



NEW ZEALAND

AIRCRAFT ACCIDENT

REPORT No. 81-077

CESSNA 172M, ZK-DWT

Near Lake Luna, Otago

19 September 1981

OFFICE OF AIR ACCIDENTS INVESTIGATION
WELLINGTON
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Price \$2.00

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BASIC INFORMATION

Operator: Southland Aero Club.

Aircraft: Type: Cessna.

Model: 172M.

Nationality: New Zealand.

Registration: ZK-DWT.

Place of accident: near Lake Luna, Otago.

Date: 19 September 1981.

SYNOPSIS

The aircraft with an instructor and 3 student pilots on board, departed on a flight from Milford Sound to Queenstown during the afternoon of 19 September 1981, while taking part in an annual Mountain Flying Experience Course.

The aircraft failed to arrive in Queenstown. An air search located the wreckage of the aircraft in an isolated area near Lake Luna at 0845 hours next morning.

The instructor and one passenger survived but the pilot under instruction, and the remaining passenger, received fatal injuries in the accident.

The Inspector of Air Accidents at Christchurch Airport was in the Queenstown area at the time and investigation of the accident commenced shortly after advice was received from the NZ Police that the wreckage of the aircraft had been found.

1. FACTUAL INFORMATION

1.1 History of the flight

1.1.1 ZK-DWT was one of a number of aircraft taking part in a Mountain Flying Experience Course organised as an annual event by the Southland Aero Club.

1.1.2 The aircraft had flown from Invercargill to Queenstown on Friday, 18 September with the instructor and 3 student pilots on board. The flight was uneventful.

1.1.3 On Saturday morning 19 September weather conditions proved unsuitable for a proposed mountain flying experience flight, and it was decided to delay the flight until after midday. Conditions were described as 'rough and bumpy', and the local tourist flight operator had cancelled further flying for the day.

1.1.4 At approximately 1230 hours the officer on duty at the Queenstown Flight Service Station (FSS) was asked by the instructor to call an aircraft to ascertain the weather towards the head of Lake Wakatipu. A reply was received from an aircraft en route to Te Anau which reported "Everything looks all right towards the head of the lake, and no turbulence". Shortly afterwards another aircraft reported that conditions were satisfactory at the end of the lake with no turbulence.

1.1.5 ZK-DWT had already been refuelled, and the instructor filed a flight plan for the route Queenstown-Glenorchy-Luggate-Queenstown, with an estimated departure time of 1250 hours. The flight plan indicated that the aircraft was equipped with a portable radio frequency 121.5 and 243 MHz, and had a fuel endurance of 4 hours.

1.1.6 The aircraft departed Queenstown at 1306 hours. After following a route which took the aircraft over Arthurs Point, Skippers, Moonlight Creek and Moke Lake, the flight continued over the Greenstone Valley to the Main Divide and hence over the Caples Valley before returning to land at Glenorchy at approximately 1405 hours.

1.1.7 While on the ground at Glenorchy the instructor telephoned the Queenstown FSS to obtain a check on the latest weather at Milford Sound and, as weather conditions appeared suitable, to amend the flight plan to include Milford Sound as the next destination.

1.1.8 ZK-DWT departed Glenorchy at 1425 hours, and proceeded via the Caples Valley and over the Main Divide, climbing to a height of approximately 8,000 feet en route, arriving Milford Sound at 1453 hours.

1.1.9 After a light lunch at the Milford Hotel the party returned to the aircraft and the instructor together with the pilot of Cessna 206 ZK-DXH, which was also taking part in the Mountain Flying Experience Course, filed flight plans and obtained the latest weather information for their return flights to Queenstown.

1.1.10 The flight plan nominated the instructor as pilot in command, gave a total estimated elapsed time to first landing at the destination,

Queenstown, of 1 hour 20 minutes, and a fuel endurance of 2 hours 45 minutes. The cruising levels were denoted as "VFR", (Visual Flight Rules) with estimated elapsed times of 40 minutes to Lake Gunn, and a further 40 minutes to Queenstown. Other information stated "RUT VIA S. Falls", and the flight plan indicated that the aircraft was equipped with Portable Radio on frequencies 121.5/243 MHz.

1.1.11 ZK-DWT departed Milford Sound at 1626 hours. The instructor had arranged that the 3 student pilots on board should each have the opportunity to fly individual legs of the flight, and for this final leg the student pilot who had not yet flown, occupied the left front seat, as the pilot under instruction.

1.1.12 The pilot of Cessna 206, ZK-DXH, which departed Milford Sound 3 minutes after ZK-DWT, reported that he observed the aircraft in the area of Lake Quill, and passed ZK-DWT soon after crossing the McKinnon Pass. He last saw the aircraft over lake Gunn and estimated that at that time ZK-DWT was 3 miles behind his own aircraft and 1500 feet below. ZK-DXH was being flown at 5000 feet amsl.

