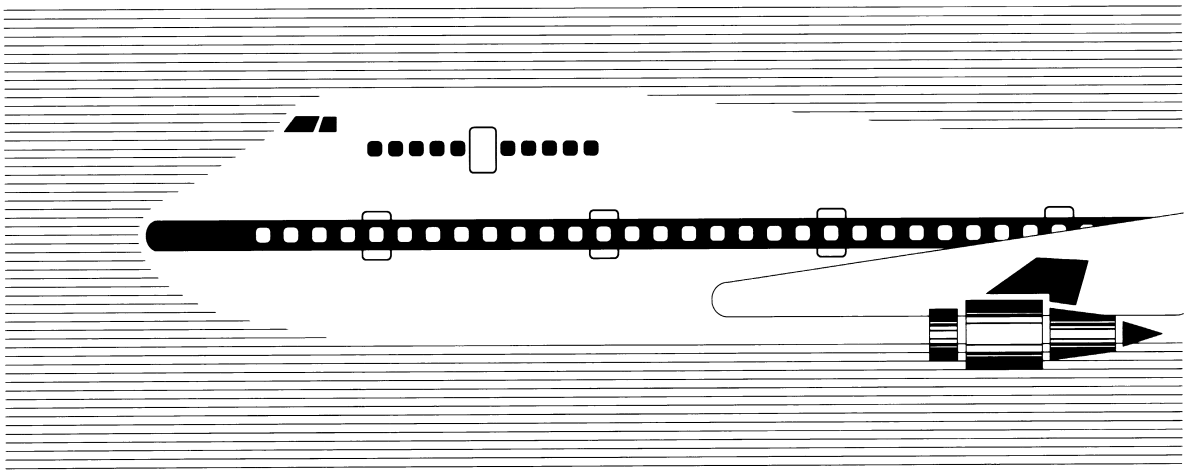
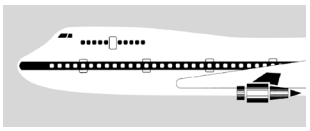
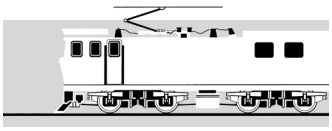


# AVIATION OCCURRENCE REPORT

**04-007** **PA34-200T Seneca 11, ZK-JAN, controlled flight into terrain Mount Taranaki/Egmont** **30 November 2004**


**TRANSPORT ACCIDENT INVESTIGATION COMMISSION**
**NEW ZEALAND**

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.

# Report 04-007

# Piper PA34-200T Seneca II

# ZK-JAN

# controlled flight into terrain

# Mount Taranaki / Egmont

# 30 November 2004

## Abstract

On Tuesday 30 November 2004, ZK-JAN, a Piper PA34-200T Seneca II, was on an air transport charter flight returning to Nelson from New Plymouth with the pilot and one passenger on board. After departing New Plymouth and obtaining approval to operate up to 8500 feet under visual flight rules, the aircraft struck Mount Taranaki / Egmont about 150 feet below the summit. The 2 occupants were killed on impact and the aircraft was destroyed.

The probable cause of the accident was the pilot unknowingly losing visual reference with the mountain. The pilot may have entered cloud as he flew south, been unable to distinguish the snow and ice covered summit against a cloud background or the nose of the aircraft could have obscured his view of the summit as he approached directly towards it.

The safety issue identified, namely the utility of terrain awareness and warning systems, was being addressed by the Civil Aviation Authority.

**Wreckage of ZK-JAN**
**Mount Taranaki / Egmont**
**(looking north)**

# Contents



# Figures

## Abbreviations

| | |
|---|---|
| AMSL | above mean sea level |
| AP | autopilot |
| ATS | Air Traffic Services |
| ºC | degrees Celsius |
| CFIT | controlled flight into terrain |
| CU | cumulus |
| ELT | emergency locator transmitter |
| FD | flight director |
| ft | feet |
| HDG | heading |
| IFR | instrument flight rules |
| km | kilometre(s) |
| kt | knot(s) |
| m | metre(s) |
| METAR | aviation routine weather report |
| MetService | Meteorological Service of New Zealand |
| nm | nautical mile(s) |
| NP | New Plymouth |
| NS | Nelson |
| QNH | an altimeter subscale setting to obtain elevation above mean sea level. |
| RCCNZ | Rescue Coordination Centre New Zealand |
| SC | stratocumulus |
| SIGMET | significant meteorological report |
| ºT | degrees true |
| TAWS | terrain awareness and warning system |
| TCU | towering cumulus |
| UTC | coordinated universal time |
| VFR | visual flight rules |
| VMC | visual meteorological conditions |
| VOR | very high frequency navigation receiver |

## Glossary

| | | |
|---|---|---|
| CFIT | when an airworthy aircraft under control of the crew is flown unintentionally into terrain, usually with no prior awareness by the crew. CFIT is more common during, but not restricted to, the approach and landing phases of flight, often under instrument flight rules and during non-precision instrument approach. | |
| cloud levels | few | 1 – 2 oktas of cloud, or covering 1 – 2 eighths of the sky |
| | scattered | 3 – 4 oktas of cloud, or covering 3 – 4 eighths of the sky |
| | broken | 5 – 7 oktas of cloud, or covering 5 – 7 eighths of the sky |
| Mount Taranaki | alternatively known as Mount Egmont | |

## Data Summary

| | |
|---|---|
| **Aircraft registration:** | ZK-JAN |
| **Type and serial number:** | Piper PA34-200T Seneca II, 34-8070027 |
| **Number and type of engines:** | 2 Teledyne Continental TSIO-360-EB |
| **Year of manufacture:** | 1980 |
| **Operator:** | Flight Corporation Limited |
| **Date and time:** | 30 November 2004, at 0954[1] |
| **Location:** | Mount Taranaki / Egmont<br>latitude: 39° 17.65′ south<br>longitude: 174° 03.92′east |
| **Type of flight:** | air transport, charter |
| **Persons on board:** | crew: 1<br>passengers: 1 |
| **Injuries:** | both fatal |
| **Nature of damage:** | aircraft destroyed |
| **Pilot's licence:** | Commercial Pilot Licence (Aeroplane) |
| **Pilot's age:** | 41 |
| **Pilot's total flying experience:** | 2560 hours (180 hours on type) |
| **Investigator-in-charge:** | I R McClelland |

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

# 1 Factual Information

## 1.1 History of the flight

1.1.1 At about 0700 on Tuesday 30 November 2004, a local Nelson-based airline contacted the duty person for Flight Corporation Limited (the operator), and asked to have an engineer and parts flown to New Plymouth and return. The duty person called his operations manager, and after checking the weather contacted the pilot and asked if he was able to complete the task.

