraft and had flown it from Alexandra to Big Bay earlier in the afternoon to pick up his son and a friend who had spent the previous week whitebaiting. The aircraft did not arrive at Alexandra. A searching helicopter located the wreckage of ZK-DRC the next morning, near the Fohn Saddle at an elevation of about 4760 feet amsl. The aircraft had stalled onto a snow terrace. The three occupants had been killed. No conclusive explanation for the accident was established.

Transport Accident Investigation Commission

Aircraft Accident Report 95-016

Aircraft type, serial number and Registration:	Cessna 177B, 177-02143R ZK-DRC
Number and type of engines:	One Lycoming O-360-A1F6D
Year of manufacture:	1974
Date and time:	21 October 1995, approximately 1612 hours ¹
Location:	Near Fohn Saddle, 15 nm south-east of Big Bay Latitude: 44° 31.4'S Longitude: 168° 15.6'E
Type of flight:	Private
Persons on board:	Crew: 1 Passengers: 2
Injuries:	Crew: 1 fatal Passengers: 2 fatal
Nature of damage:	Substantial
Pilot in Command's Licence:	Private Pilot Licence (Aeroplane)
Pilot in Command's age:	59
Pilot in Command's total flying experience:	445 hours 258 on type
Investigator in Charge:	D G Graham

¹ All times in this report are in NZDT (UTC + 13 hours)

1. Factual Information

1.1 History of the Flight

- 1.1.1 On Friday 13 October 1995, the pilot carried out an uneventful flight from Alexandra to Big Bay and return, in his aircraft ZK-DRC a Cessna 177B. The purpose of the flight was to transport one of his sons and a friend, with their camping gear and fishing equipment, to Big Bay where the two men had arranged to spend a week whitebaiting. The pilot planned to return to Big Bay in ZK-DRC on Friday 20 October 1995, to fly them back to Alexandra.
- 1.1.2 ZK-DRC remained at Alexandra Aerodrome during the week, parked in the open, on a sheltered grassed area. On Friday 20 October 1995, due to prevailing strong winds, the pilot abandoned his proposed flight to Big Bay and moved the aircraft into a local hangar overnight.
- 1.1.3 On Saturday 21 October 1995 the pilot had lunch with friends in Clyde. He took the centre seat out of ZK-DRC before his departure for Big Bay at approximately 1435 hours. He was the sole occupant of the aircraft.
- 1.1.4 The pilot followed a route via Bannockburn and west of Coronet Peak. Having already climbed to an altitude of 6300 feet (see section 1.9 Communications) it was probable that the pilot, in his lightly laden aircraft, gained further height en-route, permitting an almost direct flight to Big Bay.
- 1.1.5 Witness reports indicated that ZK-DRC landed at Big Bay about 1515 or 1520 hours. The exposed tidal area of the beach was in good condition for landings and take-offs. The pilot's son, who had been staying with his friend in the Department of Conservation (DOC) hut some distance down the beach, had earlier collected their stored whitebait from a witness's freezer, in preparation for the afternoon departure.
- 1.1.6 No one observed the aircraft being loaded but at approximately 1600 hours two witnesses, about one kilometre away, watched ZK-DRC taxi up the beach and turn prior to take-off. They recalled that as the pilot applied power there was a distinctive "miss" in the engine sound. One of the witnesses, familiar with aircraft operations in the area, described his first impression that it was a "carb heat - mag check - one mag then the other. The noise of the engine stopped, then it went again."
- 1.1.7 The aircraft then took off down the beach (toward the south) in a normal manner. After take-off it turned left and headed toward the Pyke River. The witnesses noted nothing unusual in the climb out or the aircraft's departure up the valley.
- 1.1.8 On Saturday evening, Christchurch Air Traffic Control (ATC) were advised by a concerned family member that ZK-DRC had not returned to Alexandra Aerodrome. The Rescue Coordination Centre (RCC) was notified at 2045 hours. Communication efforts to ascertain whether the aircraft was still on the ground at Big Bay were unsuccessful. There were no reports of any ELT transmissions in the area. Arrangements were made for a helicopter to proceed to Big Bay the next morning at first light.
- 1.1.9 The helicopter pilot reported at 0635 hours on Sunday 22 October 1995, that ZK-DRC had departed from Big Bay the previous afternoon. The RCC was activated, and two helicopters tasked for search duties. Cloud cover on the mountain saddles hampered the search initially, but at 1030 hours the wreckage of ZK-DRC was sighted near the Fohn Saddle. None of the occupants had survived.

1.1.10 The available evidence suggested that the accident occurred in daylight at about 1612 hours on 21 October 1995. The accident site was on a snow covered terrace on the western side of the Fohn Saddle 15 nm south-east of Big Bay, South Westland at an elevation of approximately 4760 feet amsl. Grid reference 335 211 NZMS 260 series, “Aspiring”. Latitude: 44° 31.4'S, Longitude: 168° 15.6'E.