1.1.13 The 2 aircraft were in very high frequency (VHF) radio contact, and the instructor in ZK-DWT informed the pilot of ZK-DXH that he "was going to fly down the Greenstone, low level". This was the last communication with ZK-DWT and the last known sighting of it by another aircraft prior to the accident.

1.1.14 The details of ZK-DWT's flight plan from Milford Sound to Queenstown were received by the Queenstown (FSS) through the normal aeronautical telecommunication channels at 1629 hours. ZK-DWT was airborne Milford Sound at 1626 hours, and although the officer on duty at Milford Sound experienced some difficulty in reading the departure radio/telephonic (R/T) call from ZK-DWT due to a high noise level in the Tower cab, he interpreted the final part of the transmission as being "ETA (Estimated Time of Arrival) Queenstown 1809 hours". (He subsequently amended this to an ETA Queenstown of 1749 hours, based on the given estimated elapsed time in the flight plan, and informed Queenstown (FSS) of this amendment by telephone). ZK-DXH was airborne from Milford Sound at 1627 hours and on departure advised an ETA Queenstown of 1730 hours.

1.1.15 As the Queenstown (FSS) was to close down at 1700 hours it was expected that the pilot of ZK-DWT would terminate his flight plan on arrival in Queenstown by direct telephone contact with the Dunedin Air Traffic Service (ATS) unit.

1.1.16 The pilot of ZK-DXH telephoned the Dunedin ATS on arrival to terminate the flight plan for his own aircraft and several others. Anticipating that it would be arriving very shortly, he included ZK-DWT among the other aircraft.

1.1.17 When it became apparent that ZK-DWT was overdue the leader of the Mountain Flying Experience Course took off from Queenstown in Cessna 206 ZK-DXH and retraced the expected route of the missing aircraft. He checked the Hollyford Airstrip and the shores of Lake McKenzie. He also monitored the VHF emergency frequency 121.5 MHz. No sighting of the aircraft was achieved and no emergency locator beacon (ELB) signals were heard. It was determined later in the evening that an ELB was not installed in ZK-DWT.

1.1.18 The Christchurch Rescue Coordination Centre (RCC) had been advised at 1945 hours that ZK-DWT had failed to arrive at Queenstown and a Class III SAR operation was initiated at this time.

1.1.19 An aerial search was commenced early the following morning, 20 September 1981, using 3 locally based fixed wing aircraft and 2 helicopters. An RNZAF F27 aircraft was also dispatched from Christchurch to assist in the search and act as an "on-scene" command base. Local station owners in the area were also advised that the aircraft was missing.

1.1.20 After a number of search patterns had been flown in areas to the south and west of Lake Wakatipu without success, hindered in some cases by snow showers, it was decided to conduct a search on the eastern side of the lake.

1.1.21 Smoke was seen on one of the ridges of Mt Benmore and shortly afterwards, at 0845 hours the pilot of a searching helicopter reported sighting the wreckage of ZK-DWT lying at the base of a narrow valley, below a burning area of a tussock covered ridge.

1.1.22 On arrival at the site the rescue party found the instructor close to the aircraft, and one of the passengers, who had survived the accident, trapped in the wreckage. The pilot under instruction and the remaining passenger had received fatal injuries.

1.1.23 When interviewed, following the accident, the instructor reported that the flight from Milford Sound and down the Greenstone Valley was uneventful. He said that there was only a little turbulence, but sufficient wind to warrant 'sticking to the correct side of the valley'.

1.1.24 As his students had flown the route to Milford Sound at high level and the return low level flight as far as Lake Wakatipu had only involved

navigation and flight in relatively large valleys, the instructor had decided to complete the flight to Queenstown via the 'Moonlight and Skippers' route, instead of following the lake, in order to provide a 'more balanced' training exercise.

1.1.25 While crossing Lake Wakatipu, the instructor pointed out to his student the intended route, using an NZMS 242A 1:500,000 Aeronautical Chart of the area. The instructor reported that the flight was proceeding satisfactorily at this point and, after crossing the eastern edge of Lake Wakatipu, the student pilot identified and followed Twenty Five Mile Creek, confirming the aircraft was on track. He estimated that the altitude of the aircraft as they flew up the valley was "at least 1000 feet above ground level".

1.1.26 In order to follow the intended route it was necessary to proceed in a northerly direction from Twenty Five Mile Creek, making the 'turn-off' in the region of a low saddle and tracking toward Moonlight via Lake Luna.

1.1.27 However as the turn-off point was reached the student pilot did not make the necessary turn but continued to fly the aircraft on an easterly heading.

1.1.28 The instructor reported that he was aware that the turn-off point had been passed, but refrained from drawing his student's attention to this fact "as a more effective learning situation", in that the student would recognise the navigational error for himself and take the required corrective action. The instructor had previously used this method with success during navigation training exercises.

1.1.29 The instructor was unable to recall the altitude of the aircraft as the flight proceeded, but stated that the student pilot was following the windward (southeastern) side of the valley. There appeared to be no turbulence or significant wind and he did not anticipate any difficulty in retracing the flight path to regain track.