1.1.2 The pilot, who worked part-time for the operator, was on a rostered day off from his regular job. The pilot had previously advised the operator that he did not meet the currency requirements for flying under instrument flight rules (IFR) and was therefore restricted to flying in visual meteorological conditions (VMC) under visual flight rules (VFR). The duty person and the pilot discussed the weather and the serviceability of the aircraft, a Piper PA34-200T Seneca II, ZK-JAN, and agreed the flight could be completed under VFR.

1.1.3 The pilot arrived at the operator's base at about 0730, inspected the aircraft and added 244 litres of fuel. The pilot obtained updated weather information and completed a load-sheet for the flight. The pilot did not file a flight plan for the flight but advised the operator of his intentions and nominated search and rescue time, the time at which search action should be initiated if the pilot did not update his progress or report safely on the ground.

1.1.4 The pilot loaded the passenger and parts, started ZK-JAN and departed from Nelson under VFR at about 0800. The pilot used the operator's call sign Flight Corp 07 for the flight. The weather at Nelson at this time was reported to be fine with no cloud in the local area.

1.1.5 The pilot flew directly towards New Plymouth, climbing to about 7500 feet (ft) above mean sea level (AMSL) before descending to cross the coast about 25 km west of Hawera at 2200 ft. This kept the aircraft clear of controlled airspace until approaching New Plymouth Aerodrome. The pilot manoeuvred the aircraft around the eastern side of Mount Taranaki / Egmont (hereafter referred to as Mount Taranaki) as it approached New Plymouth. The aircraft landed at about 0857.

1.1.6 The engineer was able to complete his work in about 30 minutes, after which he and the pilot re-boarded ZK-JAN for the return flight. The pilot contacted New Plymouth Tower and requested to depart from New Plymouth direct on track to Nelson, climbing to 8500 ft. The aerodrome controller passed the aerodrome weather conditions to the pilot and cleared him to vacate New Plymouth airspace direct on track to Nelson under VFR. The controller also advised the pilot that the aircraft was initially limited to 6500 ft and that the pilot would need to call Christchurch Control for clearance to 8500 ft inside controlled airspace. The pilot acknowledged the instructions.

1.1.7 At 0942 ZK-JAN took off from New Plymouth runway 23 and turned left in the general direction of Nelson. At about 0947 the pilot reported approaching 6500 ft and requested change to Christchurch Control for further climb. The aerodrome controller looked at his radar display at this time and observed ZK-JAN to be about 8 nautical miles (nm) or 15 km south of New Plymouth at about 6400 ft. The tower controller cleared the pilot to change radio frequency.

1.1.8 At 0948 the pilot called Christchurch Control and advised, "we're just VFR to Nelson from New Plymouth, currently 8 [nautical] miles south maintaining 6500 ft and requesting climb to 8500 and below on track Nelson." The radar controller replied, "Flight Corp 07 roger, squawk 4271 for identification and cleared up to 8500 VFR. Manawatu QNH[2] 1000 millibars." The pilot responded, "On 1000, climbing 8500, squawk 4271, Flight Corp 07."

[2] QNH, an altimeter subscale setting to obtain elevation AMSL.

1.1.9 The pilot set the allocated transponder code of 4271 and at 0950 the radar controller advised, "Flight Corp 07 you are identified, 8500 VFR on track to New Plymouth, say again Nelson. You will be radar monitored." The pilot replied, "Flight Corp 07 roger, thanks for that."

1.1.10 The radar controller continued his scan and at about 0953 he noticed that the radar identification target for Flight Corp 07 had disappeared. He waited a few seconds to see if the identification target would return, which it did not. At 0954, the radar controller tried to contact Flight Corp 07 but there was no response. The controller then initiated search action.

1.1.11 At 1004 the supervisor at the Airways Corporation Radar Centre in Christchurch called the Rescue Coordination Centre New Zealand (RCCNZ) and advised that ZK-JAN was missing. At about the same time Air Traffic Services (ATS) received reports of an emergency locator transmitter (ELT) signal in the Taranaki area. After liaising with Airways Corporation and Police, RCCNZ started a coordinated search for ZK-JAN using local aircraft and ground search parties and centred on Mount Taranaki. Poor weather prevented the crew of the search aircraft viewing much of the mountain, but at about 1830 a ground search party reported locating the wreckage of ZK-JAN near the summit. There were no survivors.

## 1.2 Injuries to persons

1.2.1 The 2 occupants sustained fatal injuries on impact.

## 1.3 Damage to aircraft

1.3.1 The aircraft was destroyed.

## 1.4 Other damage

1.4.1 Nil other damage.

## 1.5 Personnel information

1.5.1

| | | |
|---|---|---|
| Pilot: | male, aged 41 | |
| licence and rating: | Commercial Pilot Licence (Aeroplane), single-pilot multi-engine instrument rating | |
| aircraft ratings: | Piper PA28, PA28R, PA31, PA34<br>Cessna C206, C207, C402<br>SA227 Metro, Saab SF34 | |
| medical certificate: | Class 1, issued 2 November 2004 and valid until 1 May 2005 | |
| last biennial flight review: | 8 May 2004 | |
| last instrument rating renewal: | 8 May 2004 | |
| last competency assessment: | 15 November 2004 | |
| flying experience: | total, aeroplane | 2560 hours |
| (as at 29 November 2004) | total, multi-engine | 1715 hours |
| | PA34 type | 180 hours |
| | last 90 days | 11 hours |
| | last 7 days | nil |
| | total, instrument flight time | 444 hours |
| | actual[3] | 262 hours |
| | last 90 days | 4.6 hours |
| duty time: | | 2.5 hours |
| rest before duty: | | over 48 hours |

[3] Time accrued in actual instrument meteorological conditions, not simulated.

1.5.2 The pilot started flying in 1979 and obtained his Commercial Pilot Licence (Aeroplane) in June 1987, and multi-engine instrument rating in January 1997. He joined a regional airline as a co-pilot in April 1999 and for the next 2 years flew extensively around New Zealand, including many flights into New Plymouth, mostly under IFR. In 2001 the pilot returned to his original vocation and started flying part-time for the operator in June 2003.

1.5.3 The pilot obtained his PA34 type Seneca rating in July 1995. While flying for the operator the pilot primarily flew PA34-200T Seneca II ZK-JAN. Before the accident the pilot had flown ZK-JAN to New Plymouth on 4 occasions, including 2 flights in August 2004.

1.5.4 Civil Aviation Rules directed that pilots cannot exercise the privileges of their instrument ratings unless, among other requirements, they have within the preceding 3 months either successfully completed an instrument rating examination or flown not less than 6 hours' instrument time.[4] The pilot did not meet these requirements.

1.5.5 The pilot's fellow workers and pilots expressed respect for him and thought he was unlikely to take risks. The pilot's last routine assessment and instrument rating renewal was flown on 8 May 2004, the examiner noting a "good check to a high standard". The operator and the family of the pilot reported him to be well rested and his normal self on the morning of the flight.

