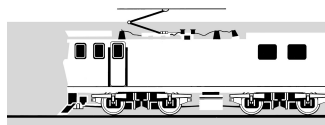
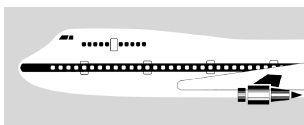


AVIATION OCCURRENCE REPORT

02-001 Cessna 207, ZK-SEV, collision with terrain, Gertrude Saddle area
11 km southeast of Milford Sound

19 January 2002



The Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

These reports may be reprinted in whole or in part without charge, providing acknowledgement is made to the Transport Accident Investigation Commission.



Report 02-001

Cessna 207

ZK-SEV

collision with terrain

Gertrude Saddle area 11 km southeast of Milford Sound

19 January 2002

Abstract

On Saturday, 19 January 2002, at 0931, ZK-SEV, a Cessna 207, took off from Te Anau Aerodrome for Milford Sound Aerodrome. At about 1000 the aircraft collided with the side of a mountainous valley, approximately 4400 feet above sea level and 500 metres southeast of Gertrude Saddle, some 11 kilometres from Milford Sound. The pilot and 5 passengers on board died in the collision.

The aircraft probably had not reached a suitable altitude to safely cross over Gertrude Saddle, and the pilot probably left his decision too late to turn back in the valley in order to gain more height.

Safety issues identified were the lack of mandatory mountain-flying training aeroplane pilots must undergo, and the potential safety benefits that could be gained from such training. Safety recommendations addressing these issues were made to the Director of Civil Aviation.



ZK-SEV wreckage at the accident site

Contents

- Abbreviations..... ii
- Data Summary iii
- 1 Factual Information 1
 - 1.1 History of the flight..... 1
 - 1.2 Pilot information 3
 - 1.3 Aircraft information 4
 - 1.4 Meteorological information 5
 - 1.5 Flight recorders 6
 - 1.6 Wreckage and impact information 6
 - 1.7 Medical and pathological information 7
 - 1.8 Survival aspects..... 7
 - 1.9 Organisational and management information 8
 - 1.10 Additional information..... 9
- 2 Analysis 10
- 3 Findings 12
- 4 Safety Recommendations 13

Figures

- Figure 1 Route Map iv

Abbreviations

amsl	above mean sea level
CAA	Civil Aviation Authority
ELT	emergency locator transmitter
GAP	Good Aviation Practice
HF	high frequency
hPa	hectopascals
kg	kilograms/s
km	kilometre/s
METAR	aviation routine weather report
mm	millimetre/s
TAF	aerodrome forecast
VHF	very high frequency
UTC	Coordinated Universal Time

Data Summary

Aircraft registration:	ZK-SEV
Type and serial number:	Cessna 207, 20700204
Number and type of engines:	one Continental IO-520-F60
Year of manufacture:	1971
Operator:	Air Fiordland Limited
Date and time:	19 January 2002, approximately 1000 ¹
Location:	Gertrude Saddle area 11 km southeast of Milford Sound latitude: 44° 45.4' south longitude: 168° 0.6' east
Type of flight:	air transport
Persons on board:	crew: 1 passengers: 5
Injuries:	crew: 1 fatal passengers: 5 fatal
Nature of damage:	aircraft destroyed
Pilot's licence:	Commercial Pilot Licence (Aeroplane)
Pilot's age:	25
Pilot's total flying experience:	635 hours (13.5 hours on type)
Investigator-in-charge	K A Mathews

¹ Times in this report are New Zealand Daylight Time (UTC + 13 hours) and are expressed in the 24-hour mode.