1.1.30 As he did not wish the aircraft to penetrate any further into the valley, the instructor pointed out to the student pilot that the terrain was not matching his intended track, and advised him to carry out a 180° turn. The student pilot acknowledged this instruction and commenced a Rate 1 turn to the left. The instructor recalled the engine rpm as approximately 2200 rpm at this time, the airspeed as 80 to 90 knots, and that the aircraft may have been climbing slightly as the turn was initiated.

1.1.31 As the turn progressed through approximately 30° the instructor realised that the airspeed was decreasing and the aircraft appeared to be

losing height. At the same time the aircraft had proceeded further towards the head of the valley and the area available for a successful turn out of the valley was rapidly reducing.

1.1.32 The instructor stated that he took over the controls, applied full power, checked that the mixture was full 'rich' and there was no carburettor 'icing'. He recalled that the engine was running smoothly at 2400 rpm. He turned the aircraft back to the right by approximately 20°, so that they were again flying up the valley on the windward side with the airspeed stabilised at about 45 knots.

1.1.33 The instructor lowered the nose slightly to regain airspeed, but despite the application of full power, the aircraft still continued to 'sink'. It was apparent that the aircraft was flying towards rising terrain and the only lower ground lay towards the left.

1.1.34 The instructor therefore decided to carry out a 180° turn to the left, in order to fly back down the valley. He commenced a turn to the left of about Rate 1 or 2, "not a steep turn, or maximum rate turn". He believed that the aircraft may have turned through some 45°, but was unable to recall any further details of the flight from then until some time after the collision with the terrain had occurred.

1.1.35 The accident occurred in daylight at about 1705 hours NZST. The accident site was at the base of a narrow valley above a tributary of Twenty Five Mile Creek, at an elevation of approximately 3100 feet amsl National Grid reference 425779 (NZMS1 Sheet S132 Wakatipu).

1.2 Injuries to persons

1.2.1 Injuries	Crew	Passengers	Others
Fatal	1	1	-
Serious	1	1	-
Minor/none	-	-	-

1.3 Damage to aircraft

1.3.1 The aircraft was destroyed by impact forces.

1.4 Other damage

1.4.1 There was no damage to other property.

1.5 Personnel information

1.5.1 The pilot in command, Wayne Robert Swinburne, 21, held a Commercial Pilot Licence No. 3736, incorporating an Instrument Class 1 ADF/VOR rating, and Instructor Category B Rating (with a type rating for the Cessna 172 aircraft). His licence was valid until 31 August 1982.

1.5.2 His total flight experience was recorded as 1426 hours. During the last 90 days he had flown a total of 191 hours which included 28 hours in Cessna 172 aircraft.

1.5.3 Mr Swinburne was issued with a Student Pilot Licence on 30 August 1976. He subsequently obtained a Private Pilot Licence, and was issued with his Commercial Pilot Licence on 12 September 1979. He obtained an Instructor 'C' Category rating on 29 January 1980 and a Class I Instrument Rating on 14 May 1980. His Instructor Rating was upgraded to 'B' Category on 5 March 1981.

1.5.4 Mr Swinburne joined the Southland Aero Club as an instructor on 8 May 1980. He had accumulated a total of 754 instructional hours at the time of the accident. His total time in Cessna 172 type aircraft amounted to 53 hours, and of this total 39 hours were recorded as instructional time.

1.5.5 On 3 September 1981 Mr Swinburne had taken part in a course designed to provide participants with a Milford Sound Rating. This involved a flight from Invercargill to Milford Sound, via Mossburn, and the Eglinton and Hollyford Valleys. Mr Swinburne successfully passed the course and obtained the necessary rating to fly into Milford Sound. In addition to this course, Mr Swinburne had recorded some 53 hours of flight over mountainous terrain. This flight time was assessed according to the definition of 'mountainous terrain' in the NZAIP page RAC 3 Appendices land 2. During this time a commercial cross-country flight had included flying over the Skippers area en route from Queenstown to Wanaka.

1.5.6 The student pilot under instruction, Paul William Harper, was issued with Student Pilot Licence (A) No. 8889 on 28 August 1980 endorsed "subject to wearing correcting lenses". His licence was valid until 6 August 1982. He was reported to have been wearing his normal corrective lenses during the flight on which the accident occurred. He had completed a total of 60 hours flying, of which 25 hours had been flown as pilot in command.

1.5.7 Mr Harper had some previous experience of flying in the Queenstown area, both as a pilot and as a passenger. It could not be established whether he had previously flown over the area where the accident occurred.

1.6 Aircraft information

1.6.1 Cessna 172M aircraft serial no. 17264043 ZK-DWT was constructed in 1974, and had accumulated a total of 1691 hours at the time of the accident.

1.6.2 Avco Lycoming O-320-E2D engine, serial no. L39516 - 27A had run a total of 1681 hours 50 minutes since new. It had run 11 hours since complete overhaul.