## 1.6 Aircraft information

1.6.1 ZK-JAN was a Piper PA34-200T Seneca II aeroplane, serial number 34-8070027, manufactured in the United States in 1980. The Seneca was a 6-seat, low-wing, twin-engine aeroplane fitted with 2 Teledyne Continental TSIO-360-EB engines; the left engine was serial number 826756-R, and the right engine was serial number 312001. The aeroplane had a retractable undercarriage.

1.6.2 ZK-JAN was imported into New Zealand from Australia in November 1996 and the operator purchased the aircraft in June 2000. It was issued with a Certificate of Airworthiness in the standard category. The certificate was non-terminating, subject to the aircraft being maintained and operated in accordance with the approved flight manual for the type. Records showed that the aircraft was maintained in accordance with the operator's approved maintenance programme, and on 8 November 2004 a routine 100-hour check and annual review of airworthiness were recorded as being completed at 4684 total aircraft hours.

1.6.3 Records showed that up to the day of the accident ZK-JAN had accumulated 4703 hours and had about 35 hours to run to the next scheduled inspection. No outstanding defects were recorded, but a pilot who had flown the aircraft the previous night had advised the operator that the left vacuum pump might not be working properly. However, the right pump was still functioning correctly and powering the associated instruments. This information was reported by the operator as being passed to the pilot before he departed from Nelson.

1.6.4 The vacuum pumps provided pressure to drive the aircraft's directional gyros and attitude indicators. Warning of failure of one or both pumps was provided by a pressure gauge with 2 warning indicators and a warning light. In the event of a double failure, secondary instruments could be used to provide essential flight information until the pilot was able to obtain VMC.

1.6.5 Navigation equipment included 2 very high frequency navigation receivers (VORs), 2 automatic direction finders and one distance measuring equipment. The aircraft was fitted with an autopilot. The navigation, communication and instrument fitment for ZK-JAN meant that it was single-pilot IFR capable.[5]

1.6.6 Calculations showed the aircraft was below its maximum permitted take-off and landing weights, and within the approved centre of gravity limits for the duration of the flight.

[4] Civil Aviation Rule 61.807, dated 1 April 2002. At the time of writing this report, the Rule and currency requirements were being reviewed.
[5] Civil Aviation Rules 91.517 and 91.519, effective 25 November 2004.

## 1.7 Meteorological information

1.7.1 The Meteorological Service of New Zealand provided an aftercast of the weather conditions on Tuesday 30 November 2004. The information is summarised as follows:

**Situation**

A strong south-westerly flow covered New Zealand. Frontal bands embedded in this flow were moving away to the east of New Zealand during the morning. A small low was moving eastward across the south Tasman Sea.

**Weather in the area New Plymouth to Nelson during the morning**

Conditions were dominated by the deep and strong south-westerly airstream. In the Taranaki area, cloud increased at New Plymouth Airport during the morning, and was reported at 0800 and 0900 as scattered at 2500 ft, and then becoming few at 2500 ft and broken at 3000 ft at 1000 and 1100. Visibility was reported as 30 km through the morning.

Conditions at Nelson Airport throughout the morning were good with cloud reported as generally few at 5500 ft and scattered at 30 000 ft. A fresh south-westerly wind developed at the surface at Nelson Airport during the morning.

**Likely conditions in the vicinity of Mount Taranaki**

Because of the onshore flow onto Cape Egmont area, the mountain was most likely well covered in cloud.

It is likely there was a layer of broken to overcast cumulus (CU) / stratocumulus (SC) with a base around 2500 ft and tops estimated at 8000 ft. It is possible the base shelved a little lower on the windward side of Mount Taranaki and possibly a little higher in the lee of the mountain.

Due to the unstable sounding from Paraparaumu at 1000, it is possible that towering CU (TCU) could have been embedded within the deck of CU / SC, with TCU bases around 2500 ft and tops to about 10 000 ft possible.

Satellite imagery indicated the presence of some middle to high level cloud covering much of the south-west of North Island, including Mount Taranaki. The base of this cloud in the vicinity of Mount Taranaki is estimated to be about 15 000 ft to 20 000 ft.

Enroute from just west of Egmont to Nelson, skies were fairly clear with fast moving areas of CU / SC.

**Winds and turbulence**

Data taken from the 0700 balloon flight from New Plymouth indicated south-west winds of 45 knots (kt) to 50 kt below 10 000 ft. These had decreased a little by 1300.

A SIGMET (significant meteorological report) for turbulence was valid throughout the morning forecasting isolated severe turbulence over North Island below 9000 ft.

Clearly evident from the satellite image at 1000 are streets of low level wave cloud over and to the east of the northern half of North Island. It is likely there was also some wave activity about and in the lee of Mount Taranaki with associated down drafts and turbulence, probably at least moderate in intensity but possibly severe as per the SIGMET.

1.7.2 The routine meteorological report (METAR) for New Plymouth Aerodrome issued at 0900 reported the surface wind as 250º True (T) at 14 kt, visibility 30 km, scattered cloud at 2500 ft, temperature 14º Celsius (C) and the QNH as 1003 hectopascals. The 1000 METAR recorded the surface wind as 260º T at 12 kt, visibility 30 km, cloud few at 2500 ft and broken at 3000 ft, temperature 14º C and the QNH as 1004 hectopascals.

1.7.3 Witness accounts of the weather at the time of the accident were obtained from about 10 people located around Mount Taranaki. The weather was generally described as strong westerly winds with the mountain surrounded by broken cloud. The amount of cloud increased during the morning. Several of the witnesses reported being able to see the summit at various times during the morning.

1.7.4 The pilot of a light aircraft on a local training flight heard the pilot of ZK-JAN depart from New Plymouth and also change frequency to Christchurch Control. The pilot of the training aircraft reported the cloud base as broken at about 3000 ft. At about 1005 he was asked by the aerodrome controller to listen out for an ELT signal. He climbed his aircraft through a gap in the cloud to about 9000 ft and, once above the cloud layer, flew in the general direction of Mount Taranaki. The pilot tracked the ELT signal to the general area of Mount Taranaki, but he was unable to see the mountain due to extensive cloud moving in from the west.

1.7.5 The crew of a search aircraft reported the wind over the mountain was strong with "big down draughts" on the eastern side. The summit was obscured by cap cloud during the afternoon.

1.7.6 At the time of the accident, the sun was calculated to have been about directly behind the pilot as he flew towards Mount Taranaki, at about 46º above the horizon.

## 1.8 Aids to navigation

1.8.1 Air Traffic Services (ATS) radar recorded most of the flight north from Nelson as described in section 1.1. The last radar return was as the aircraft descended through about 2400 ft about 10 nm south of New Plymouth Aerodrome, after having flown around the eastern side of Mount Taranaki.