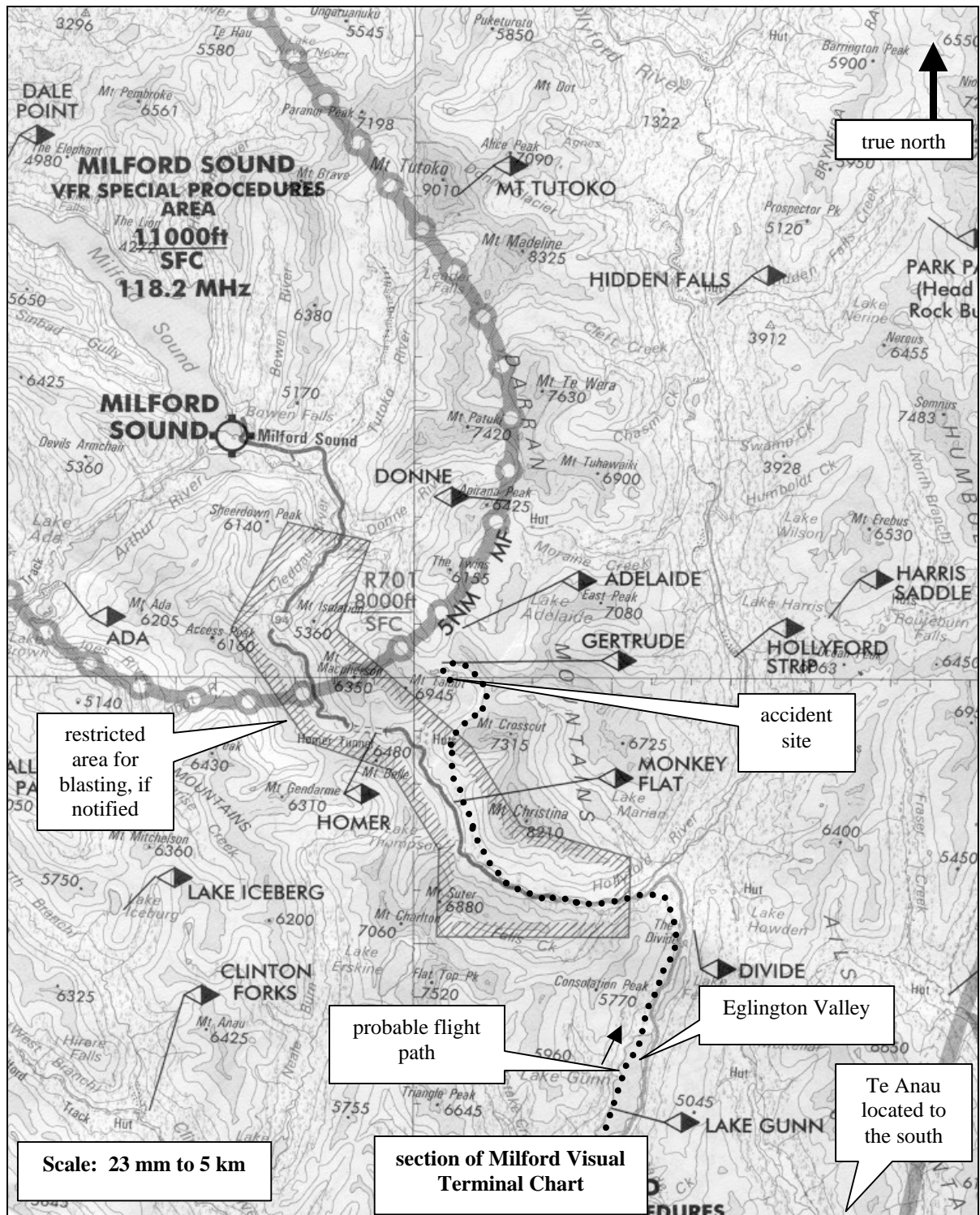


Figure 1
Route map

1 Factual Information

1.1 History of the flight

- 1.1.1 On Saturday, 19 January 2002, at 0931, ZK-SEV, a Cessna 207, took off from Te Anau Aerodrome for Milford Sound Aerodrome. On board were the pilot and 5 passengers.
- 1.1.2 The pilot was normally based in Queenstown. He had flown to Te Anau that morning as a passenger in a company Cessna 206, arriving about 0830. Arrangements had been made earlier for the pilot to fly passengers from Te Anau to Milford Sound on the morning of 19 January.
- 1.1.3 Before leaving Queenstown the pilot had obtained the relevant weather information and discussed it, and the planned flying, with the company pilot who flew him to Te Anau. Milford Sound had clear weather conditions and the eastern passes were reported as being clear. Te Anau also had clear weather conditions. During the flight to Te Anau the pilot discussed the weather conditions and general flying with the other company pilot. The pilot was in good spirits and appeared, to the other pilot, to be his normal self.
- 1.1.4 At Te Anau the pilot prepared ZK-SEV for the flight. The other company pilot observed him complete a pre-flight inspection of ZK-SEV. The pilot checked the fuel quantity and fuel for any water contamination. The pilot advised the other company pilot that he had not found any water contamination of the fuel. The aircraft reportedly contained about 190 litres of fuel, giving it a total endurance of about 3 hours flying. No discrepancies were noted with the aircraft. The pilot prepared a load sheet, recording passenger details, fuel and total weight.
- 1.1.5 The company chief executive said he had carried out a pre-flight inspection of ZK-SEV earlier that morning, in preparation for the flight to Milford Sound. He did not find any discrepancies with the aircraft. He picked up the 5 passengers and transported them to the aerodrome for the flight. At the aerodrome he discussed the weather conditions and route to Milford Sound with the pilots. The latest weather information was available to the pilots, including the Milford Sound weather conditions.
- 1.1.6 The chief executive said the pilot was in good spirits and seemed his normal self. He did not notice anything untoward with the pilot.
- 1.1.7 The 2 pilots each received the passengers for their respective aircraft, briefed them and seated them in the aircraft. The pilots planned to fly in company to Milford Sound. Because the other company pilot was flying a Cessna 206, which was faster than ZK-SEV, he elected to take off first. Each pilot completed normal engine runs before departure and no discrepancies were reported. The chief executive observed both aircraft during their engine runs and did not notice anything unusual.
- 1.1.8 ZK-SEV took off normally and departed approximately 30 seconds after the other aircraft. The chief executive watched both aircraft depart and did not observe anything untoward. The pilot gave the usual departure radio call after take off, which sounded normal to the other company pilot (the lead pilot). The lead pilot initially climbed to about 1000 feet above the ground and observed the weather conditions. The weather conditions to the west of Lake Te Anau appeared unsuitable in that direction for the flight so he elected to remain east of the lake and fly north, directly to the Eglington Valley. He contacted Milford Flight Service and lodged a flight plan for both aircraft, giving an estimated arrival time at Milford Sound of 1005. Milford Flight Service advised the pilots the Milford Sound weather conditions were clear, and that the eastern passes were open.
- 1.1.9 The lead pilot established flight following with the operator's Te Anau base, and advised that both aircraft would be routing via the Eglington Valley to Milford Sound, and that the Eglington Valley weather conditions appeared suitable for the flights. The pilots were in regular direct

voice contact using 2 transceivers tuned to both company and area VHF (very high frequency) channels. The lead pilot advised the pilot of the planned route and observed weather conditions.

- 1.1.10 The lead pilot gave a position report at Te Anau Downs, just before the entrance to the Eglington Valley. The pilot responded that ZK-SEV was only a few miles behind. The lead pilot asked the pilot if he was happy with the route and the pilot responded that he was.
- 1.1.11 At Knobs Flat the lead pilot was at 3500 feet above mean sea level (amsl) and gave a further position report, stating he was flying toward Lake Gunn. Several minutes later the pilot reported at Knobs Flat and said he was also proceeding toward Lake Gunn at 3500 feet amsl. The lead pilot later said they were at this height because of some cloud in the upper Eglington Valley.
- 1.1.12 At Lake Gunn the lead pilot gave a position report stating he was flying toward The Divide, the next reporting point. The lead pilot could see the weather was clear to the north, along the intended route to Milford Sound, and informed the pilot. Following the report the lead pilot put his aircraft into a climb in order to gain sufficient height to safely cross the eastern passes to Milford Sound (see Figure 1 for route details).
- 1.1.13 At The Divide the lead pilot gave a position report saying he was heading for Monkey Flat, which was 10 km ahead and situated 5 km south of Gertrude Saddle. The lead pilot later said the weather conditions were clear blue skies from The Divide through to Milford, with a southeasterly breeze providing a tail wind. Between The Divide and Monkey Flat the lead pilot called the operator on the company high frequency (HF) channel, advising the progress, the estimated arrival time at Milford, and the weather conditions.
- 1.1.14 When the lead pilot reached Monkey Flat he heard the pilot report at The Divide that he was climbing through 4400 feet and heading for Monkey Flat. That was the last radio call he heard from the pilot, who sounded normal. The lead pilot recalled being at 5000 feet or higher at Monkey Flat, and that he reported his position on VHF and advised that he was proceeding to Gertrude Saddle.
- 1.1.15 The lead pilot proceeded up Gertrude Valley, initially flying on the eastern side in accordance with standard procedure and good mountain-flying practice. Near the head of the valley he crossed to the western side to take advantage of updraughts, and approached Gertrude Saddle west of Black Lake. The lead pilot said he encountered some strong updraughts on the western side of the valley just south of Black Lake. The normal procedure for traffic avoidance considerations was to remain on the eastern side of the valley, when flying to Milford Sound via Gertrude Saddle.
- 1.1.16 The lead pilot said the weather was clear with blue skies in the valley and through Gertrude Saddle to Milford Sound. There was some cloud on the mountain peaks to the northeast and southwest of the saddle. The lead pilot said the updraughts he encountered in the Gertrude Saddle area did not create any problems when he crossed the saddle.
- 1.1.17 The lead pilot passed Gertrude Saddle at 5800 feet amsl on descent for Milford Sound. He called Milford Flight Service at 5600 feet amsl, advising his position and intentions. The lowest point in Gertrude Saddle was 4650 feet amsl. The lead pilot advised that it was normal company procedure to cross Gertrude Saddle at 5500 feet amsl or higher, because of safety and noise abatement concerns.
- 1.1.18 Milford Sound Aerodrome was situated at sea level, 10.5 km northwest of Gertrude Saddle. The lead pilot descended normally to land at the aerodrome. As he approached the aerodrome he expected to hear the pilot advise Milford Flight Service that ZK-SEV had crossed Gertrude Saddle. Because he had not heard the pilot make a radio call, he attempted to contact him on the company VHF channel. He got no response and initially thought ZK-SEV may have experienced a radio failure.

