Report 07-011, Cessna A152 Aerobat, ZK-KID, impact with terrain,
Te Urewera National Park, 23 kilometres south-east of Murupara, 26 October 2007

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 07-011

Cessna A152 Aerobat
ZK-KID

impact with terrain

Te Urewera National Park
23 kilometres south-east of Murupara

26 October 2007

Abstract

At 1555 on Friday 26 October 2007, Cessna A152 ZK-KID was on a cross-country navigation training flight when it entered a narrow and rising valley at low level from which escape was impossible. As the instructor attempted to manoeuvre out of the valley, the aircraft struck several trees. The instructor was killed and the student suffered serious injuries, but was able to walk out and summon assistance.

The instructor did not have the training and skills necessary to recognise the dangers associated with flying over mountainous terrain or to make an early decision to avoid entering the valley. The low flying leading up to the accident was not approved or justified.

In the past 15 years the Commission has investigated 5 accidents where poor decision-making coupled with inadequate mountain-flying skills has contributed to the deaths of 29 people. The Commission has previously made recommendations to the Director of Civil Aviation that training syllabi for aeroplane pilots be amended to include mandatory mountain or adverse terrain training. The Commission has again recommended that the Director address this significant safety issue.

Cessna A152 Aerobat ZK-KID
(Courtesy of Bay Flight International Limited)

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Abbreviations

CAA	Civil Aviation Authority of New Zealand
CPL	commercial pilot licence
ELT	emergency locator transmitter
km	kilometre(s)
MoT	Ministry of Transport
NPRM	Notice of Proposed Rule Making
PPL	private pilot licence
SAR	search and rescue
TAIC	Transport Accident Investigation Commission
UTC	coordinated universal time

Glossary

altitude	the vertical distance of a level, a point, or an object considered as a point, measured from mean sea level
empennage	the tail unit of an aeroplane, including the horizontal tailplane, fin and rudder
height	the vertical distance of a level, a point, or an object considered as a point, measured from a specified datum
mountainous terrain	terrain considered to have the following features: • terrain conductive to increased frontal activity or wind shear • high winds, funnel winds, lee waves or severe turbulence • marked pressure differential

Data Summary

Aircraft registration:	ZK-KID
Type and serial number:	Cessna A152 Aerobat, A1520979
Number and type of engines:	one Lycoming O-235-L2C reciprocating engine
Year of manufacture:	1981
Operator:	Bay Flight International Limited
Date and time:	26 October 2007, about 1555[1]
Location:	Te Urewera National Park, 23 km southeast of Murupara latitude: 38° 37.23´ south longitude: 176° 52.32´ east
Type of flight:	cross-country navigation training
Persons on board:	instructor: one student: one
Injuries:	instructor: fatal student: serious
Nature of damage:	aircraft destroyed
Instructor's licence:	commercial pilot licence (aeroplane)
Instructor's age:	21
Instructor's total flying experience:	543 hours (423 hours on type)
Investigator-in-Charge:	I R M^{c}Clelland

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

Factual Information

1.1 History of the flight

1.1.1 On Friday 26 October 2007, an instructor and student from Bay Flight International Limited (the operator) planned to fly a cross-country navigation training exercise, Tauranga – Whakatane – Gisborne – Taupo – Tauranga. The aircraft to be used was ZK-KID, a Cessna A152 Aerobat.

1.1.2 The flight was to be the third cross-country flight flown by the student as part of his commercial pilot licence (CPL) training. The flight was to include instruction on low-level diversions, precautionary landings and lost procedures. It did not include instruction on"low-level flying" or mountain flying instruction for which the instructor was not trained. [2]

1.1.3 Before the flight, the instructor briefed the student on the exercises to be flown and asked him to plan the flight. As part of his planning, the student studied the latest weather and aeronautical information for the flight, and then filed a flight plan with air traffic services. The student completed a pre-flight inspection of ZK-KID and fuelled the aircraft to full tanks, giving a safe flying endurance of about 3 hours 40 minutes.

1.1.4 At 1404, ZK-KID departed Tauranga Aerodrome and was flown directly to Whakatane for a touch–and-go landing.[3] After departing Whakatane and nearing Opotiki, the instructor asked the student to divert to Lake Waikaremoana, so the student calculated the new heading and started flying towards the lake (see Figure 1). The student completed his diversion planning and at 1505 advised air traffic services by radiotelephone of his amended flight plan.

1.1.5 Arriving overhead the eastern end of Lake Waikaremoana, the instructor gave the student a simulated forced landing,[4] after which the student climbed the aircraft to about 1500 feet above the local terrain. At about 1530, the student attempted to contact Christchurch Information[5] to update his search and rescue (SAR) time.[6] At 1535, unable to contact Christchurch Information, the student called Napier Tower and advised the tower controller of the amended SAR time.

1.1.6 On departing Lake Waikaremoana the instructor initiated the lost procedure exercise by taking control of the aircraft and telling the student not to look outside. According to the student this was done by the student closing his eyes, but likely also involved him lowering his head. The instructor then flew a constant heading and after about 9 minutes told the student to look up and locate their position.