1.8.2 The recording of the return flight to Nelson commenced at 0948:38 as ZK-JAN was climbing past 6700 ft, 9 nm (17 km) south of New Plymouth Aerodrome. At this time the aircraft was flying on a track that would have taken it about 3 km east of the summit of Mount Taranaki. Groundspeed during the climb averaged about 115 kt (see Figure 1).

1.8.3 At 0951:26, about 20 seconds after ZK-JAN was levelled at 8300 ft, the aircraft track veered right by about 20º. This new track took ZK-JAN directly towards the summit of the mountain. At 0951:45 the groundspeed started to decrease steadily and, over the next 90 seconds, went from a maximum of 119 kt to 100 kt. Over the next 60 seconds, the groundspeed decreased further to 76 kt. After levelling at 8300 ft, the aircraft remained at about this altitude until radar information was lost.

1.8.4 The last radar recording was at 0954:13 as ZK-JAN was near the summit of Mount Taranaki. The recorded altitude was 8400 ft and the groundspeed was 77 kt.

## 1.9 Communication

1.9.1 All relevant radiotelephone communications from ZK-JAN are included in section 1.1 of the report.

## 1.10 Aerodrome and airspace information

1.10.1 New Plymouth Aerodrome was located within the New Plymouth Control Zone, which was classified as class D controlled airspace. South of the New Plymouth Control Zone, airspace above 6500 ft was also classified as class D controlled airspace. ATS controllers in the Airways Centre in Christchurch managed this latter section of airspace.

1.10.2 In class D airspace, IFR and VFR flights were permitted and all flights were provided with an air traffic control service. Separation was provided between IFR flights, but not between IFR and VFR flights. Pilots were provided with general traffic information on other flights in the airspace that might conflict.[6]

1.10.3 Outside of 13.5 nm from New Plymouth, in the area of Mount Taranaki, the airspace became class G uncontrolled airspace below 9500 ft.

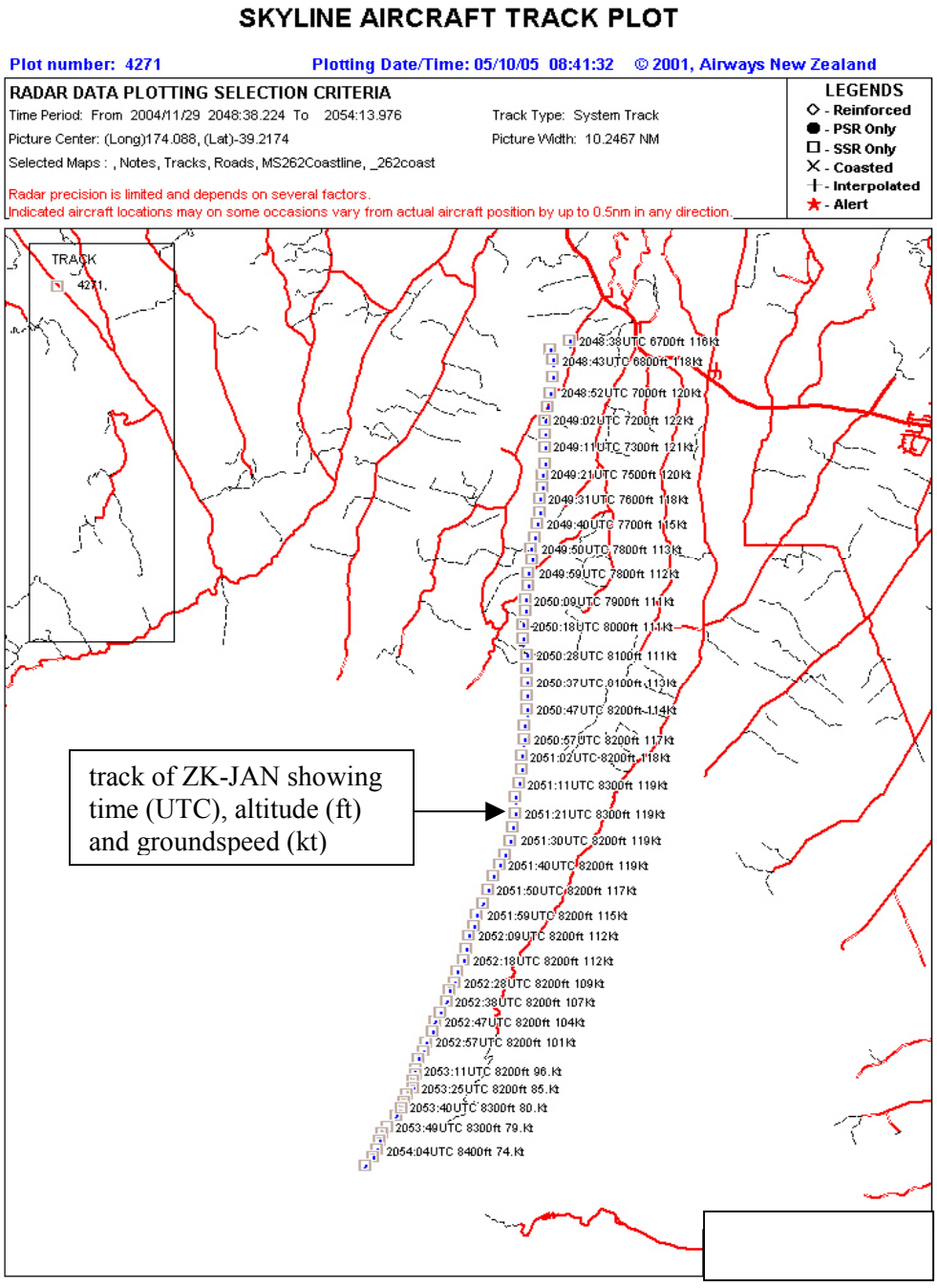



**Figure 1**
**Radar track plot for ZK-JAN**
**(Courtesy of Airways Corporation of New Zealand)**

[6] Aeronautical Information Publication New Zealand, ENR 1.4 ATS Airspace Classification, dated 25 November 2004.

## 1.11 Flight recorders

1.11.1 ZK-JAN was not fitted with any flight recorders, nor was it required to be.

## 1.12 Wreckage and impact information

1.12.1 The accident site was on the summit of Mount Taranaki, on the eastern slope of the cone within the crater rim. The site was at an elevation of about 8100 ft (2470 m), or about 150 ft (50 m) below the summit. The summit was 18 nm (33 km) south of New Plymouth Aerodrome

1.12.2 ZK-JAN had impacted on the 35º ice-and-snow covered slope in an erect and almost wings level attitude. The aircraft lay on a south-south-westerly heading. The aircraft had penetrated about one metre into the snow and ice, leaving most of the fuselage and wings exposed. Because of poor weather the recovery team was unable to reach the aircraft until Monday 6 December 2004, 6 days after the accident, by which time the aircraft was partly covered by recent snow and ice (see Figure 2).