- 1.1.19 The lead pilot positioned his aircraft to land on runway 11, which was facing southeast toward Gertrude Saddle. On final approach he expected to see ZK-SEV descending from the east toward the aerodrome. Because he did not see ZK-SEV, he asked Milford Flight Service if they had heard from the pilot. Flight Service advised they had no radio contact with ZK-SEV.
- 1.1.20 The lead pilot asked a pilot flying a helicopter in the area to contact ZK-SEV. The helicopter pilot attempted to contact ZK-SEV without success. The lead pilot then asked the helicopter pilot to divert to the area and attempt to locate ZK-SEV.
- 1.1.21 At about 1011 the helicopter pilot crossed Gertrude Saddle in clear weather conditions. As he crossed the saddle he saw the wreckage of ZK-SEV on a rock face above Black Lake, 500 metres southeast of Gertrude Saddle, at approximately 4400 feet amsl. The helicopter pilot advised Milford Flight Service and asked for further helicopter assistance. He landed above the site and walked down to the wreckage to check for any survivors. He did not find any sign of life. He noticed aviation fuel pouring out of the aeroplane wing tanks. No fire occurred.
- 1.1.22 Another helicopter from Milford Sound arrived several minutes later. The 2 helicopter pilots together made a further check for any survivors, but found none. The second helicopter pilot turned off the ELT (emergency locator transmitter), which had activated during the accident.
- 1.1.23 Milford Flight Service did not have any radio contact with the pilot. No pilots in the area reported hearing the pilot transmit a distress message or ask for any assistance.

1.2 Pilot information

- 1.2.1 The pilot was aged 25. He held a Commercial Pilot Licence (Aeroplane) issued on 4 November 1998, and a Class 1 Medical Certificate valid until 2 November 2002. The pilot completed his professional pilot training at Christchurch, which included flying experience around South Island. His various aeroplane type ratings included the Cessna 206 and 207. His Cessna 207 type rating was completed on 9 January 2002. He had flown a total of 635 hours, including 13.5 hours in the Cessna 207.
- 1.2.2 In March 2001 the pilot completed a Cessna 206 floatplane rating. In June 2001 he travelled to Alaska, where he flew Cessna 206, Piper PA18 and Cessna 172 aircraft. He remained in Alaska flying until about the end of August 2001, having flown a total of 54 hours, mostly on the Cessna 206. The New Zealand operator's chief executive reported that, during the pilot's time in Alaska he periodically flew to remote areas to determine and report on the actual weather conditions, before general flight operations could start in those areas.
- 1.2.3 The pilot began full time employment as a pilot for the New Zealand operator on 1 October 2001, and was paid a salary. He initially completed 10 days of ground familiarization. This included 2 days of mountain-flying theory training, which was taught by the chief executive and chief pilot.
- 1.2.4 The Civil Aviation Authority (CAA) has produced a number of GAP (Good Aviation Practice) aviation information booklets, and in recent years produced 3 booklets designed to address the principles of flying in mountainous areas. Two booklets discussed operations into and out of Milford Sound and Queenstown, and one booklet discussed general mountain-flying. Two mountain-flying videotapes were also available. The chief executive advised that he had referred to those materials during the pilot's 2 days of mountain-flying theory training, and said they were available generally to all his pilots.
- 1.2.5 Soon after starting work for the operator, the pilot flew 9 times as an observer with the chief pilot or other company pilots to Milford Sound, on return flights from either Queenstown or Te Anau. Some of the flights included dual instruction. His dual instruction flight time to Milford Sound totalled 6 hours, including route checks.

- 1.2.6 Since 4 October the pilot had flown 108 hours for the operator in the Te Anau, Queenstown and Milford Sound areas. The majority of the pilot's flying included return flights to Milford Sound, with many of the flights crossing Gertrude Saddle. There were a number of specific entries in the pilot's logbook that mentioned flying via Gertrude Saddle. The flights from Queenstown to Milford Sound would normally pass The Divide and Gertrude Saddle areas.
- 1.2.7 The pilot's most recent biennial flight review, including an operational competency assessment, was completed on 14 October 2001. On 20 October he completed a route check assessment to Milford Sound. His most recent route check assessment was completed on 5 November, to Mount Cook.
- 1.2.8 On 16 January 2002 the operator's operations manager completed a ground procedures performance review of the pilot. No areas of concern were noted, and the pilot scored above average in the majority of areas assessed.
- 1.2.9 The pilot had flown 8.1 hours in the 7-day period before the accident, all on the Cessna 207. He had flown 40.2 hours in the 30-day period before the accident, and 98.8 hours in the 90-day period before the accident. No night flying was carried out.
- 1.2.10 In the 7-day period before the accident, the pilot had been 44 hours on duty. He had recorded 41 hours of duty in the previous 7-day period. He was off duty for one day, 2 days before the accident. Five days earlier, he had 2 days off duty. The pilot normally had 2 days off duty each week.
- 1.2.11 On 18 January, the day before the accident, the pilot had flown a return flight from Queenstown to Milford Sound, with the lead pilot travelling as a passenger to Milford Sound. The lead pilot said the flight to Milford was very pleasant with the pilot flying competently.
- 1.2.12 A number of people with whom the pilot worked spoke highly of him and held him in high regard. The chief executive and chief pilot, and other company pilots said the pilot was a conscientious and safe pilot. He was not known to take risks, rather he was considered to be conservative and safety conscious. The chief executive said the pilot was not afraid to ask questions, and would often seek the chief executive's advice. Other pilots also said the pilot would often discuss flying with them and seek their opinion before or during a flight.