1.2 Injuries to persons

1.2.1 The pilot and the two passengers received fatal injuries on impact.

1.3 Damage to aircraft

1.3.1 The aircraft sustained substantial damage.

1.4 Other damage

1.4.1 Nil.

1.5 Personnel information

1.5.1 The pilot-in-command, 59, commenced flying training in November 1984, and obtained a restricted Private Pilot Licence (Aeroplane), (PPL(A)) in September 1987. By February 1988 he had fulfilled the necessary cross-country training and flight time requirements and was issued with an unrestricted PPL(A). He held a Flight Radio Telephone Operator’s Rating.

1.5.2 The pilot renewed his PPL(A) regularly and on 27 January 1993 was issued with New Zealand Lifetime PPL(A) Number 22357. This Licence was endorsed “Restricted to student pilot licence privileges by night”. In conjunction with the PPL(A) the pilot held a Class 2 Medical Certificate issued 30 January 1995 and valid to 6 February 1996. The Medical Certificate contained the restriction “Half spectacles must be readily available”.

1.5.3 The pilot’s training had been conducted on the Cessna 150 and Cessna 172 types, and after obtaining his PPL(A) he had continued to fly these types in the main, with some brief experience on the Cessna 206 and Piper PA28 aircraft. In August 1989 he undertook conversion training in Cessna 177B ZK-DRC. He became the registered owner of this aircraft in September 1989. His total flight time at that time amounted to 161.4 hours of which 57.5 hours was dual instruction.

1.5.4 The conversion instruction on ZK-DRC comprised 1.2 hours dual and included steep turns, stalls, and circuit training, together with maximum all-up weight circuits. The majority of the pilot’s subsequent flying was in Cessna 177B ZK-DRC for personal transport and general private use but occasionally he flew a Cessna 172 or Cessna 150 aircraft.

1.5.5 Much of the pilot’s flying involved cross-country trips to and from his business interests in Alexandra to destinations in the lower South Island, including his home property at Aparima, Southland. His first recorded round-trip from Alexandra to Big Bay took place on 31 August 1991.

1.5.6 Log book entries indicated that between 1991 and 1995 the pilot had flown from Alexandra to Big Bay on 12 separate occasions, including the flight on the day of the accident. He had flown from Aparima to Big Bay, and return, on two occasions, and had also recorded several flights from Alexandra which, while not involving a landing at Big Bay, overflew the south Westland area.

1.5.7 Subsequent to his conversion flying on ZK-DRC the pilot had recorded flights with an instructor on only two occasions, for practice when renewing his PPL(A) in 1990, and when positioning a C150 aircraft in 1991. His most recent Biennial Flight Review (BFR) was conducted by an instructor on 15 June 1994 and flown in ZK-DRC. No dual practice was flown prior to this flight. Records indicated that the pilot had maintained a satisfactory flight standard on each renewal occasion. The total “dual” time he had recorded since 1989 amounted to 2.48 hours.

1.5.8 The pilot’s total flying experience amounted to approximately 445 hours. Of this total 384 hours was pilot-in-command, and 61 hours was dual. Dual instructional time on Cessna 177 ZK-DRC amounted to about 2.5 hours, including his type conversion flying, and he had flown a total of some 255 hours as the owner/pilot of this aircraft.

1.5.9 In the 90 days preceding the accident the pilot had flown 5.6 hours, all in ZK-DRC. He had flown 3.7 hours within the last 10 days. This flying had comprised a flight from Aparima to Alexandra on 12 October 1995, a round-trip Alexandra - Big Bay - Alexandra on 13 October 1995 and the flight Alexandra - Big Bay and return on 21 October 1995, during which the accident occurred.

1.5.10 The pilot had averaged some 41 hours flying each year in the period between 1985 and 1994. He had accumulated about 24 hours during 1995 up to the time of the accident.

1.6 Aircraft information

1.6.1 The Cessna 177B is an all-metal, single engine, high wing light aircraft of conventional design, fitted with a fixed tricycle undercarriage. The cabin layout comprises pilot and front passenger seating, a centre double passenger seat and provision for an auxiliary seat at the rear of the cabin. Cessna 177B, ZK-DRC, serial number 177-02143, was manufactured in the United States in 1974. It was imported new to New Zealand in 1975. After being operated briefly by a flying school it was sold in 1976 to a North Island owner.

1.6.2 ZK-DRC was extensively damaged in an accident in December 1976 and subsequently de-registered. It was re-built during 1977 and re-registered in 1978, then sold to an Invercargill based partnership. The aircraft was owned by this partnership until its purchase in 1989 by the pilot who lost his life in this accident.

1.6.3 As a privately owned and operated aircraft, ZK-DRC was subject to a minimum maintenance requirement of one, 100 hour inspection annually. In practice it had received 100 hour and 50 hour inspections on a periodic basis, conducted in accordance with an approved maintenance schedule. The most recent maintenance comprised a 100 hourly check carried out on 22 March 1995. No significant defects were disclosed at the time of this inspection.