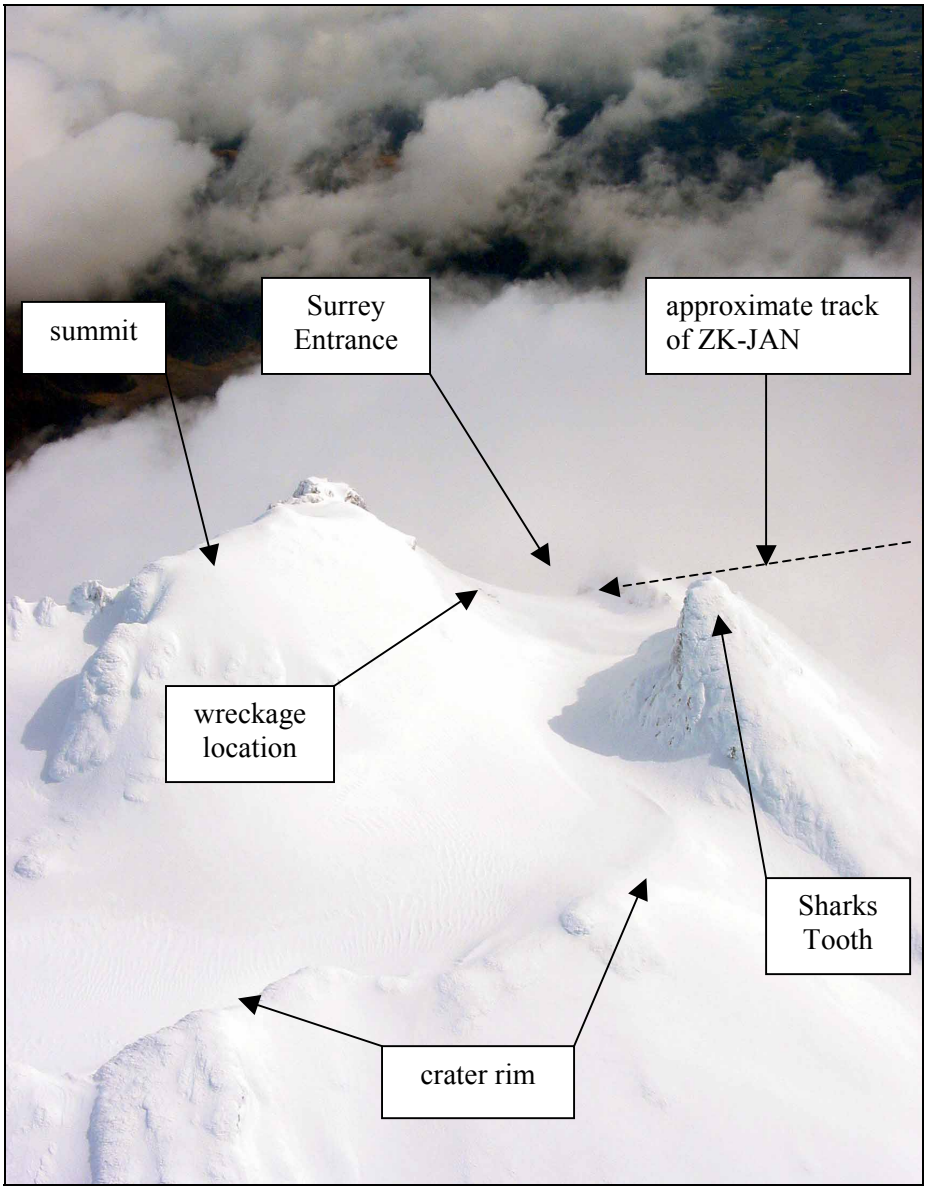



**Figure 2**
**Accident site**
**(summit of Mount Taranaki)**

1.12.3 All the aircraft components were accounted for at the site. The aircraft alignment indicated that it had crossed the crater wall between the Surrey Entrance and the Sharks Tooth, a prominent rock feature directly east of the accident site. The crest of the crater wall, about 150 m to the north-east of the impact point, was about the same elevation as the accident site.

1.12.4 The aircraft cabin was severely compressed, and the rear of the fuselage remained attached by control cables only. The undercarriage was in the retracted position and the flaps were fully up.

1.12.5 Both occupants were found restrained in their seats, the pilot in the front left seat and the engineer in the front right. A pen was found in the pilot's right hand, and a clipboard resting on his lap. The clipboard held the remnants of the operator's standard plan templates for IFR flights between Nelson and New Plymouth, and return. The templates were dated 10 June 2004 and contained information such as radio and navigation frequencies and standard route information.

1.12.6 The template for New Plymouth to Nelson had noted at the top of the page: "NP – NS 8000´ Radar monitored".[7] The standard route information is summarised as follows:

| From | To | Minimum safe altitude | Track | Distance | Time | Altitude |
|---|---|---|---|---|---|---|
| NP | SELTA | 3000 ft | 132º | 27 nm | 0:11 | 8000 ft |
| SELTA | NS | 5800 ft* | 185º | 127 nm | 0:51 | 8000 ft |

*Minimum Reception Altitude 10 000 ft

1.12.7 SELTA was a reporting point located 27 nm from New Plymouth on a track of 132º magnetic. The direct New Plymouth – Nelson track was shorter than the New Plymouth – SELTA – Nelson track, but it had a higher minimum safe altitude of 10 300 ft due to the proximity of Mount Taranaki.

1.12.8 The following trapped instrument readings, control positions or information were noted:

| | |
|---|---|
| <u>Pilot's instrument panel</u> | |
| Attitude indicator | 10º left bank, 20º pitch nose down |
| Direction indicator | 188º |
| Course deviation bar | about central |
| Altimeter | 8400 ft, 1002 set on the subscale |
| Relative magnetic bearing indicator | #1 VOR pointing about 10º left of aircraft heading<br>#2 VOR pointing about directly behind aircraft |
| The pitot heat switch was found ON. | |
| <u>Right side instrument panel</u> | |
| Attitude indicator | 20º left bank, 0º pitch |
| Altimeter | 8240 ft, 1002 set on the subscale |
| <u>Throttle quadrant</u> | |
| Both throttle levers | set to about 80% |
| Both propeller levers | full fine |
| Both mixture levers | full rich |

1.12.9 The wreckage of ZK-JAN was removed from the site and examined further. The 2 propellers had separated from the engines with the crankshaft fractures consistent with overload failure. The blades of each propeller were bent backwards from near the hub. The propeller governor lever for the left engine was found set at the maximum setting. The position of the governor for the right engine could not be determined.