1.6.3 A non-terminating Certificate of Airworthiness had been issued on 14 July 1981, and remained valid provided that the aircraft was maintained in accordance with Dalhoff and King Cessna Progressive Care Manual.

1.6.4 A maintenance inspection in accordance with the Cessna Progressive Care Manual was carried out on 17 September 1981 and Maintenance Release No. 208317 was issued on the same day, valid until 4 November 1981 or until the attainment of 1706.05 total airframe hours, whichever was the shorter period.

1.6.5 During this inspection a major inspection and overhaul was carried out on the elevator trim tab actuator in accordance with instructions in the Cessna Service Manual. The vertical speed indicator, altimeter, artificial horizon and direction indicator were removed at this time for calibration purposes, and serviceable instruments installed.

1.6.6 50 litres of Avgas 100 were added to the aircraft's fuel tanks prior to departure from Queenstown for Glenorchy. No further refuelling took place.

1.6.7 The aircraft's weight at the time of the accident was estimated as being 990 kg, with the centre of gravity 1225 mm aft of the datum. At this weight the maximum aft limit of the centre of gravity as shown in the aircraft flight manual was 1201 mm. The aircraft's maximum authorised take-off weight was 1043 kg.

1.7 Meteorological information

1.7.1 On Saturday, 19 February 1981 a strong westerly flow covered South Island. A weak front in this flow had passed over the Queenstown/Glenorchy area earlier in the day, and by 1500 hours lay just south of Hokitika and Christchurch. To the rear of the front cloud was only scattered at Milford and Queenstown.

1.7.2 The 1600 hours hourly report from Milford Sound indicated a wind of $290^{\circ}\text{T}/20$ knots, visibility 50 km, $2/8$ total cloud cover, $2/8$ cumulus at 6000 feet and the QNH was 1011 mb. At Queenstown the 1600 hours hourly report indicated a wind $250^{\circ}\text{T}/10$ knots visibility 60 km, $2/8$ total cloud cover, $1/8$ cumulus 6000 feet. The QNH was 1007.5 mb. At 1700 hours the wind at Milford Sound was $310^{\circ}\text{T}/18$ knots, visibility estimated at more than 70 km, while the cloud cover, remained unchanged. At Queenstown the wind was reported as $260^{\circ}\text{T}/10$ knots with no change in visibility or cloud cover. The barometric pressure at Milford Sound had increased to 1011.3 mb at 1700 hours, but remained constant at 1007.5 mb at Queenstown.

1.7.3 The pilot of ZK-DXH which departed Milford Sound shortly after ZK-DWT, estimated the wind to be 15 to 20 knots from the northwest judging

by windlanes evident on Lake Wakatipu, during the portion of his flight from the Glenorchy area through to Queenstown at about the time that the accident occurred. He reported that no turbulence was encountered until his aircraft was abeam Mt Nicholas Station, at which time he turned in towards the centre of the lake to avoid any more discomfort than necessary. He also reported that all of the downdrafts encountered by his aircraft throughout the day were minor.

1.7.4 The leader of the Mountain Flying Experience Course reported a general lack of significant turbulence in the Queenstown to Milford Sound area during the day. Some downdrafts "as smooth as glass" were experienced by his aircraft in the lee of well defined ridges.

1.7.5 The pilot of another aircraft participating in the mountain flying course reported that his aircraft experienced "an occasional bump", but no downdrafts or marked turbulence in the area to the west of Lake Wakatipu.

1.7.6 A local property owner who was also a private pilot reported that about 1700 hours on the slopes of Mt Creighton, some 7 km from the accident site, "a strong westerly was blowing", which he estimated as 15 to 18 knots. It was "quite turbulent" and the property owner anticipated that from his personal experience a light aircraft flying in the area would be likely to encounter downdraft effects in the lee of the ranges.

1.7.7 An 'Aircraft Report' from Christchurch at 1354 hours advised that a Mount Cook Airline's aircraft had earlier reported "moderate turbulence in and out of Queenstown".

1.7.8 The Meteorological Office, in a report on the weather conditions in the Queenstown/Glenorchy area at the time of the accident stated: "the westerly flow was a strong one". Forecast winds at 5000 feet and 7000 feet above MSL in the CN (Cromwell) area were 35 knots and 45 knots respectively. The winds aloft reported from Invercargill at 1200 hours were 5000 feet 280°T/50, 7000 feet 270°T/50. At 1800 hours the winds aloft were 5000 feet 300°T/25, 7000 feet 290°T/25. The reduction in wind speeds between the 2 observations would have been due to the minor ridging in the rear of the weak front. An examination of the synoptic chart for mid-day shows that the strong winds recorded then occurred in the relatively clear air in the rear of the weak front and not in the cloudy zone seen in the satellite imagery. It must therefore be a matter for conjecture at what time winds decreased over the Glenorchy/Queenstown area if in fact they did so. Winds as strong as those forecast in the CN area forecast, and recorded at Invercargill at 1200 hours could have produced strong downdrafts and turbulence. Additional evidence for the existence of downdrafts and

associated turbulence comes from temperature reports from Queenstown. At 1500 hours the temperature at Queenstown was 16°C and the dew point 0°C indicating very dry air. At the same time the temperature and dew point at Milford were 14°C and 7°C respectively. The very much lower dew point at Queenstown indicates a well developed Fohn effect and consequent down-drafts and turbulence as forecast in the CN area forecast".