1.6.4 Maintenance Release number 004671 was issued following the 100 hour inspection. It was valid until 22 March 1996 or the attainment of 1771.7 hours total aircraft time in service, whichever occurred sooner. The following conditions were specified on the Maintenance Release:

- (1) Pilot’s daily and pre-flight checks
- (2) Operation in accordance with Flight Manual.

The tachometer readings indicated that 19.4 hours had been flown since the 100 hour inspection. The total aircraft time in service, as at the occurrence of the accident, was calculated to be 1740.5 hours.

- 1.6.5 The aircraft was fitted with a 180 HP Lycoming O-360-A1F6D engine, serial number 19120. Logbook records indicated that, at the time of the most recent 100 hour inspection, the engine had accumulated a total time since new of 1663.33 hours. McCauley B2D34C211 propeller, serial number 775343 was installed, and had run a recorded time of 1503.41 hours at the time of the inspection.
- 1.6.6 Flights carried out in ZK-DRC were recorded in a notebook kept in the aircraft. There were no entries in this document to indicate that any significant malfunctions or defects involving the airframe, engine, or propeller had occurred during the period of some seven months which had elapsed between the 100 hourly inspection and the occurrence of the accident.
- 1.6.7 The aircraft was equipped with long-range fuel tanks. Each tank had a total capacity of approximately 114 litres. The flight details provided by the pilot to Queenstown Air Traffic Services (ATS) included an endurance of three hours and thirty minutes (see paragraph 1.9.1). It was likely that each tank contained about 70 litres of Avgas 100 aviation fuel on departure from Alexandra Aerodrome.
- 1.6.8 The total fuel quantity on board ZK-DRC when the accident occurred was probably about 100 litres. The aircraft's all-up weight was estimated to be approximately 2712 lb (1230 kg). The cargo amounted to 371 pounds (168 kg). The maximum authorised all-up weight was 2500 pounds (1134 kg). (See paragraphs 1.12.11 and 1.16.3.)
- 1.6.9 The position of the centre of gravity (CG), at the time of the accident, could not be calculated with accuracy as the pre-impact distribution of the cargo load was not known. The CG position was estimated, however, to have been between 112 inches (2845 mm) and 113 inches (2870 mm) aft of datum (AOD). At an all up weight of 2500 pounds the permissible CG forward limit was 105.6 inches (2682 mm) AOD, and the aft limit 114.8 inches (2916 mm) AOD.

1.7 Meteorological information

- 1.7.1 In an after-cast of the weather situation the Director of the Meteorological Service of New Zealand provided information summarised as follows:

At 1500 hours on 21 October 1995 an anticyclone over the South Tasman Sea extended a broad ridge across South Island. To the north and east of this system a cold front extended from just west of the Chatham Islands to a small depression north of Nelson, and thence over the North Tasman Sea.

A satellite picture taken at about 1600 hours showed that Fiordland was mostly clear of cloud except for the area south of 45°S. Patches of cloud existed just south-west of Big Bay and on the ranges either side of the Hollyford Valley. The Hollyford Valley was clear of cloud as were the Dart and Shotover Valleys.

Queenstown reported that the skies were clear while Milford recorded one octa of cloud during the afternoon with a base of 5000 feet rising to 6000 feet. Information from the meteorological office at Invercargill suggested the cloud base was generally 5000 feet to 6000 feet throughout the area. There was a deep isothermal layer between about 6000 feet and 10 000 feet so that any cloud that formed probably had little vertical development.

Winds were light at the surface, probably a westerly quarter sea breeze near the coast and up valley winds elsewhere. Winds aloft in the free air were south-westerly 20 to 25 knots between 1000 feet and 7000 feet, increasing to 35 knots at 10 000 feet. Earlier in the day the winds had been north-west and stronger but were backing and decreasing as the ridge spread across South Island. Over the mountains the wind flow would have been concentrated between the isothermal layer and the

mountaintops. This would have led to stronger winds than usual over the mountaintops. Below the isothermal layer the air in the afternoon was extremely unstable with cloud development restricted by the layer. Areas of severe turbulence between 5000 feet and 7000 feet were likely due to the combination of strong wind flows and turbulent energy released by afternoon heating being trapped beneath the layer.

The mountainous terrain to the west and south-west of the accident site included a number of ridges lying north/south and thus across the wind. These ridges may have generated areas of down draught but it is not possible to determine whether the accident area was affected. However any significant turbulence would have included transient areas of downward motion as a part of the eddies which constituted it. At 5000 feet the outside air temperature (OAT) was about -4°, and the dew point -6° resulting in a relative humidity of about 87%.