1.3 Aircraft information

- 1.3.1 ZK-SEV was a Cessna 207, serial number 20700204, manufactured in the United States in 1971. The aircraft was an all-metal, single-engine, high-wing, light aircraft of conventional design, fitted with fixed tricycle undercarriage. The cabin layout comprised front seating for the pilot and one passenger, plus other seating for 5 further passengers. The aircraft was listed in the operator's Operations Specifications as being approved for air transport operations.
- 1.3.2 A new Teledyne Continental IO-520-F60 engine, serial number 821512-R, had been fitted to the aircraft on 30 August 2001. At the time of the accident the engine had operated for 118.9 hours.
- 1.3.3 A 3-bladed, Hartzell HC-C3YF-1BF constant speed propeller, serial number EC1092A, was fitted to the engine. At the time of the accident the propeller had operated for 1955.4 hours.
- 1.3.4 ZK-SEV had been issued with a non-terminating Certificate of Airworthiness in the standard category. The aircraft records showed the aeroplane was maintained in accordance with the operator's approved maintenance programme. At the time of the accident the aeroplane had amassed 7530 airframe hours. The last maintenance check was a Cessna Progressive Care Op 2 inspection at 7529.35 airframe hours, completed on 18 January 2002. The next check, an Op 3 inspection, was due at 7581 airframe hours. Maintenance recorded as being due before the next check was a propeller change at 7574.4 hours.

- 1.3.5 The maximum approved aircraft all-up-weight was 3800 pounds (1724 kg). The aircraft weight was estimated as having been about 3470 pounds (1574 kg), with the centre of gravity within limits, at the time of the accident. No cargo was recorded or reported as being on board, apart from personal effects and hand baggage.
- 1.3.6 The Cessna 207 owners' manual showed the maximum rate-of-climb achievable at 5000 feet in standard atmosphere, at 3500 pounds (1588 kg) all-up-weight, to be about 650 feet per minute. The operator said he would plan on around 450 feet per minute rate-of-climb at that weight and altitude in the Cessna 207. The full-throttle height² was around 4000 feet.

1.4 Meteorological information

- 1.4.1 The Meteorological Service of New Zealand Limited (MetService) provided an aftercast of the likely weather conditions prevailing in the Gertrude Saddle area, around 1000 on the day of the accident. The information included satellite images, surface observations and weather balloon readings. The aftercast included, in part, the following observations:

A low pressure centre lay to the east of North Island. An area of high pressure was beginning to build a ridge over the far south of the South Island. A trough had passed over South Island leaving in its wake a southerly flow.

The satellite images indicated that there was a certain amount of cloud cover. The manual observation from Milford Sound Aerodrome reported few to scattered (1-4 oktas) cloud with a base of 5500 feet amsl at 0900. The balloon flight from Invercargill the previous midnight suggested a layer of cloud between approximately 5000 feet and 10 000 feet amsl, though the midday flight indicated this layer became drier during the morning. The cloud top temperatures from the infra red satellite image at 1000 ranged between -3° Celsius and -7° Celsius, which would equate to cloud tops between 8000 feet and 10 000 feet amsl. The conclusion was that scattered Strato Cumulus cloud could have been in the area with bases of 5000 feet to 6000 feet amsl, and tops of 8000 feet to 10 000 feet amsl.

The winds from the Invercargill balloon flight indicated a southerly flow at the time of the accident. A midday balloon flight reported the winds below 10 000 feet as southerly with a speed range of 9 knots to 23 knots. The pressure difference between Haast and Invercargill at 1000 was -6.3 hPa. Over the Fiordland area this pressure difference would indicate a moderately strong southerly to southeasterly flow. At 1000 on the day of the accident the Queenstown automatic weather station reported a mean wind speed of 10 knots and gusts of 22 knots. During the afternoon Milford Sound also reported [sea breeze] gusts of 22 knots. The Invercargill balloon temperature plot at midday exhibited a weak subsidence inversion above 9000 feet. This indicated the potential for downdraughts. The accident site location was sheltered to the south by terrain. The conclusion was that during the morning of the day of the accident the wind would have been from a southerly direction, light (<10 knots) in the valley, though gusty (about 20 knots) at times, and stronger (25 - 35 Knots) along and above the ridgelines.

A manual observation from Queenstown reported showers in the vicinity from 0800. The midnight sounding from Invercargill reported a moist layer between 5000 feet and 10 000 feet, but the midday sounding was much drier in that layer. This suggested there might have been moderate showers in the area overnight, with the possibility of light showers at 1000. Visibility could have been reduced to between 10 km to 20 km in any light showers.

² Where maximum throttle travel is necessary to achieve the desired power setting.

The relatively warm cloud top temperatures, and the lack of widespread instability in the temperature sounding from the midday Invercargill balloon flight, indicated that there was no cumulonimbus cloud (thunderstorm) activity.

- 1.4.2 The Milford Sound aerodrome forecast (TAF) issued at 0334 on the day of the accident, and valid from 0200 to 1900, forecast the following conditions:

wind 140° true at 8 knots; visibility 50 km; few (1-2 oktas) clouds at 1000 feet; scattered cloud at 6000 feet; temporary change from 1300 to 1900 with wind 320° true at 10 knots; the 2000 foot wind 160° true at 20 knots.

An updated TAF issued at 1004, and valid from 0900 to midnight, forecast the same conditions, except for an increase in the wind speed at 2000 feet to 25 knots.

- 1.4.3 The 0900 Milford Sound aviation routine weather report (METAR) reported the following conditions:

wind 140° true at 10 knots; visibility 90 km; few clouds at 6000 feet; temperature 12° Celsius; QNH 1012 hPa; wind speed lull of 3 knots with a 13 knot maximum speed.

The 1000 Milford Sound METAR included the following changes:

wind 120° true at 7 knots; few clouds at 6500 feet; temperature 16° Celsius; wind speed lull of 2 knots with a 13 knot maximum speed.