[7] New Plymouth to Nelson, 8000 ft, under radar monitoring.

1.12.10 Examination of the propellers at an approved overhaul facility found no evidence of any pre-existing fault. The overhaul facility confirmed that the consistency of the general damage to the propellers was indicative of both propellers rotating under power at time of impact.

1.12.11 The autopilot annunciator panel was removed for more detailed examination. Evidence of filament hot stretch was found on the lights titled AP (autopilot), FD (flight director) and HDG (heading). Hot stretch is an indicator that a bulb was illuminated at time of impact and, therefore, shows that it was switched on or activated. The absence of hot stretch does not, however, mean that the bulb was not illuminated. Therefore, the hot stretch found on the autopilot annunciator panel for ZK-JAN was indicative of the autopilot being engaged and flying the aircraft on a heading set by the pilot.

## 1.13 Medical and pathological information

1.13.1 Post-mortem examinations of the occupants found that they had sustained extensive injuries that would have been immediately fatal. The examinations, including toxicology tests, did not reveal any evidence of incapacitation or impairment.

1.13.2 The pilot's last medical examination was completed on 2 November 2004 and did not identify any medical problem relevant to the accident.

## 1.14 Fire

1.14.1 There was no fire.

## 1.15 Survival aspects

1.15.1 The autopsies showed that the occupants' injuries were consistent with severe longitudinal deceleration resulting from the aircraft impacting on the steep slope of the mountain in a level attitude. The injuries were not survivable.

1.15.2 The aircraft's ELT activated on impact and provided a general area for search parties to focus on. However, due to the inherent inaccuracy of the ELT signal and the steepness of the terrain, the search area was initially very large.

## 1.16 Additional information

**Meteorological minima**

1.16.1 For flight under VFR, a pilot was required to remain in VMC in accordance with prescribed weather minima.[8] The minima varied according to airspace categorisation and height above terrain. For class D controlled airspace, a pilot was required to remain clear of cloud by at least 2 km horizontally and 1000 ft vertically, and maintain a minimum of 5 km visibility.

1.16.2 For class G uncontrolled airspace, the distance from cloud requirement varied depending on the aircraft's height above terrain and mean sea level. If above 3000 ft AMSL or 1000 ft above terrain, whichever was the higher, the minima were the same as for class D airspace. If at or below either of these datum, a pilot was required to remain clear of cloud and in sight of the surface. The minimum visibility requirement remained at 5 km.

1.16.3 With some exceptions such as take-offs and landings, no pilot was to operate an aircraft under VFR at a height less than 500 ft above the surface.[9]

[8] Civil Aviation Rule 91.301, dated 25 November 2004.
[9] Civil Aviation Rule Part 91.311, dated 25 November 2004.

**Terrain awareness and warning system (TAWS)**

1.16.4 On 6 June 2003 a Piper PA31-350 Navajo Chieftain impacted on terrain during an instrument approach to Christchurch.[10] The pilot and 7 passengers were killed and 2 passengers were seriously injured. On 2 February 2005 a Piper PA34-200 Seneca struck Mount Tauhara near Taupo during an instrument approach.[11] The pilot and 2 passengers were killed.

1.16.5 The investigations into those 2 accidents identified them as controlled flight into terrain (CFIT) type events. Both flights were being flown single-pilot under IFR and in both accidents the pilots were probably flying in instrument meteorological conditions. Further, in both accidents it was determined that had a TAWS been fitted to the aircraft, the pilots would probably have received a warning in sufficient time to take appropriate avoiding action.

1.16.6 The main feature of TAWS is predictive terrain warning. In addition to audio alerts for the pilot, the system can include a terrain situation awareness display. This capability enhances the pilot's general awareness and provides a final defence against flying unintentionally towards terrain.

1.16.7 With the assistance of a commercial manufacturer of TAWS equipment, a profile of the flightpath of ZK-JAN was calculated using ATS radar information. This was overlaid onto the local area terrain database to determine what information a pilot should receive in similar circumstances. It was calculated that a pilot should receive 2 audio alerts; the first advising "Caution Terrain" at 41 seconds before calculated impact and, a second advising "Terrain Terrain Pull Up" at 30 seconds before impact. Where an aircraft was also fitted with a visual display, a pilot should be shown a depiction of the mountain ahead (see Figure 3).

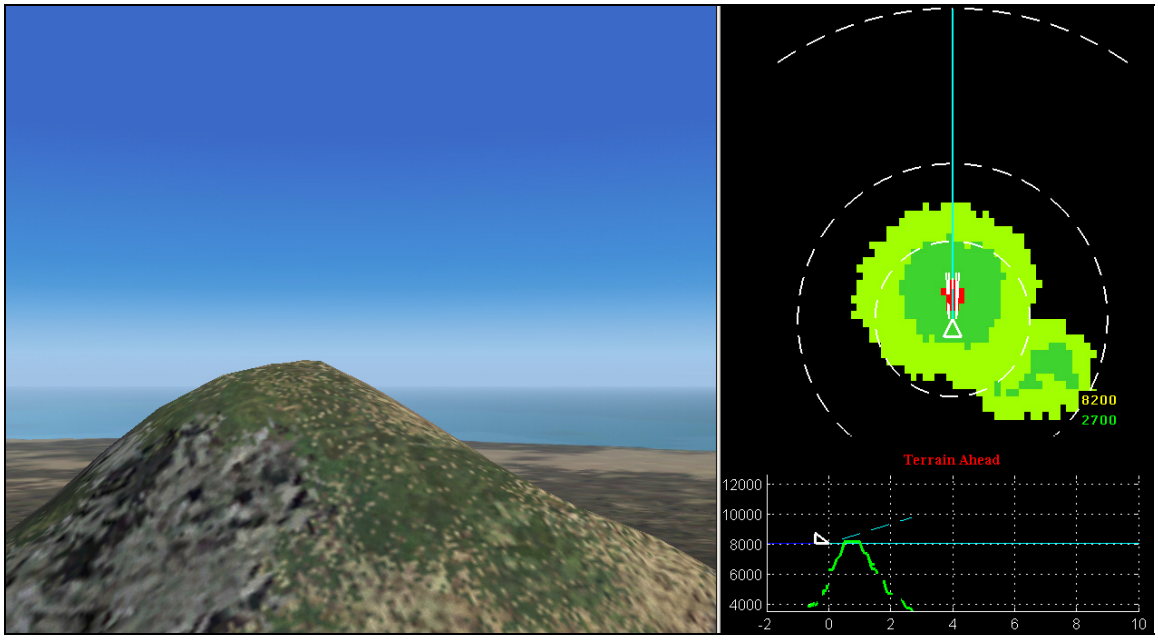



**Figure 3**
**Depiction of TAWS imagery 30 seconds before impact**

[10] Refer TAIC Aviation Occurrence Report 03-004, Piper PA31-350 Navajo Chieftain ZK-NCA, controlled flight into terrain, near Christchurch Aerodrome, 6 June 2003.
[11] Refer TAIC Aviation Occurrence Report 05-003, Piper PA34-200T Seneca ZK-FMW, controlled flight into terrain, 8 km north-east of Taupo Aerodrome, 2 February 2005.