1.8 Aids to navigation

1.8.1 Not applicable.

1.9 Communications

1.9.1 The aircraft was equipped with a Cessna RT528E 300 Series Nav Com VHF communications transceiver. An Emergency Locator Beacon was not installed, nor was the aircraft fitted with an HF communications transceiver.

1.9.2 Normal VHF departure radio communications took place between ZK-DWT and Milford Sound FSS. Contact on VHF frequency (121.3 MHz) was maintained between ZK-DWT and ZK-DXH after both aircraft had departed from Milford Sound on their return flight to Queenstown. At approximately 1650 hours the pilot of ZK-DXH observed ZK-DWT over Lake Gunn. During a VHF contact at this time the instructor in ZK-DWT informed the pilot of ZK-DXH that he was going to fly down the Greenstone low level. No further communications took place between the 2 aircraft.

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 wreckage of the aircraft was located at the base of a narrow tussock covered gully, beside a small creek, a tributary of Simpson or Twenty Five Mile Creek, approximately 2.5 km southwest of Mt Benmore 6010 feet and 2 km east of Lake Luna.

1.12.2 The accident site is bounded to the south by the ridges of the Twenty Five Mile range which are of 5000 feet elevation, and to the north by the southwest ridge of Mt Benmore. The valley between these ridges rises steeply in a northeasterly direction, and although the southern slopes are relatively open, several prominent spurs result in steep-sided valleys and gullies on the northern sides.

1.12.3 The southern facing slopes and ridges of Mt Benmore were snow covered down to a level of approximately 4,500 feet at the time of the accident.

1.12.4 The wreckage and impact debris was confined within a very small area. Damage to the aircraft structure and ground impact marks, indicated that the aircraft had struck the side of the gully in a very steep attitude, at a relatively low forward speed on a heading of 320°M.

1.12.5 Impact forces were severe enough to cause marked distortion of the cabin structure, and the right cabin door was dislodged during the impact sequence. Following impact the wreckage slid and fell a distance of 30 m, coming to rest in an inverted position at the base of the slope.

1.12.6 Damage to the propeller indicated that the engine had been delivering power at the time of impact.

1.12.7 All of the flight control surfaces of the aircraft were within the wreckage area. Although the structure had sustained extensive damage during impact, no evidence was found to indicate any abnormality, or malfunction of the aileron, rudder or elevator control systems.

1.12.8 The elevator trim was found selected in a nose-down position. The wing flaps were selected "UP".

1.12.9 The fuel tank selector in the cockpit was on "BOTH". The left fuel tank cap was missing, but was located in the wreckage. The right fuel tank cap was still in position. A residual quantity of fuel was found in the fuel strainer bowl.

1.12.10 The severe forces involved rendered the positions of the engine controls as found following the accident, inconclusive. The throttle was found to be fully forward, and the mixture control in the full rich position. The primer was "locked", the magneto switches in the "ON-BOTH" position, and the battery and alternator switches "ON". The carburettor heat control was pulled out 10 mm from the 'full cold' position.

1.13 Medical and pathological information

1.13.1 Mr Swinburne, the pilot in command, had been assessed as medically fit for a Commercial Pilot Licence since 9 March 1978. He was last assessed as medically fit to that standard on 26 August 1981 when renewing his licence.

1.13.2 Paul William Harper the student pilot under instruction was assessed as medically fit on 15 July 1980 at the time of issue of his Student Pilot Licence. He was required to wear correcting lenses.

1.13.3 The post-mortem and toxicological examinations did not reveal any abnormality which may have been significant in relation to the cause of this accident.

1.14 Fire

1.14.1 Fire did not occur.

1.15 Survival information

1.15.1 At 1945 hours on 19 September 1981 a Class III SAR operation was initiated by the Christchurch RCC, following notification that Cessna 172 aircraft ZK-DWT, which had departed Milford Sound on a VFR flight plan, had failed to arrive at Queenstown. Initially it was believed that the missing aircraft had an ELB installed. An aerial search by the leader of the Mountain Flying Experience Course, along the expected track of ZK-DWT, monitoring the VHF emergency frequency, was unsuccessful. It was subsequently determined that the aircraft did not have an ELB on board.

1.15.2 The accident occurred at approximately 1705 hours. The instructor was able to extricate himself from the wreckage and render assistance to the surviving passenger during the night.