- 1.4.4 The lead pilot did not report any weather difficulties and said the Gertrude Saddle area was blue skies, clear of cloud and with very good visibility. He experienced updraughts when he crossed to the western side of the Gertrude Valley and when he crossed Gertrude Saddle. He believed there were some downdraughts on the eastern side of the valley.
- 1.4.5 Reports from pilots flying in the area at the time, including the helicopter pilots who attended the accident scene, indicated the Gertrude Valley and Gertrude Saddle were clear of cloud and that there were no adverse weather conditions. The second helicopter pilot who attended the scene said the skies were blue, with the Gertrude Saddle area completely clear of cloud. He said there was some cloud on the high peaks to the west and east of the area. There were some updraughts and downdraughts in the area but they were not significant.
- 1.4.6 Around the time of the accident the sun was in the northeast quadrant. The eastern side of the Gertrude Valley was in shadow, whereas the western side was in sunshine.

1.5 Flight recorders

- 1.5.1 Under the current legislation the aircraft was not required to carry any flight recorders, and no such equipment was on board the aircraft.

1.6 Wreckage and impact information

- 1.6.1 The wreckage of ZK-SEV was located on a rock face 500 metres southeast of Gertrude Saddle, at approximately 4400 feet amsl, some 260 feet above Black Lake on its south side. The rock face sloped about 30° down near the wreckage and first impact point.
- 1.6.2 From the first strike mark to a rock face where the aircraft came to rest, the wreckage trail extended on a heading of about 114° true for some 35 metres. The wreckage trail showed the aircraft had been travelling away from Gertrude Saddle, and away from the intended destination, at the time of the accident.
- 1.6.3 The complete aircraft was accounted for at the site. There was no evidence of any in-flight structural failure. The aircraft had broken up extensively during the impact sequence, consistent

with an impact velocity between climb and cruise speed. The empennage was the only intact section of the aircraft. The first strike marks on the rock face included paint and wing material, which matched the material and scrape marks underneath and inboard of the right wing tip. There was no evidence that any other part of the aircraft had struck the rock face simultaneously with, or before, the wing tip. The wreckage trail showed the aircraft was in a slightly nose down attitude with a little left bank applied, at the time of impact. The impact signature was consistent with the aircraft being in controlled flight at the time of impact.

- 1.6.4 Control continuity was established as far as possible, given the disruption that occurred. The flaps were in the retracted position.
- 1.6.5 The fuel tanks had ruptured during the impact sequence and little fuel remained in the tanks. A strong fuel smell was evident around the wreckage. Both fuel tank caps were in place.
- 1.6.6 Although little useful information could be gained from the cockpit instruments and control settings, the following information was noted:
 - the mixture was rich
 - the propeller pitch control was full fine (maximum speed)
 - the altimeter QNH was set at 1015 hPa (hectopascals)
 - the magnetos were on BOTH
 - the electric driven fuel pump was selected off.
- 1.6.7 The engine had broken away from its engine mounts and careered some 100 metres past the wreckage, before falling around 100 metres down a cliff face and coming to rest submerged in a small mountain lake. A trail of engine debris extended to the cliff edge. The propeller had separated from the engine and was located at the main wreckage. The engine crankshaft had fractured in torsional overload near the propeller flange, consistent with a power-on sudden stoppage. The 3 propeller blade tips exhibited clear evidence of being driven under power when they first struck the rock face.
- 1.6.8 No dangerous goods or cargo, apart from some personal effects, were found amongst the wreckage. Two cameras were recovered, but no relevant information was obtainable.
- 1.6.9 The engine remains were removed to the Commission's premises for further examination. Nothing was found indicating any power loss. The broken engine crankshaft corresponded with the observation near the propeller flange, that it had fractured in torsional overload.

1.7 Medical and pathological information

- 1.7.1 Post-mortem and toxicological examination did not reveal anything that would have affected the ability of the pilot to control the aircraft. There was no medical or pathological evidence of pilot incapacitation or impairment.
- 1.7.2 The pilot's most recent medical assessment had been carried out on 31 October 2001. He held a valid Class 1 medical certificate. Periodic medical surveillance did not indicate any medical problem relevant to the accident.

1.8 Survival aspects

- 1.8.1 The longitudinal deceleration forces, and the disruption to the occupiable cabin space, rendered the accident unsurvivable.

1.9 Organisational and management information

The operator

- 1.9.1 The operator had a transitional Air Operator Certificate valid from 1 May 1999 until 28 February 2003, and was approved to conduct air transport operations carrying passengers and goods for hire or reward. ZK-SEV was approved for those operations.
- 1.9.2 The operator began operations in October 1984, and since then had gained extensive experience in the southern part of New Zealand, in remote area, waterborne, tourist, and search and rescue flight operations. The operator was based in Te Anau, although a number of pilots and aircraft were stationed at Queenstown. Senior Queenstown-based pilots were used on a rotational basis as base operations managers. They would assess the daily weather and determine the planned flying for the Queenstown operation. They reported to the chief executive in Te Anau.
- 1.9.3 The operator conducted air transport operations, including scenic flights, throughout Fiordland using a fleet of 9 aeroplanes, namely Cessna 172, 185, 206 and 207 aircraft. The operator had a flight following system in place to monitor the progress of each flight. Most of the operations were conducted between Queenstown, Te Anau and Milford Sound. At the time of the accident the operator employed 13 pilots.
- 1.9.4 The operator's chief executive was also the maintenance controller and operations manager. He had been chairman of the Milford Users Group for the previous 13 years. For 2 years he had assisted the CAA in its Aero Kiwi safety seminars, and spoke on decision-making at the seminars. He also assisted the CAA in producing an instructional mountain-flying videotape presentation, mainly on physiological aspects. Apart from a landing accident at Te Anau Aerodrome in 1994, the operator had not had an accident in the previous 12 years of operations.
- 1.9.5 The operator conducted regular internal quality assurance audits, and arranged for independent quality assurance audits about 3 times a year. The CAA also conducted normal routine safety audits and spot checks. The chief executive said safety meetings involving all the pilots occurred periodically, and prior to monthly managers' meetings.
- 1.9.6 The chief executive visited an overseas airline in 2000. He said he was in stage 2 of developing a training programme based on pertinent points he gained during that visit.
- 1.9.7 The chief executive, as operations manager, was also responsible for the initial and on going pilot training. He said all his pilots were trained in mountain-flying techniques, including the use of escape options. The operator's Operations Manual stated that, "all pilots shall have passed, to a satisfactory standard, an Area and Mountain Check". The check was to be completed on initial employment, and thereafter every 12 months by the company flight-training pilot. The Operations Manual also specified 500 feet as being the minimum height permitted above terrain during normal operations. The manual also stated, "[the] Company requires that pilots 'Fly Neighbourly' with the interests of passengers, the surrounding area population, and the good name of the company."
- 1.9.8 All the operator's other pilots had, in addition to the operator's requirements, previously attended an independent mountain-flying training course run by a senior flying instructor at Queenstown. The pilot was the only one not to have attended this voluntary course. The chief executive said he did not detect any bad decision-making by the pilot during his training, or afterwards. He said he assessed the pilot as having exceeded the minimum experience requirements, skill and ability to operate safely in the region.
- 1.9.9 The operator's pilots were all on salaries and were not paid incentives for successful completion of flights. The chief executive said his operating policy was to be the last to start flying, and the first to finish or cancel flights. The operator's pilots spoken to confirmed this was the policy, and said they were never under any undue pressure to fly in adverse conditions. They believed the operating and training requirements were of a high standard. They said there was an