- 1.7.2 A pilot who took off from Big Bay at about 1620 hours on the same day to return to Arrowtown followed a route likely to have been similar to that taken by ZK-DRC. The pilot crossed the main range via the Fohn Saddle between 1630 hours and 1635 hours and then flew down the Beans Burn. He reported that a layer of cloud some 300 feet to 400 feet thick covered the peaks each side of the Fohn Saddle, with a clearance of some 150 feet to 200 feet at the saddle itself. Some “wispy bits” of cloud existed here and there. The Fohn Saddle was the only one open in the area, adjacent saddles on the surrounding higher terrain being closed due to cloud. He had climbed his aircraft directly after leaving Big Bay and had reached the cloudbase at about 5100 feet or 5200 feet before passing through the Fohn Saddle. He had made his approach to the final ridge, and the saddle, at an angle, from a north-westerly direction. There was no cloud in the valley of the Beans Burn, or elsewhere on the eastern side of the main range.
- 1.7.3 The pilot had flown over the cloud layer at about 6000 feet amsl en-route to Big Bay from Arrowtown about one hour earlier. The layer commenced at the main range and extended about three to four nautical miles to the west, beyond Forgotten River. There was a brisk south-westerly wind of around 20 to 25 knots blowing at Big Bay, but the pilot considered the wind at the saddle was unlikely to have been more than about 15 knots from the south-west. He experienced some mild turbulence, but no significant up or downdraughts when traversing the area.
- 1.7.4 Reports from pilots who had flown from Milford Sound to Queenstown, and from Milford Sound to Wanaka, during the late afternoon of 21 October 1995 indicated that, despite the south-west flow, conditions in flight were relatively smooth. There were areas of layer cloud with a base of about 5000 feet, obscuring some of the peaks, on the western side of the main ranges, but the major valleys were clear of cloud. To the east the skies were clear. No significant turbulence or downdraughts were encountered by these pilots.

1.8 Aids to navigation

- 1.8.1 Not applicable.

1.9 Communications

- 1.9.1 ZK-DRC was equipped with a Cessna RT328C VHF navigation/communication transceiver. Following his departure from Alexandra Aerodrome the pilot established communications with Queenstown Flight Information on RTF frequency 128.0 MHz at 1442 hours. He reported at Bannockburn, providing abbreviated details of his flight as “Alexandra to Big Bay, one person on board, a fuel endurance of three hours and thirty minutes, and an estimated time of arrival (ETA) at Big Bay of 1530 hours”. He stated his existing cruise altitude as 4700 feet.

1.9.2 The Airways Corporation, Flight Information Officer asked the pilot if he would like the Flight Information Service to maintain an alerting watch to confirm his arrival at Big Bay. The pilot responded in the negative, and advised that he would terminate his abbreviated flight plan when clear of the Queenstown Control Zone.

1.9.3 The pilot next contacted Queenstown Tower on RTF frequency 118.1 MHz at 1449 hours, at Bungy Bridge. He was cleared on track through the Control Zone, and due to some local hang-glider activity, climbed at this time to an altitude of 6300 feet amsl. At 1454 hours the pilot reported west of Coronet Peak and clearing the zone, and informed the Queenstown Duty Controller that he would be returning from Big Bay to Alexandra in approximately one hour's time. The Duty Controller asked the pilot if he would like his flight plan to be held open, but he again replied in the negative saying he would establish contact on his return before entering the zone. There were no known further communications on any RTF frequency with ZK-DRC.

1.10 Aerodrome information

1.10.1 Not applicable.

1.11 Flight recorders

1.11.1 Not applicable.

1.12 Wreckage and impact information

1.12.1 The Fohn Saddle is located at the head of the Beans Burn, on the southern end of the Barrier Range which forms the western boundary of Mt Aspiring National Park. The peaks flanking the saddle rise to almost 6000 feet and the terrain falls steeply on the western side in a series of snow covered bluffs, terrace slopes, and ridges to a branch valley of the Olivine River. Further west the Olivine River joins the Pyke River, with the Pyke Valley, Lake Wilmot and the Upper Pyke providing an easily recognised and reasonably direct route from the Fohn Saddle area to the coast at Big Bay.

1.12.2 The wreckage of ZK-DRC was lying on a small snow terrace about 500 m north of the Fohn Saddle at an elevation of 4760 feet amsl, some 250 feet below the level of the mid point of the Saddle. No component scatter had occurred, apart from a portion of the battery cover which was lying 14 m ahead of the aircraft, and fragments of windscreen forward of the cockpit.

1.12.3 The aircraft had impacted an essentially level area of the snow terrace in a nose-down attitude of some 60° on a heading of about 135° M. The propeller and engine were buried completely in the firm snow and the wing had sustained severe leading edge compression across the whole span. The depth of fuselage penetration and impact force on the wing leading edge had sheared the wing support structure each side of the cabin, virtually detaching the wing assembly from the fuselage. The empennage was intact apart from slight damage to the tip of the right horizontal stabiliser, but the steep nose-down impact had resulted in a collapse of the rear fuselage immediately aft of the cabin.

1.12.4 A search of the surrounding snow slopes, and rocky bluffs, disclosed no evidence of prior contact by any part of the aircraft. The compact layout of the wreckage and the extensive structural damage indicated steep uncontrolled descent from a probable height of 200 to 300 feet above the terrain.