1.15.3 At first light the following morning, the instructor climbed the ridge above the wrecked aircraft in order to establish whether it would be possible to seek help in any direction other than proceeding down the valley. Using pages from the flight manual of the aircraft he succeeded in setting fire to part of the tussock covered ridge, in the hope that this would attract the attention of searching aircraft.

1.15.4 The first rescue party to arrive at the scene, shortly after the wreckage of the aircraft had been located at 0845 hours, found the instructor near to the aircraft in a shocked and physically exhausted condition. The surviving passenger was trapped in the wreckage. "Jaws of Life" cutting equipment was used to free the passenger, and after medical treatment at the site the 2 survivors were flown to Queenstown, and later transferred to Invercargill.

1.15.5 The seating in the aircraft consisted of 2 separate adjustable seats on rails for the instructor and student pilot. The combined two-place rear seat was bolted to the cabin floor.

1.15.6 All of the seats were fitted with lap straps using metal to metal buckles, attached to fittings on the cabin floor. In addition the 2 front seats were provided with diagonal type shoulder straps which attached to the upper section of the cabin structure on each side, and clipped to the metal buckle on each lap strap.

1.15.7 All straps and seat belt anchorages were intact. The available evidence indicated that each occupant was wearing a lap strap, and the instructor and student pilot in the front seats were also wearing their diagonal shoulder straps at the time of the accident.

1.15.8 Both the front seats remained essentially in their normal positions, but each leg attachment of both seats was separated from the respective seat rail. The rear seat remained attached to the cabin floor structure by the rear right attachment only.

1.15.9 This accident was survivable. The fatalities were due to the severe deformation of the cabin structure which occurred during terrain collision, and the consequent loss of protection to the occupants.

1.15.10 As in many accidents of this nature the severity of the injuries is a result of the severity of the impact, the nature of the terrain and the sequence of events in relation to the protection afforded to the occupants by the aircraft structure and the type of occupant restraint provided. For this reason it is very good sense to ensure an ELB is carried in the aircraft on any cross country flight to ensure the accident site is located as soon as possible after the accident occurs and to ensure medical assistance is provided as soon as practicable. The additional benefits of the savings in SAR effort and minimising the risk of not locating the aircraft at all are also important considerations.

1.15.11 This was not the first time that a pilot in command had indicated on the flight plan that an ELB was on board the aircraft when such was not the case. The consequent planning of the SAR action includes the tasking of aircraft to fly electronic search patterns. This effort is totally wasted in cases where no coincidental visual search is possible due to weather if an ELB is not carried despite the information on the aircraft's flight plan.

1.16 Tests and research

1.16.1 Not applicable.

1.17 Additional information

1.17.1 The Southland Aero Club has traditionally been involved in flying in mountainous areas, and a club aircraft has normally been based in Te Anau or Queenstown for the benefit of members at holiday times. The Mountain Flying Experience Courses have been held successfully for several years and have been designed to familiarise members with the area, allow the opportunity of scenic flying, and enable experience to be gained in navigation and the basic principles of safe flying operations in mountainous terrain.

1.17.2 The venue for the course has been changed from time to time, but Queenstown has proved to be most suitable as it is reasonably close to the club's base at Invercargill and is the most likely area in which members will be flying. It also offers reasonable options for weather changes, and

good valleys to fly in between Queenstown and Te Anau. The 1980 Mountain Flying Experience Course was conducted in this area. The 1981 course was the fifth Mountain Flying Experience Course to take place.

1.17.3 Before each Mountain Flying Experience Course takes place an evening "Briefing Lecture" is held and those participating in the course are strongly encouraged to attend. The 1981 "Briefing Lecture" was conducted on or about 15 September 1981. The CFI of the Southland Aero Club and an experienced glider pilot instructor, very familiar with the proposed flight area, both took part in this briefing.

1.17.4 "Mountain Flying Notes" dealing with low level operations in mountainous terrain were distributed to those attending and comprehensive visual material was presented relating in particular to the meteorological factors involved in mountainous regions. The student pilot, together with the other 2 student pilot passengers attended this briefing, but the instructor was away from Invercargill at the time and could not attend.

1.17.5 On Friday, 18 September 1981 the CFI of the Southland Aero Club discussed with the club instructors the most suitable valleys and routes in which to conduct training operations during the 1981 Mountain Flying Experience Course.

1.17.6 The area discussed did not include the Richardson Mountains, in which the accident occurred.

2. ANALYSIS

2.1 The aircraft was participating in a Mountain Flying Experience Course. Prior to the course a briefing lecture had been held to familiarise those taking part with the meteorological and operational aspects of mountain flying and navigation. Although the instructor (pilot in command) was absent, the 3 student pilots on board ZK-DWT had all attended this lecture.

2.2 On the morning of Saturday, 19 September 1981 the weather was unsuitable for the purpose of mountain flying and navigation training. As conditions had improved toward midday, the instructor of ZK-DWT obtained the most up-to-date weather information available, including reports from aircraft in the area, for a flight planned from Queenstown to Glenorchy and thence to Luggate.