emphasis on being safe and professional in their flying. They said there was pride in being able to take a nervous passenger on a flight, and cause the passenger to relax during the flight and to enjoy the experience.

- 1.9.10 The operator's flights often connected passengers with sight-seeing boat trips that departed at prescribed times from Milford Sound. On the day of the accident the next boat trip was scheduled to depart at 1030, followed by one at 1100, then 1200, 1230, 1300 and 1500. The operator's flights departed from Queenstown and Te Anau at least one hour ahead of the boat departure times. This ensured there was minimal pressure on the pilots to have their passengers arrive on time for any one boat trip.

Operator surveillance

- 1.9.11 The operator was subject to normal CAA surveillance, including programmed audits and random spot checks, to assess the operator's operations and safety performance by a systematic sampling of activities.
- 1.9.12 The most recent surveillance check was completed on 29 November 2001. This was a compliance entry inspection for air operator certification under Civil Aviation Rules. Two items were identified as needing action before a revised air operator certificate could be issued. One item was the installation of shoulder restraints for each flight crew member, and the other item was for the supply and the acceptance of aircraft performance data.
- 1.9.13 On 16 March 2001 CAA inspected Milford Aerodrome and another airstrip used by the operator. On the same day, 2 flight checks were completed on flights between Milford and Queenstown with different pilots. A comment noted on the surveillance form was that both flights were conducted in a professional manner, with good airmanship being demonstrated.
- 1.9.14 Previous spot checks were completed on 28 November 2000, 8 May 2000 and 5 April 1999. A minor discrepancy about a loadsheet was noted. Comments noted included, "a good attitude was observed amongst staff and pilots; generally in compliance and wishing to get better; the operator appears to have a well controlled operation; and the pilots are well briefed with a good flight following system".
- 1.9.15 Audits covering flight operations and maintenance were completed on 20 October 1999 and 10 December 1998. The audit summary and conclusions stated that, in the areas audited, management showed positive control of operations and maintenance, and that the flight operations and maintenance aspects were well controlled. Some follow up work for avionics inspections documentation needed to be streamlined to make them timelier.

1.10 Additional information

- 1.10.1 Basic mountain-flying training formed part of the commercial helicopter pilot training syllabus, but did not form part of the commercial aeroplane pilot syllabus. CAA advised that the commercial pilot training requirements were being reviewed, with an intention to introduce some basic mountain-flying training to the aeroplane syllabus. While each operator was responsible to ensure its pilots were trained and competent for the operations and routes flown, in accordance with Civil Aviation Rules, there was no requirement for pilots to attend a specialised mountain-flying training course prior to operating routinely in mountainous areas.
- 1.10.2 CAA provided Advisory Circulars with explanatory information and examples of how to comply with most Civil Aviation Rules. The circulars did not provide mountain-flying training guidance information for operators who conduct routine commercial operations into mountainous areas, to assist them to meet the Civil Aviation Rules requirement to establish a training programme that ensures each of their pilots is trained and competent to fly in such areas. CAA, however, did provide GAP booklets and videotapes on mountain flying (see 1.2.4).

- 1.10.3 Following a Nomad aircraft accident at Franz Josef Glacier on 25 October 1993, the Commission recommended to the CAA (safety recommendation 078/93) that it include mountain-flying training in the commercial aeroplane pilot syllabus, similar to that specified in the commercial helicopter pilot training syllabus. The CAA responded saying it would consider the recommendation during a review of Civil Aviation Rule Part 61. After an accident involving a Cessna 310 aircraft at Queenstown on 3 January 1997, the Commission again made a similar recommendation (033/97) to the Director of Civil Aviation. The director responded saying he was prepared to accept the recommendation, by considering the recommendation as a request for the amendment of the relevant Advisory Circular to Part 61. The director expected this to have been complied with by the end of 1997. At the time of the accident these recommendations had not been implemented.

2 Analysis

- 2.1 The accident site was remote; there were no survivors and no eyewitnesses to the accident. The Commission's analysis of the likely cause is based primarily on the conclusions it has been able to draw from the physical evidence (such as its site and wreckage inspection) and its experience of accidents and incidents of this type.
- 2.2 The flight began as a routine event by a pilot who, by all accounts, was professional and safety conscious, and who was familiar with the route to be flown and the likely weather conditions encountered. From information gathered during the investigation, the operator's chief executive set high standards for his pilots, was safety conscious and expected his pilots to fly professionally and safely. He was also known for his contribution over many years to improving flight safety in the Fiordland region.
- 2.3 The aircraft was suitable for the purpose, it was recorded as being properly maintained and serviceable, and it had no outstanding defects. The aircraft engine had been installed new, approximately 119 hours before the accident. The latest inspection, completed the day before the accident, showed the engine performance to be normal in all respects. The propeller, however, with only 44.6 hours to run until overhaul, may have had less than optimum performance, which could have affected the aircraft climb performance to some degree. The pilot did not report any difficulties with the aircraft before, or during, the flight.
- 2.4 The weather conditions were suitable for the flight and improved significantly as the flight progressed past Lake Gunn. A tail wind prevailed for most of the flight, and up Gertrude Valley to the accident site, probably increasing to some 25 knots near the head of the valley.
- 2.5 The flight progressed normally to at least The Divide, where the pilot made his last known position report; this sounded normal to the lead pilot. Here the pilot said he was proceeding to Monkey Flat and climbing through 4400 feet. ZK-SEV should have reached a similar height to the lead pilot's aircraft of 5000 feet or higher at Monkey Flat, with a rate of climb of approximately 400 feet per minute. The aircraft should have been capable of a faster climb rate, given the altitude and the all-up-weight of the aircraft.
- 2.6 Flying to Milford Sound, via the Gertrude Valley over Gertrude Saddle, was a common route, and it was the route planned by the lead pilot and the pilot. There was no evidence the pilot flew any route other than up Gertrude Valley to the accident site. Gertrude Saddle was approximately 5 km (3 nautical miles) from Monkey Flat up the Gertrude Valley. Assuming the aircraft had reached about 5000 feet at Monkey Flat and climbed normally up the valley, the aircraft probably approached the saddle within about 1.5 minutes after leaving Monkey Flat, given the tail wind conditions. The operator, and other pilots familiar with the Cessna 207, reported that around 400 feet per minute rate of climb would have been typical in the circumstances. If this was so, then the aircraft could have reached 5500 feet near the head of Gertrude Valley, discounting any updraughts or downdraughts.