1.16.8 As a result of the investigations into the 2 accidents referred to in paragraph 1.16.4, recommendations were made to the Director of Civil Aviation regarding the need for aircraft such as ZK-JAN, which operate under Part 135[12] of Civil Aviation Rules and can be flown single-pilot under IFR, to be fitted with an approved terrain warning system. At the time of writing this report, the Civil Aviation Authority was preparing proposed changes to Civil Aviation Rules for Part 135 operations, to require aircraft being operated under IFR to be fitted with a terrain awareness and warning system.

# 2 Analysis

2.1 The flight was a routine commercial charter to carry an engineer and parts from Nelson to New Plymouth, and return. The pilot was familiar with the route, having flown it numerous times before.

2.2 The pilot appropriately informed the operator that he did not meet the currency requirements to be able to fly under IFR. However, after checking the available weather information on the morning of the flight, the operator said the pilot was comfortable that he could conduct the flight under VFR. After departing from Nelson, the pilot remained below controlled airspace until approaching New Plymouth.

2.3 The radar data plot showed ZK-JAN was flown around the eastern side of Mount Taranaki to New Plymouth. Given the wind conditions recorded at New Plymouth at this time, it is likely that the pilot would have encountered some turbulence in the lee of the mountain as he approached the aerodrome. This may have influenced his flight path selection for the return flight. However, there was no evidence that the pilot experienced any difficulty in reaching New Plymouth.

2.4 After completing the engineering task, the pilot and engineer re-boarded ZK-JAN. There was no urgency for the return flight. The pilot's radio transmissions gave no indication that he was under any stress as he taxied and departed from New Plymouth for Nelson.

2.5 Mount Taranaki lies on the direct track between New Plymouth and Nelson and is the highest feature in the area at 8259 ft (2518 m). The pilot should have been able to see the lower slopes of the mountain as he departed from New Plymouth and his initial selection of track would indicate he was intending to fly to the east of it again. By asking for a clearance to operate up to 8500 ft, the pilot was apparently planning to fly higher as he passed the mountain. This may have been to mitigate the effect of any turbulence that might be present, or he possibly intended to climb through the broken cloud layers to get a better view of the top of the mountain.

2.6 Approaching 6500 ft, the pilot correctly obtained ATS clearance to operate up to 8500 ft in controlled airspace as he progressed south. The controller, by identifying ZK-JAN on radar and advising that "you will be radar monitored", was agreeing to keep a general eye on the progress of the aircraft but not to actively control it. ATS was not required to provide any form of separation for ZK-JAN while it was under VFR.

2.7 The pilot of ZK-JAN, having been "cleared up to 8500 [ft] VFR" by the controller, was able to manoeuvre his aircraft and navigate around any cloud that surrounded the mountain. He was also able to fly close to the summit if he wished. The pilot was solely responsible for maintaining the required visual minima and safe separation from terrain for the flight.

2.8 Once beyond 13.5 nm from New Plymouth, ZK-JAN entered uncontrolled airspace. ATS would have continued to observe the general progress of the aircraft as it flew towards Nelson, but again separation and maintaining the required visual minima remained the responsibility of

[12] Air transport operations and commercial transport operations using aeroplanes with a seating configuration of 9 or less seats and a maximum take-off weight of 5700 kg or less, and helicopters.
[13] Air transport operations and commercial transport operations using aeroplanes with a seating configuration of 9 or less seats and a maximum take-off weight of 5700 kg or less, and helicopters.

the pilot. The VFR minima also remained the same at 2 km horizontally and 1000 ft vertically from cloud with a minimum visibility of 5 km. Only when within a few hundred metres of the terrain of Mount Taranaki did the minima change to requiring the pilot to remain clear of cloud and in sight of the surface.

2.9 The discovery of the light filament hot stretch on the autopilot AP and FD annunciator lights, and the finding of the pen in the pilot's hand, indicate that the aircraft was probably being flown on autopilot at this time. The positioning of the 2 VOR needles on the instrument panel was consistent with the pilot selecting the #1 VOR to Nelson and the #2 VOR remaining on New Plymouth. The course deviation bar being about central and the hot stretch on the autopilot HDG annunciator light were also consistent with the autopilot heading being selected to intercept or follow a VOR track to Nelson.

2.10 The radar recorded small changes only in track as the aircraft was climbed. The 20º turn to the right about 20 seconds after ZK-JAN was levelled at 8300 ft was probably deliberate as it would require positive controlling of the aircraft to turn it through 20º and then remain steady on the new track for the next 3 minutes.

2.11 The turn would have headed the aircraft further into the prevailing strong south-westerly wind, possibly accounting for the initial reduction in groundspeed. But for the groundspeed to get as low as 74 kt, the aircraft probably also entered a downdraught due to now being in the lee of the mountain. To hold level in a downdraught, the nose of the aircraft would need to be raised, causing the airspeed to decrease.

2.12 However, there was no evidence that the aircraft stalled as it approached the summit. With a 40-50 kt headwind component and a groundspeed of 74 kt, the aircraft was still well above its stall speed when it disappeared from radar. Further, the aircraft's altimeter readings matched the radar transponder altitude and no descent was recorded that could be associated with a stall. Rather, the last 45 seconds of radar information recorded a slight climb followed by the aircraft holding level at 8400 ft. There was also a small increase in groundspeed.

2.13 Finding the aircraft's pitot heat switch selected ON would indicate that there was visible moisture present as ZK-JAN flew towards Mount Taranaki. This does not confirm that the aircraft was being flown through cloud at the time, rather that cloud was present in the area.

2.14 An increase in icing on the airframe could also have caused the aircraft to lose speed. However, any ice forming on the wings should have quickly been identified by the pilot and power increased to counter its effects. For the reasons stated in paragraph 2.12, combined with finding the throttles in a position consistent with cruise power, it was unlikely that the aircraft stalled due to icing as it approached the summit.

2.15 Throughout the reduction in groundspeed, the aircraft remained level at 8200 ft until the slight climb before impact. This climb, 200 ft over about 40 seconds, was not consistent with the pilot positively climbing the aircraft to clear the top of the mountain, but was probably a response to the effect of a downdraught decreasing and the airspeed starting to increase.

2.16 The accuracy at which the aircraft remained level at 8200 ft was indicative of the autopilot's height-holding facility being engaged. The lack of hot stretch on the light filament for the altitude-holding capability on the autopilot does not eliminate the possibility of this light being illuminated at the time of impact.