2.3 It was intended that if weather conditions had improved sufficiently, the flight would proceed to Milford Sound instead of Luggate. Accordingly, after departure from Queenstown and over-flying the Skippers and Moke Lake area, the aircraft continued as far as the Main Divide to confirm that the actual conditions were suitable, before returning to Glenorchy to advise Queenstown Flight Service Unit of the change to the flight planned route.

2.4 The cruising altitude maintained during the flight from Queenstown to Glenorchy varied according to the terrain. However, at no stage did the valley walls prevent an adequate view of the surrounding terrain. The subsequent flight from Glenorchy to Milford Sound was flown at altitudes of up to 8000 feet. Both flights were uneventful and no significant turbulence, downdraught effects or adverse weather conditions were encountered.

2.5 Since the 'outward' flights had been conducted at relatively high altitude and actual weather conditions now appeared suitable for the purpose, the instructor decided to utilise the return flight for "low level" training. The instructor stated that on departing from Milford Sound the wind conditions "warranted sticking to the correct side of the valley". No difficulties were experienced due to turbulence, downdraughts or other effects during the low level stages of the return flight through the mountainous area to the west of Lake Wakatipu.

2.6 While crossing Lake Wakatipu, the instructor briefed the student pilot who was flying the aircraft, on the remainder of the route to be followed to Queenstown. The proposed return route after leaving the western edge of the lake was not included in the area briefed as being suitable for the purposes of mountain flying and navigation training for the 1981 Mountain Flying Experience Course. The instructor stated that the decision to continue low level operations via the Moonlight, Skippers and Arthurs Point route, rather than follow the lake to Queenstown, was made in order to provide a "more balanced" training exercise, in view of the fact that earlier flying during the day had involved mainly high altitudes. The outward flight from Queenstown to Glenorchy had overflowed the general area and conditions so far experienced during the low level return flight from Milford Sound had proved acceptable for training operations.

2.7 After passing over the eastern edge of Lake Wakatipu the flight proceeded satisfactorily with the student pilot maintaining track by visual reference. At the required "turning point" some 2 kilometres west of the accident site, the student pilot did not make the necessary heading change but continued to fly the aircraft towards the head of the valley. The instructor was aware that the turning point had been passed, but delayed drawing the attention of his student to this fact to provide a more effective learning experience, in allowing the student to recognise the navigation error for himself and take the necessary corrective action. This was a technique he had previously used with success in navigation training exercises.

2.8 Taking into account the position of the accident site and the speed of the aircraft, it is probable that some 45 seconds may have elapsed

between the missed 'turning point' and the point at which the instructor advised his student to take corrective action. The instructor was unable to recall the altitude of the aircraft, but was not concerned for the safety of the flight at this point as it appeared that a 180° turn to the left would allow the aircraft to vacate the area without difficulty.

2.9 The terrain in which the accident occurred, as in many mountainous areas, is deceptive. The ridges and spurs on the northern side of Twenty Five Mile Creek, with more open slopes to the south, may give the pilot of an aircraft following Twenty Five Mile Creek toward the head of the valley the impression that the valley branches to the north, and that a much larger 'turning area' or 'basin' exists beyond the ridge adjacent to the accident site than is the case. In addition the valley floor rises almost 900 feet over the distance of 2 km from the missed 'turning point' to the accident site, but this rapid rise is not immediately obvious to the pilot of an aircraft approaching from the west due to the high terrain at the head of the valley.

2.10 The aircraft had been flying on the 'windward' side of the valley, and it was not until the turn to the left had been commenced that the effect of a smooth downdraught or 'sink' became apparent. The instructor took over the controls and attempted to retrieve the situation by applying full power and returning to the windward side of the valley, but the aircraft still continued to 'sink', and it was evident that a further 180° turn to the left was imperative if contact with the rising terrain ahead was to be avoided.

2.11 The instructor reported that the airspeed had stabilised at approximately 45 knots as he commenced a Rate 1 or Rate 2 turn to the left, and believed that the aircraft may have turned through some 45°. Neither survivor was able to recall any further details prior to the collision with the terrain.

2.12 The wreckage distribution and impact damage was consistent with terrain collision occurring after the pilot lost control of the aircraft in a turn to the left.

2.13 The meteorological conditions as recorded for the Queenstown/Glenorchy area at the time of the accident, were conducive to the existence of downdraughts and turbulence. A property owner working on the slopes of Mt Creighton 7 km from the accident site reported a 'strong westerly' and 'quite turbulent' conditions.

2.14 No significant turbulence or downdraught effects had been experienced by ZK-DWT during the low level flight from Milford Sound, as far as Lake Wakatipu, and pilot reports from other aircraft participating in the

Mountain Flying Experience Course indicated that only occasional turbulence was encountered in the area to the west of Lake Wakatipu. One pilot reported that all downdraughts experienced by his aircraft were minor. The leader of the Mountain Flying Experience Course reported encountering downdraught effects 'as smooth as glass' in the lee of well defined ridges.