- 2.7 The pilot likely proceeded up the eastern side of Gertrude Valley, in accordance with normal procedure and good mountain-flying practice. Being on the right side of the valley the aircraft would have been in shadow, thus permitting the pilot's eyes to adjust to the shade and to allow him to also see the sunlit side of the valley. With the pilot sitting on the left side of the aircraft he would have had a good escape option down the valley, using a left turn for better turning visibility, as well as flying into a sunlit area.
- 2.8 Given the position of the wreckage, the impact signature, and the turning capabilities of an aeroplane, the aircraft would have been displaced toward the right side of the valley and turned to the left away from Gertrude Saddle as it approached it. No other plausible explanation exists for the aircraft being in the position it was found. Why the pilot turned away from Gertrude Saddle is unclear, but the most feasible explanation is the aircraft was too low to cross the saddle safely, and the pilot, being uncomfortable with the situation, elected to turn away in order to orbit and gain more height. The saddle was clear of cloud, and the lead pilot safely flew across the saddle some 3 minutes before the accident. There was no evidence of any aircraft malfunction, although a partial loss of power for some reason is an unsubstantiated possibility. There was, however, good evidence the aircraft engine was delivering significant power at impact, and the pilot did not report any problems. There was no evidence of pilot incapacitation or interference by one of the passengers.
- 2.9 If the aircraft had reached about 5500 feet as it approached Gertrude Saddle, it would have been at the minimum altitude to cross the saddle safely. If the pilot had crossed at a lower altitude he would not have complied with company and noise abatement procedures. Downdraughts were likely on the eastern side of the valley and, had the aircraft encountered downdraughts, it may not have reached 5500 feet or it may have been prevented from climbing effectively after leaving Monkey Flat. Because the accident site was at approximately 4400 feet the aircraft was probably at a similar altitude when it started its turn, because the pilot would have wanted to at least maintain his altitude. Alternatively, the aircraft could have reached a higher altitude initially and downdraughts may have caused it to lose altitude as it approached the saddle on the east side of the valley.
- 2.10 The available evidence indicates the pilot delayed his decision to turn away from Gertrude Saddle until the aircraft neared the saddle. Had the pilot turned away sooner, before the aircraft got into the head of Gertrude Valley, he should have had enough room to safely turn away from the saddle in order to orbit and gain additional height. Why the aircraft did not reach a suitable height earlier, and why the pilot delayed his decision are open to conjecture, but could have been for several reasons. The tail wind increased in strength with altitude and in the valley because of its narrowing. This would have increased the aircraft ground speed, which may have caught the pilot by surprise and caused the aircraft to approach the saddle more rapidly than he expected, and at a lower-than-planned altitude. The pilot may have been anticipating encountering updraughting air near the head of the valley in order to gain the necessary height. The pilot might, for some reason, have reduced or stopped his climb for a period after leaving The Divide, or encountered earlier downdraughts. If the pilot had continued his climb from The Divide from 4400 feet, the aircraft should have reached a suitable altitude at Monkey Flat in the prevailing conditions, and potentially a safe crossing altitude prior to reaching Gertrude Saddle. A suitable altitude at Monkey Flat would have been 5000 feet or higher, before starting a climb up Gertrude Valley.
- 2.11 The wreckage distribution and impact signature indicated the aircraft had completed its left turn and was in, essentially, a wings level attitude, or slight left bank, and heading back out of the valley at the time of impact. This could suggest the pilot was not aware how close the right wing was to the terrain just before the impact. If the aircraft had sufficient speed, a left turn and pull up manoeuvre could have enabled the aircraft to clear the terrain.
- 2.12 A number of factors could have led to the aircraft closing with terrain on the western side of the valley. The pilot would have lost the normal horizon reference in the turn, and his depth perception could have been affected by turning from shadow toward a sunlit rock face with no

discernable horizon. The wind would have pushed the aircraft toward the saddle during the crosswind segment of the downwind turn, further restricting the available manoeuvring space. A feature of the Cessna 207 is its long nose, which would have restricted the pilot's forward visibility under the aircraft, especially in the right forward sector, during the turn. These factors, along with an aeroplane's turning ability, may have contributed to the pilot being unaware of how close the aircraft was to the rock face. Any turbulence encountered would have exacerbated the situation and could have contributed to the right wing tip striking the rock face.

- 2.13 Although the pilot had received some mountain-flying training, had some mountain-flying experience, and was familiar with the route, he was, nevertheless, relatively inexperienced. He did not have the benefit of receiving any CAA accepted basic mountain-flying instruction during pilot training, or of having attended a formal independent mountain-flying training course, which the operator's other pilots had attended. The pilot also had limited experience on the aircraft type, having only completed a type rating 10 days before the accident. However, he did have experience on the Cessna 206, an aircraft similar to the Cessna 207. Although the pilot was supervised, considered by the operator to be competent, and not known to take risks, inexperience could have been a contributing factor to the accident. Appropriate forward planning and timely decision-making are essential for safe mountain-flying. Even though the operator had checked the pilot and was not concerned about his forward planning and decision-making ability, the accident circumstances, nevertheless, suggest these were lacking just before the accident, and that the pilot should have turned the aircraft away sooner, or started his climb earlier. A pilot's decision-making ability can be enhanced by extended exposure to the operating environment, and by specific task training.
- 2.14 The Fiordland region of New Zealand is a mountainous area with high snow and ice covered mountain peaks and a high annual rainfall. Consequently, it and other similarly mountainous areas can present pilots with demanding mountain-flying challenges. Some past aeroplane accident reports (e.g. 93-014 and 97-002) suggest pilot inexperience, or a lack of appreciation for the mountain-flying challenges these areas presented, contributed to the accidents.
- 2.15 Some basic mountain-flying training should be included in the aeroplane pilot training syllabus, as recommended previously by the Commission. This training, by itself, would not necessarily suitably equip aeroplane pilots for routine operations in demanding mountainous environments such as Fiordland.
- 2.16 CAA should provide specific mountain-flying training guidance material in its Advisory Circulars, to assist operators who conduct routine commercial operations into mountainous areas like Fiordland to meet their pilot training obligations. CAA could also consider requiring those operators have their aeroplane pilots attend a CAA accepted advanced mountain-flying training course, covering both theory and practical flying, as a prerequisite requirement before operating commercially in these areas. These initiatives could increase pilot skill level and decision-making ability necessary for safe flight operations in mountainous environments, and help inexperienced pilots through the early period of their mountain-flying careers when they may be vulnerable to this type of accident. Routine pilot checks, such as the annual route check or the biennial flight review, should also reassess a pilot's mountain-flying skills.