- 1.12.5 Extreme disruption had occurred within the cockpit and cabin. The integrity of the primary control systems was established in relation to basic cable connection and control surface movement. Elevator trim position was determined as approximately mid-way between the “nose down” and the “take-off” position. The flaps were “up”. Wing damage was such that the right and left integral fuel tanks were ruptured and no significant quantity of fuel remained in either tank. Both tank caps were in place and residual wetness suggested that a quantity of fuel had been contained in each tank at the time of the accident. The fuel tank selector was positioned to “BOTH” and the fuel shut-off valve was “ON”.
- 1.12.6 The aircraft’s instrument panel was severely damaged by impact forces. Throttle, mixture and pitch control positions and most switch positions were inconclusive due to the disruption that had occurred. The following observations and readings were considered representative of conditions immediately prior to the accident:
- Altimeter set to 1017 hPa (Altitude reading 4820 feet).
 - Pilot’s microphone and headset jacks plugged in.
 - Cylinder head temperature - Mid range (green)
 - Ammeter indicating a small positive charge
 - Primer locked ‘IN’
 - Battery switch ‘ON’
 - Auxiliary pump switch ‘OFF’
 - Magneto switch selected to ‘BOTH’
 - Carburettor heat control ‘OFF’
 - Direction indicator indicated 120°
 - Autopilot ‘OFF’
 - VHF transceiver selected to 119.2 MHz and ‘ON’ (Volume between ½ and ¾)
 - ADF selected to 214 and ‘ON’
 - VOR selected to 116.8 MHz and ‘ON’
- 1.12.7 ZK-DRC was equipped with dual controls. The left control yoke had fractured completely from the control column as a result of impact forces. The right control yoke and column assembly was intact. As found, both control columns were extended fully aft (full “nose-up” elevator). The emergency locator transmitter which had been positioned on the cockpit floor to the rear of the fuel selector, had been demolished on impact.
- 1.12.8 The wreckage of ZK-DRC was lifted by helicopter from the accident site and subsequently transported by road to a suitable location where further detailed inspection of the airframe and engine could be carried out. Propeller damage indicated low power at impact. The throttle setting at the carburettor was in the fully closed position. The carburettor assembly had broken away from the engine at its attachment flange due to the severe impact. The gascolator filter was clean and the drain shut-off closed. A quantity of fuel which remained in the filter was uncontaminated. Clean fuel was also present within the main fuel line to the carburettor and within the auxiliary fuel pump. The aeroduct air filter hose was in a deteriorated condition and had been severely compressed by impact forces.
- 1.12.9 The aircraft’s electrically powered clock, which reportedly kept accurate time, was found completely separated from its mounting in the instrument panel. It indicated approximately 1612 hours. Supporting evidence suggesting the accident occurred within some 15 minutes of leaving Big Bay was provided by the aircraft’s tachometer reading.
- 1.12.10 The front left and front right seats of ZK-DRC were equipped with an inertia-reel type combined lap belt and diagonal upper torso restraint. The pilot and front passenger were wearing the installed harness. The rear passenger seated on the low auxiliary seat at the rear of the cabin had been wearing a simple lap type seat belt. The nature of the accident had resulted in impact forces that considerably exceeded the restraint capability of the safety harnesses in use.

- 1.12.11 The cargo on board ZK-DRC during the return flight consisted primarily of camping equipment and supplies and whitebaiting gear which the two passengers had required during their eight-day stay at Big Bay. The disruption to the aircraft's cabin rendered it impracticable to determine with accuracy the pre-impact distribution of the load. It was evident however that the majority of heavy and bulky items, including two back packs, two whitebait nets, waders and boots and various containers of food had occupied the area normally taken up by the centre seat, with other items being stowed alongside the passenger seated at the rear of the cabin. There was no indication that a mesh net, straps, or tie-downs of any kind, had been employed to secure the cargo.

1.13 Medical and pathological information

- 1.13.1 Post-mortem and toxicological examination did not reveal any medical condition which was likely to have affected the ability of the pilot to control the aircraft.
- 1.13.2 The pilot was reported to have been in normal health and good spirits at the time the accident flight was undertaken.
- 1.13.3 There was no evidence of pilot incapacitation and the injuries sustained by the pilot suggested that he was holding the controls at the time of impact.
- 1.13.4 The pilot's son, who occupied the front right seat was in good health. He was accustomed to flying in the aircraft, but had no formal training or qualification as a pilot.

1.14 Fire

- 1.14.1 No fire occurred.