2.17 To have held level as ZK-JAN flew through the area of downdraught, the autopilot, or pilot, would have had to raise the nose of the aircraft. As airspeed reduced this would have increasingly obscured the pilot's view of what lay directly in front of him.

2.18 Why the aircraft was turned right is not known. The pilot may have wanted to fly closer to the summit of Mount Taranaki, or he could have been focused on flying directly towards Nelson and was unaware of the proximity of the mountain. Whatever the reason, the new track took the aircraft directly towards the summit of the mountain.

2.19 The evidence does not support the possibility of the pilot intending to conduct a deliberate low flypast of the summit. Firstly, the pilot would most certainly have been aware of the windy conditions and been monitoring his airspeed and groundspeed relationship. If the pilot could see the approaching summit he would be expected to have given himself sufficient space to manoeuvre away from the danger and not get caught in any turbulence near the summit, including downdraughts. Secondly, the aircraft was probably being flown on a pre-selected heading on autopilot. If the pilot intended to conduct a low flypast of the summit, he would most likely have been manually flying the aircraft. However, the possibility of a deliberate low flypast cannot be fully eliminated.

2.20 There was a discrepancy of nearly 300 ft between the reading found on the pilot's altimeter and the actual accident site elevation. While 300 ft may seem excessive, this should be treated with caution as some inaccuracy can be expected, especially in a mountainous environment, and the sudden and violent impact into the snow-covered slope may have affected the reading. Further, the subscale setting found on the pilot's altimeter did not correspond to the QNH passed on by the radar controller – adding to any initial inaccuracy of the instrument reading.

2.21 The QNH pressure advised by the radar controller was a general area pressure setting. The pilot may have wished to leave the local New Plymouth pressure set as he possibly considered this to be more accurate or relevant for the flight to Nelson. Nevertheless, the possibility that the pilot intended deliberately to overfly the top of the mountain by sole reference to his altimeter and other instruments, with no visual reference, was considered unlikely.

2.22 The sun was above and behind the pilot as he approached the summit, so this was unlikely to have been a factor in the accident.

2.23 Considering the meteorological reports, and observations made by pilots flying at the time or shortly after, there was probably extensive cloud present around the mountain, possibly extending above the summit. With the upper slopes of the mountain covered in snow and ice, it may have been difficult to distinguish the upper slopes from the surrounding clouds. The pilot may, therefore, have lost visual reference with the summit as ZK-JAN approached it. Like any visual illusion, the pilot may also have not known he had lost visual reference and thought he continued to have the required minimum visibility.

2.24 As ZK-JAN neared the summit from the leeward side, it probably encountered increasing turbulence, including local downdraughts. The location and attitude of the wreckage were consistent with the aircraft being in controlled flight and being caught in a downdraught as it passed over the ridge line to the south of Surrey Entrance immediately before impact. The turbulence, however, was unlikely to be severe as it would have dislodged the clipboard sitting unrestrained on the pilot's lap.

2.25 There was no evidence of any pilot incapacitation or problem. The pilot had recently passed his routine medical assessment and post-mortem examinations identified no contributory factors. The finding of the pen in the pilot's hand was indicative of the aircraft being flown by autopilot and the pilot being ready to update his flight log.

2.26 There was no evidence of an aircraft mechanical fault contributing to the accident. Post-accident examination of the propellers and engines indicated that both engines were under power at the time of impact. The attitude and direction indicators were about correct for the impact attitude of the aircraft. If a double vacuum failure had occurred, and this was very unlikely, there were numerous indicators to alert the pilot of this.

2.27 The standard plan found on the pilot's lap was primarily designed for flying the route under IFR, but could still provide the pilot with useful route information if flying under VFR. For example, the navigation aids were properly tuned to assist his navigating the aircraft to Nelson. Therefore, the possibility that the pilot did not have the required visual references and was flying by primary reference to his instruments cannot be excluded. However, the pilot never intercepted or followed the published track from New Plymouth to SELTA. If the pilot was not in VMC and was flying solely by reference to instruments, it would be likely that he was unaware of his proximity to Mount Taranaki and may have thought he had passed it.

2.28 Whether the pilot either intentionally or unintentionally and unknowingly lost visual reference with the mountain will never be known. However, this was another accident that could possibly have been prevented had the aircraft been fitted with a TAWS. Had the pilot unintentionally lost visual reference, a TAWS warning could have reminded him of his proximity to the mountain in sufficient time to allow him to take avoiding action.

2.29 The benefit of TAWS for Part 135 IFR operations has been widely acknowledged and the fitment of this equipment will provide another defence against CFIT accidents and improve air transport safety. The Commission continues to encourage the fitment, and use, of TAWS equipment to aircraft operated under Part 135 and capable of being flown under IFR, either voluntarily or through legislative requirement.

# 3 Findings

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

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

3.2 The pilot was familiar with the aircraft and route to be flown on the day of the accident.

3.3 The pilot did not meet the requirements to fly under IFR.

3.4 The weather was suitable for flight under VFR.

3.5 The aircraft had a valid Certificate of Airworthiness and was recorded as being serviceable for the flight.

3.6 The flight from Nelson to New Plymouth was completed without incident.

3.7 The pilot intended to return to Nelson along a similar route but at a higher altitude, probably due to the weather conditions or to view the mountain.

3.8 The aircraft was probably being flown on autopilot as it approached Mount Taranaki.

3.9 There was extensive cloud around the mountain that would have affected the conduct of the flight and possibly masked the location of the summit.

3.10 The pilot probably, and possibly unknowingly, lost visual reference with Mount Taranaki due to either cloud obscuring the mountain or the nose of the aircraft obstructing the pilot's view.

3.11 There was no evidence of any aircraft defect or pilot medical problem that could have contributed to the accident.

3.12 The aircraft probably encountered a downdraught as it crossed the crater rim, causing the aircraft to descend and impact on the slope in an erect manner.

3.13 Had the aircraft been fitted with TAWS, the equipment should have provided the pilot with a timely alert to allow him to take effective avoiding action.

# 4. Safety Recommendation

4.1 On 28 October 2005 the Commission recommended to the Director of Civil Aviation that he:

4.1.1 further promote the introduction of a Civil Aviation Rule requiring current and new Part 135 aircraft capable of being operated under IFR to be fitted with an approved terrain awareness and warning system at the soonest opportunity. (108/05)

4.2 On 17 November 2005 the Civil Aviation Authority replied to the preliminary safety recommendation, which remained unchanged and became final:

4.2.1 The Director will accept this recommendation. He has already committed to a time frame for preparing a draft Final Rule for the Ministry of Transport. This will require the fitting of TAWS equipment to aircraft first entering the New Zealand Register at the earliest opportunity

Approved on 16 December 2005 for publication

Hon W P Jeffries
**Chief Commissioner**

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