3 Findings

Findings and safety recommendations are listed in order of development and not in order of priority.

- 3.1 The pilot was appropriately qualified, fit and authorised to conduct the flight.
- 3.2 The aircraft records indicated the aircraft was properly maintained and airworthy. The aircraft was appropriate for the purpose and was approved for air transport operations.
- 3.3 The weather conditions were suitable for the flight.

- 3.4 The aircraft was probably too low to safely cross Gertrude Saddle, and the pilot probably elected to use his escape option of a left reverse turn after recognising that he would be unable to safely cross the saddle. This was left too late to safely complete the manoeuvre.
- 3.5 Had the aircraft reached a suitable height to safely cross Gertrude Saddle prior to entering Gertrude Valley, the accident may have been averted.
- 3.6 The pilot may have misjudged the strength of the tailwind and thus the aircraft ground speed, and the strength of any downdraughts, as he approached Gertrude Saddle. Consequently, the closing speed with the saddle and the low height of the aircraft may have caught the pilot by surprise.
- 3.7 The pilot's delayed action in initiating a reverse turn away from Gertrude Saddle was probably a prime contributing factor to the accident.
- 3.8 Pilot inexperience may have contributed to the accident.
- 3.9 The current aeroplane pilot training requirements are not sufficient to ensure pilots are suitably equipped to handle the demanding flying challenges that mountainous environments can present.

4 Safety Recommendations

4.1 On 19 July 2002 the Commission recommended to the Director of Civil Aviation that he:

4.1.1 implement previous safety recommendations 078/93 and 033/97, which stated:

The training syllabus for the New Zealand Commercial Pilot Licence (Aeroplane) be amended to include "Mountainous-terrain flight training" and the extent of training required be similar to that already specified in the case of Commercial Pilot Licence (Helicopter), and the requirement be applicable prior to the validation or conversion of foreign Pilot Licences to equivalent New Zealand Pilot Licence[s];

Include mountain-flying in the training syllabus for Private Pilot and Commercial Pilot Licences (Aeroplane), as is the case for helicopter licences; (023/02) and;

4.1.2 include in Advisory Circulars detailed mountain-flying training guidance information, to assist operators who conduct routine commercial operations into mountainous areas, such as Fiordland or similar regions, to meet the Civil Aviation Rules requirement to establish a training programme that ensures each of their pilots is trained and competent to fly in such areas. (024/02)

4.2 On 29 July 2002, the Director of Civil Aviation replied, in part:

4.2.1 **023/02**

I will not accept the recommendation as worded, however I have initiated a Rule change in the current review of Part 61 to include mountain-flying training as a requirement for pilot licensing. This matter has already been considered by an Industry and CAA Technical Study Group and a Notice of Proposed Rule Making is currently being drafted for public consultation in accordance with the requirements of the Civil Aviation Act. The implementation of a final rule is therefore not expected before 2003. (023/02).

4.2.2 **024/02**

I accept this recommendation and will include in Advisory Circulars detailed mountain-flying training guidance information to assist operators who conduct routine commercial operations into mountainous areas, such as Fiordland, or similar regions, to meet the Civil Aviation Rules. This will be completed by the end of February 2003.

Approved for publication 07 August 2002

Hon. W P Jeffries
Chief Commissioner



**Recent Aviation Occurrence Reports published by
the Transport Accident Investigation Commission**

- 00-008** Aerostar S81 A hot air balloon ZK-SKY, power line incident, near Methven, 6 July 2000
- 00-009** MD 369E ZK-HFT, loss of engine power, near Te Anau, 17 October 2000
- 00-011** Cameron A180 hot air balloon ZK-FAS, collision with power line, Taupo, 28 October 2000
- 00-012** temporary loss of air traffic control communications system, Christchurch main trunk air traffic services centre, 25 October 2000
- 00-014** Piper PA23 Aztec, ZK-DIR, nose undercarriage collapse after landing, Gisborne Aerodrome, 14 December 2000
- 00-015** Piper PA28-140, ZK-CIK, loss of control and impact with terrain, Amuri Range, near Hamner Springs, 19 December 2000
- 01-002** Fairchild SA227-AC Metro III, ZK-RCA, bird strike and loss of both engines, Tauranga Aerodrome, 9 March 2001
- 01-003** Hughes 369D ZK-HMN, in-flight engine flameout, 12.5km northwest of Milford Sound, 23 March 2001
- 01-005** Bell UH-1H Iroquois ZK-HJH, tail rotor failure and in-flight break-up, Taumarunui, 4 June 2001
- 01-007** P-68B Partenavia ZK-DMA, double engine power loss, North Shore Aerodrome, 20 July 2001
- 95-008** Addendum to Report 95-008, Piper PA 28-161, ZK-MBI, missing after departing from Gisborne, 21 May 1995
- 01-004** B767-300 ZK-NCH, in-flight loss of flap component, Auckland, 19 May 2001
- 01-009** Bell 206B Jetranger, ZK-HWI, perceived engine power loss and heavy landing after takeoff, Mt Pisa Station, Cromwell, 11 September 2001
- 01-010** Embraer EMB-820C Chieftain ZK-RDT, door open in flight, near Auckland, 31 October 2001
- 01-011** Cessna A185E Skywagon, ZK-JGI, forced landing following power loss after take-off, near Motueka, 29 November 2001

Transport Accident Investigation Commission
P O Box 10-323, Wellington, New Zealand
Phone +64 4 473 3112 Fax +64 4 499 1510
E-mail: reports@taic.org.nz Website: www.taic.org.nz

Price \$20.00

ISSN 0112-6962