1.15 Survival aspects

- 1.15.1 The pilot and passengers died instantly. The impact forces and injuries sustained were consistent with the severe longitudinal and vertical decelerations resulting from the steep nose-down attitude of the aircraft as it descended into the snow.
- 1.15.2 The Pointer 3000 ELT unit in ZK-DRC did not serve its intended purpose as it was destroyed by the severe impact forces. Its position on the cockpit floor, while convenient for portability, afforded little protection for the unit.
- 1.15.3 ZK-DRC was not reported overdue until the evening, when a family member became concerned. The absence of ELT transmissions, and lack of success in communicating with Big Bay meant that no definite information concerning ZK-DRC's whereabouts could be obtained until the following morning. The pilot had declined the offer by ATS personnel at Queenstown to maintain his flight plan open. This was probably because of the difficulty of RTF communications from the area and to allow greater flexibility in the event of some unforeseen delay at Big Bay, although the pilot did indicate his intention to return within approximately one hour. Submission of a round-trip, or return flight plan which included an ETA for Alexandra would have resulted in the initiation of ATS action to attempt to locate ZK-DRC once the ETA had been exceeded by 30 minutes. In the circumstances, however, the delays which occurred had no bearing upon the survivability of the accident.

1.16 Tests and research

- 1.16.1 The engine and propeller from ZK-DRC were transported to an approved overhaul facility and subjected to strip examination and component testing. The inspection and test report is summarised as follows:

Engine

No metal contamination found in the oil filter.
Magnetos timing checked and found to be at manufacturers setting.
Number 1 induction hose had one clamp not fitted around hose at sump tube.
Evidence of fuel stain at this location.
Number 4 cylinder top ring found broken - high blowby evident in bore.
All piston rings heavily worn.
Engine driven fuel pump operational.
Electrical fuel pump operational.
Internal wear in the engine normal for the hours run.
Dual magnetos, harness and spark plugs bench tested as complete assembly.
The magnetos performed satisfactorily. All plugs tested and found operational.
Number 1 ignition lead found accident damaged.
Magnetos checked internally and no defects found.
Carburettor top body removed (damaged) and inspected internally. Noted that metal float had one pontoon which had impressed into the body/bowl gasket.
Also the float level on the other pontoon was not as per the manufacturer's setting - i.e. the float was set rich. One pontoon had 'dents' probably due to impact
It was noted that the air intake aeroduct hose was in poor condition.

Propeller

Number 1 blade bent back approximately 45° at 12 inches station.
Both blades rotated in the hub indicating a pitch change mechanism failure.
Subsequent strip of the propeller showed that the bent blade had impacted the pitch change blade pin into the block assembly which broke the remaining link.
It is not considered that there was any defect with this propeller.

- 1.16.2 ZK-DRC was fitted with an acoustic type stall warning horn. This unit functioned satisfactorily when tested following the accident.
- 1.16.3 The cargo from ZK-DRC was itemised and weighed, and sample calculations performed to provide various estimates, depending on load distribution, of the aircraft's CG position at the time of the accident. (See para. 1.6.9 Aircraft Information.)

1.17 Additional Information

- 1.17.1 The pilot was known to have used lower level routes such as the Greenstone and Hollyford Valleys in flying between Alexandra and Big Bay. Whether he had previously flown via the Fohn Saddle was not established. However, flights over the general area in clear conditions were likely to have given him some familiarity with saddles and passes which could be used to cross the Barrier Range.
- 1.17.2 The Cessna 177 Owner's Manual kept in ZK-DRC included pencilled information relating to operating speeds in knots, rather than the mph speeds published in the manual. Normal and Maximum Performance climb speeds were noted as 80 knots.

1.17.3 The Operational Data section of the Owner's Manual contained a table of stall speeds at gross weight, 2500 pounds, for various angles of bank and flap settings.

The Flaps UP stall speeds, converted from MPH CAS to KNOTS CAS, were as follows:

ANGLE OF BANK	0°	20°	40°	60°
STALL SPEED	55	57	63	78

POWER OFF - AFT CG

2. Analysis

- 2.1 The pilot had owned Cessna 177 ZK-DRC since 1989 and more than half his total flying experience had been obtained in this aircraft. In six years as a private owner/operator he had flown some 255 hours as pilot in command of ZK-DRC. The additional 26 hours he accumulated during the same period were almost all flown in Cessna 150 and 172 aircraft, which had handling characteristics similar to ZK-DRC. The pilot thus was familiar with the aircraft type and its operation.
- 2.2 Over the previous 10 years the pilot had averaged about 41 hours annually. He had already flown some 24 hours in 1995, prior to the accident. Most of his flying was cross-country, in the lower South Island. His experience and the relative regularity of his flying in ZK-DRC enabled him to operate the aircraft routinely with confidence and proficiency.
- 2.3 In common with many private owners, and PPL holders, the pilot, after his initial training, had received minimal further dual instruction. His most recent dual had comprised a practice flight prior to his PPL renewal test in 1990, and a positioning flight in a C150 aircraft in 1991. Occasional periods of dual refresher training offer a potential for the pilot to revise or further develop skills required for effective response to non-routine and emergency situations which might be encountered in flight.
- 2.4 The pilot had carried out a Biennial Flight Review successfully in 1994. This had been flown in ZK-DRC. Whether he had practised recently the appropriate actions relating to an unexpected loss of engine power in flight, recovery from a stall with minimum loss of height, or response to other emergencies, was not established.
- 2.5 The pilot was accustomed to making at least two round-trip flights from Alexandra to Big Bay during the whitebait season each year. He was familiar with lower level routes such as the Greenstone, and Hollyford Valleys, in proceeding to, or from, the coast.
- 2.6 He had postponed his intended flight from Alexandra to Big Bay on 20 October 1995 due to the prevailing strong winds. Conditions on Saturday, 21 October 1995, had improved considerably and there was no reason for the pilot to anticipate any undue weather related problem during the flight.
- 2.7 The available evidence suggested that the outbound flight proceeded uneventfully. The route followed by the pilot after passing west of Coronet Peak could not be established conclusively, but fine weather east of the Barrier Range, and the elapsed flight time, suggested that his track was essentially direct. It was probable that he flew ZK-DRC at an altitude sufficient to overfly