2.15 Due to the varied nature of the mountainous terrain, conditions as experienced to the west of Lake Wakatipu would not necessarily reflect the conditions likely to be encountered on the eastern side of the lake. It is a well established fact of particular relevance to low level mountain operations that local geographical features may affect the general pattern of weather in an area, and produce unexpected variations in wind direction and velocity, together with possible downdraughts and turbulence in mountainous areas.

2.16 The accident site was located 2.5 km southwest of Mt Benmore (6010 feet). The southern facing slopes and ridges of Mt Benmore above the accident site were snow covered down to a level of approximately 4500 feet at the time of the accident. It is possible that these slopes, which would have remained shaded throughout most of the day, may have contributed to the existence of a smooth 'katabatic' down flow or 'sink' in the area and accentuated the effect of any 'lee-slope' downdraught produced by the prevailing wind conditions.

2.18 The improvement in the weather conditions during the day and the lack of significant turbulence or any marked downdraught effects during the preceding stages of the flight conducted at low level through the mountainous terrain on the western side of Lake Wakatipu may have combined to reduce the awareness of the instructor to the possibility of any significant downdraught or 'sink' condition existing in the Twenty Five Mile Creek area.

2.19 The instructor had accumulated 1426 hours total flight time but his flying experience over mountainous terrain amounted to only 53 hours. This flight time was assessed according to the definition of 'mountainous terrain' in the AIP RAC 3 Appendices 1 and 2, and does not necessarily reflect flight experience at low level over terrain similar to that in which the accident occurred. Although the instructor had flown over the general area of the site where the accident occurred on a previous occasion, and the flight from Queenstown to Glenorchy on the day of the accident also included this general area, these flights were conducted at generally higher altitudes.

2.20 The student pilot was reported to have flown, both as a pilot and a passenger, in the Queenstown locality. However it is considered most likely that his limited flying experience did not include any previous low level

flying or navigation, either as a pilot or passenger, in the particular area where the accident occurred.

2.21 No evidence was found to suggest that any loss of power or malfunction of the aircraft in any way contributed to the occurrence of the accident.

2.22 The aircraft's weight at the time of the accident was estimated as being 990 kg and the CG position 1225 mm aft of the datum. The aircraft was 53 kg below the maximum permitted all up weight, but the CG position was approximately 24 mm rearward of the aft limit of the CG as shown in the aircraft's flight manual.

2.23 The estimated position of the CG, aft of the specified rearward limit, is not considered to have been a significant factor in the accident.

2.24 However, this accident, and previous similar accidents, emphasise the necessity for all pilots to be aware of the performance limitations of most existing light aircraft particularly when operated with all seats occupied, close to maximum all-up weight and with an aft CG position, when attempting to manoeuvre in confined airspace.

3. CONCLUSIONS

3.1 The pilot in command held a valid Commercial Pilot Licence Aeroplane and a Type Rating covering the Cessna 172M aircraft type. He also held a 'B' category Instructor Rating.

3.2 As a qualified instructor employed by the Southland Aero Club the pilot in command was authorised to conduct training operations within the framework of the rules and regulations of the club.

3.3 The pilot in command was a duly appointed instructor for the 1981 Mountain Flying Experience Course organised by the Southland Aero Club.

3.4 At the time of the accident the aircraft was engaged in mountain flying training operations in an area which had not been included in an Instructors' Briefing held prior to the 1981 Mountain Flying Experience Course to discuss suitable areas for such operations.

3.5 The aircraft Maintenance Release was valid at the time of the accident.

3.6 No evidence was found to indicate that any engine or airframe malfunction in any way contributed to the occurrence of the accident.

3.7 The aircraft's estimated gross weight at the time of the accident was within the specified limit. The estimated centre of gravity position was 24 mm rearward of the aft limit of the centre of gravity as permitted in the aircraft flight manual.

3.8 Although the student pilot flying the aircraft continued beyond an intended turning point and entered a blind valley while engaged in a Mountain Flying Experience Course exercise the instructor was aware of the situation and deliberately refrained from drawing the pilot's attention to the fact in order to produce a more effective learning situation.

3.9 The probable cause of this accident was that a downdraught effect was encountered during an initial attempt to turn the aircraft to vacate the narrow valley, and in the course of a subsequent turn the instructor was unable to prevent the aircraft from colliding with the terrain.

4. REGULATORY

4.1 Pursuant to Regulation 15(1) of the Civil Aviation (Accident Investigation) Regulations 1978 the pilot in command was invited to avail himself of the opportunities afforded him thereunder.

4.2 The latter advised the undersigned of some minor matters of interpretation which have been clarified.

4.3 The comments made by the pilot in command are not to be taken as an admission of liability of any kind on his part and are without prejudice to his right to act as he thinks fit in any action or proceedings which may be based upon the event to which this report refers.

R. CHIPPINDALE

Chief Inspector of Air Accidents

15 June 1982