the cloud layer which shrouded the main peaks and extended some three to four nautical miles to the west of the Barrier Range.

- 2.8 Evidently the passengers were ready with their camping equipment and whitebaiting gear for the aircraft to be loaded for the return flight without delay. Witness observations of the aircraft taxiing for take-off at approximately 1600 hours were consistent with the pilot's indication to Queenstown ATS that he expected to be returning to Alexandra in about an hour's time. This suggested that no obvious defect or malfunction had occurred in the operation of ZK-DRC during the outbound flight, or on start-up and while taxiing, to warrant a delay in departure.
- 2.9 The significance of the engine "miss" heard by witnesses before the pilot commenced take-off could not be established. It was probable that it occurred as a result of standard pre-take-off checks conducted by the pilot. A deliberate magneto 'dead-cut' check or inadvertent positioning of the ignition to 'OFF' during left and right magneto checks at higher power, would have caused a momentary interruption of engine operation. Alternatively the 'miss' may have resulted from a brief hesitation, in the engine's response to an application of power, which subsequently cleared.
- 2.10 Whatever the explanation, it was unlikely that the pilot would have persevered with the take-off if he suspected any component of the engine, the dual magneto, or the fuel system, to have seriously malfunctioned. The aircraft was heavily loaded, and the return flight, by any route, would pass over inhospitable terrain. In the event, nothing unusual was noted about the take-off, or the aircraft's climb-out and departure.
- 2.11 Strip examination after the accident and testing of relevant components disclosed no evidence of any major defect in the engine, its accessories, or the propeller which might have contributed to an in-flight failure. The internal condition, however did reflect wear and minor defects, consistent with the total hours run and the annual utilisation of a privately owned aircraft. Some deterioration in power output was to be expected.
- 2.12 The elevation of the accident site proved that despite this consideration and the load on board, the aircraft had achieved a creditable climb performance within the short period of 12 to 15 minutes which had probably elapsed since the take-off at sea level. This suggested that the engine, and the aircraft as a whole, was operating satisfactorily at the outset of the flight. Any perceived short coming in performance, or malfunction, could be expected to have prompted the pilot to follow a lower level route with which he was familiar, or return to Big Bay.
- 2.13 The location of the accident site indicated that the pilot had chosen to follow the most direct route to Alexandra, and had climbed the aircraft on track. This was a logical action given his knowledge of the fine settled weather east of the Barrier Range. While there was cloud cover over the main range and toward the west the pilot would have been aware, from his outward flight, of its localised extent and layered nature. However, if as was likely, he had flown over it on his way to Big Bay he would not have known whether the cloud would permit a safe crossing via the Fohn Saddle until approaching the area beneath the cloud layer on the return flight.
- 2.14 The steep nose-down attitude in which the aircraft had impacted the snow terrace and the compact layout of the wreckage, was indicative of a stall with insufficient height available for the pilot to recover control of the aircraft before it struck the terrain. The severity of the structural damage, and depth of penetration, suggested the aircraft was several hundred feet above the accident site when it stalled.
- 2.15 The lowest point of the Fohn Saddle had an elevation slightly above 5000 feet. A pilot who traversed the main range via the Fohn Saddle on his way from Big Bay to Arrowtown probably some 20 to 25 minutes after the accident, estimated the base of the cloud to be 5100 feet to

5200 feet amsl with some wispy patches of cloud also in the area. A gap of 150 feet to 200 feet existed at the Saddle itself.

2.16 The all-up weight of ZK-DRC at the probable time of the accident exceeded the manufacturer's authorised all-up weight by about 96 kg or 8.5%. The CG was likely to have been positioned toward the aft limit specified for the maximum authorised all-up weight. The overload, and the CG position, should not have, in themselves, resulted in an accident. However, the combination had the effect of raising the aircraft's stall speed, and rendered it more vulnerable to pitch instability, loss of airspeed, and stall onset.

2.17 The meteorological aftercast indicated that conditions in the area were conducive to turbulence and downdraughts. Pilot reports, however, suggested that such conditions were not widespread. The possibility could not be eliminated that a sudden upset due to localised and unexpected severe turbulence or downdraught, as experienced on occasion in New Zealand mountain regions, was a factor in this accident.

2.18 The reported layer cloud meant that to cross the Barrier Range beneath cloud the pilot would have been obliged to climb to just below the cloud base on the western side and continue towards the Fohn Saddle until it was evident that a suitable gap existed. The wreckage location indicated that ZK-DRC was probably still climbing above the rapidly rising snow slopes and rocky bluffs which led to the saddle, when the accident occurred.

2.19 During flight over mountainous terrain a variety of misleading visual impressions may be gained, particularly in cloudy conditions when surrounding peaks and other prominent features may not be visible. A deceptive and hazardous situation involves climbing flight above rising terrain. Known risks exist in overestimating the capability of a laden aircraft to outclimb a rising slope, and the possibility of a gradual and unperceived decay in airspeed during such a climb. Such factors may have contributed to the accident to ZK-DRC.

2.20 Pencilled notes in the Cessna 177 Owners Manual suggested that the pilot was likely to have climbed ZK-DRC at an indicated airspeed of 80 knots. This was supported by the achieved climb performance, which was probably close to the maximum rate of climb for the aircraft's weight. At a nominal 80 knots, the small margin above the aircraft's stall speed would have required prompt and positive action by the pilot to avert stall onset had a subtle, unrecognised decay in airspeed occurred. Any significant angle of bank introduced in a turn, for example, away from terrain, had potential to result in a fully-developed stall from which recovery might be impossible in the height available.

2.21 Complete engine failure, or a sudden significant loss of power during the climb, would also have required prompt and positive action to maintain a suitable airspeed, and set up a controlled descent. However, provided a turn toward lower ground was conducted safely, the aircraft's location and altitude should have enabled the pilot to carry out a survivable forced landing. In the circumstances, no evidence was obtained to indicate that an in-flight engine failure or power loss did occur, but this possibility could not be excluded.

2.22 In the event, the wreckage of ZK-DRC was located visually but was very difficult to distinguish amongst the rocky, snow covered terrain. The potential for a functioning ELT to assist in a timely intervention in the case of survivable accidents in mountainous country is well proven, and careful consideration should be given to the location of an ELT unit to provide maximum opportunity for it to operate satisfactorily. Its position on the cockpit floor, while convenient for portability, afforded little protection for the unit.

2.23 The remoteness of the accident site which provided no witness observations to describe the aircraft's flight path immediately prior to the accident, the lack of any survivors, and the absence of evidence to indicate a major defect or malfunction in the engine or airframe, precluded conclusive determination of the reason(s) for this accident.

3. Findings

3.1 The pilot held a valid Private Pilot Licence (Aeroplane).

3.2 The aircraft's Certificate of Airworthiness and Maintenance Release were valid.

3.3 The pilot's regular cross-country flights during the six years in which he owned the aircraft meant he was familiar with the routine operation of the aircraft.

3.4 In view of the pilot's minimal dual flying after the completion of his initial training it was unlikely that the pilot was in current practice in responding to emergency situations which might be encountered in flight.

3.5 The pilot had flown his aircraft with passengers and cargo from Alexandra to Big Bay and return, in previous years, without difficulty.

3.6 The pilot displayed sound airmanship in postponing his proposed flight until the weather for the round-trip had improved suitably.

3.7 The location and elevation of the accident site indicated that the aircraft and its engine had performed satisfactorily during the early stages of the return flight.

3.8 Impact damage and the wreckage layout was typical of a stall and steep uncontrolled descent onto the mountainside.

3.9 The accident was unsurvivable.

3.10 The estimated all-up weight of the aircraft at the time of the accident exceeded the manufacturer's maximum authorised all-up weight by 8.5%.

3.11 The estimated CG position was toward the aft limit specified for the maximum authorised all-up weight.

3.12 The aircraft's cargo was not properly secured.

3.13 The ELT's vulnerable position on the cockpit floor was unsuitable for it to perform the function for which it was designed.

3.14 The investigation disclosed no evidence of significant defect or malfunction in the airframe or engine to account for the accident.

3.15 A meteorological aftercast indicated that the prevailing conditions may have produced localised areas of strong turbulence and downdraught.

3.16 The cloud cover increased the potential for the pilot, climbing his aircraft toward Fohn Saddle above steadily rising snowy terrain, to be visually misled with the consequence of an unperceived decay in airspeed and stall onset.

- 3.17 The aircraft's weight and probable CG position would have raised the stall speed and rendered it susceptible to a loss of control.
- 3.18 The aircraft's position and altitude prior to the accident was such that in the event of a complete, or partial, engine failure, the pilot should have been able to make a survivable forced landing.
- 3.19 The circumstances of the accident precluded determination of a probable cause.

23 October 1996

M F Dunphy
Chief Commissioner