1.1.7 The student took control and established the aircraft in an orbit, which he estimated to be about 600 feet above the floor of a valley. Although there was no cloud in the area, the instructor told the student to simulate a cloud base of 900 feet above ground level and not to fly above 800 feet. After a few minutes, the student identified the village of Ruatahuna, about 20 km northwest of Lake Waikaremoana.

1.1.8 Eyewitnesses in Ruatahuna reported seeing ZK-KID flying around the valley several times before departing in a westerly direction. Two of the witnesses were positioned at the local school on the western slopes of the valley. They recalled the aircraft flying low overhead as it orbited the area. One witness, who had some flying experience, estimated the aircraft to be about 100 feet (30 to 40 m) above the trees located near the school as it flew around. The witness also said he was able to see the outline of a pilot.

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[2] Civil Aviation Rule 91.311 prescribed minimum heights for flight under visual flight rules. For a cross-country flight, this was 500 feet above the surface.
[3] After touching down, the pilot applies power and without stopping takes off again.
[4] Normally by retarding the throttle to simulate an engine failure.
[5] Christchurch Information was the primary air traffic service agency providing flight information services for aircraft operating outside controlled airspace within New Zealand.
[6] The time at which SAR action will be initiated unless amended or cancelled by the pilot.

1.1.9 At about 1550, ZK-KID departed Ruatahuna with the student flying the aircraft and following the general direction of the road to Murupara. The intention was to fly to Galatea Aerodrome, 6 km northeast of Murupara, for a touch-and-go landing before returning to Tauranga.

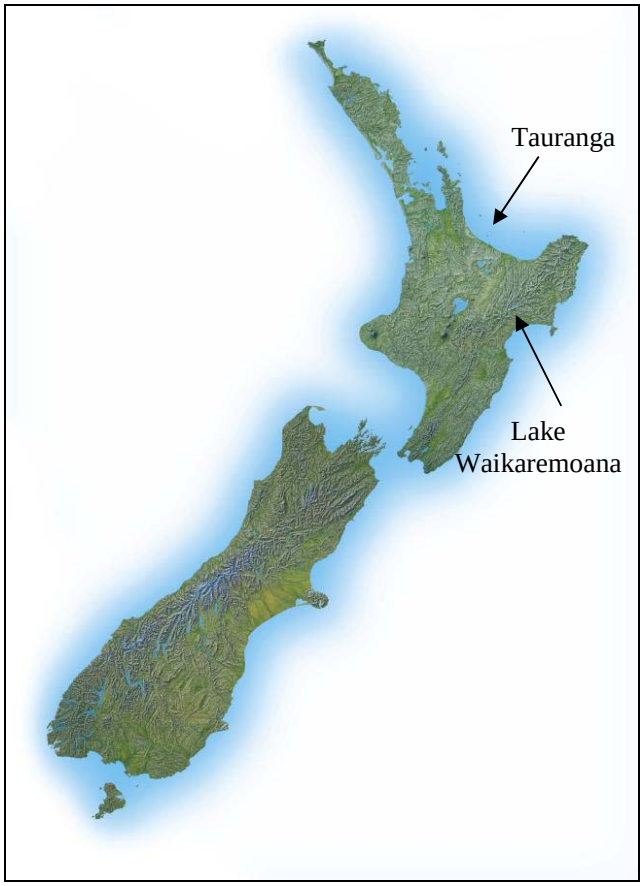

Figure 1
Location map

1.1.10 The student reported that after leaving Ruatahuna the terrain rose steadily, so the aircraft was slowly climbed to maintain the same height above the road (see Figure 2). It also became increasingly windy and turbulent, and after several minutes the instructor took control of the aircraft, estimated by the student to be about 2 or 3 minutes before the accident. No explanation was given for taking control, but the student thought it was because of the turbulence, including localised downdraughts, and to give him a break from flying.

1.1.11 Shortly after passing the village of Papueru and when following a left-hand bend in the road, the student saw that the road ahead turned sharply right and would cross underneath the path of the aircraft. The road climbed up the side of a hill to the right of the aircraft, but the instructor continued flying straight ahead up a valley towards a saddle. The student recalled that the engine was at full power and that he became increasingly concerned that they did not have enough height to get over the saddle. He later estimated they needed another 400 feet to get over the hill.

1.1.12 With the aircraft on the left side of the valley, the instructor started a turn to the right as the aircraft approached the saddle. No words were spoken at this time. The student said that the aircraft remained at a constant altitude during the turn before it struck trees on the eastern side of the valley and fell to the ground nose first. He recalled no indication of the aircraft stalling before it struck the trees,[7] or any change in engine noise or power.

1.1.13 When the student was aware the aircraft was going to strike the trees, he raised his hands to shield his face. He sustained moderate injuries to his hands, face and one foot, but was able to release his harness and move around the aircraft to gain access to the instructor. Concerned about leaking fuel, the student released the instructor's harness and removed her from the aircraft before rendering first aid. However, she had died from her injuries on impact.

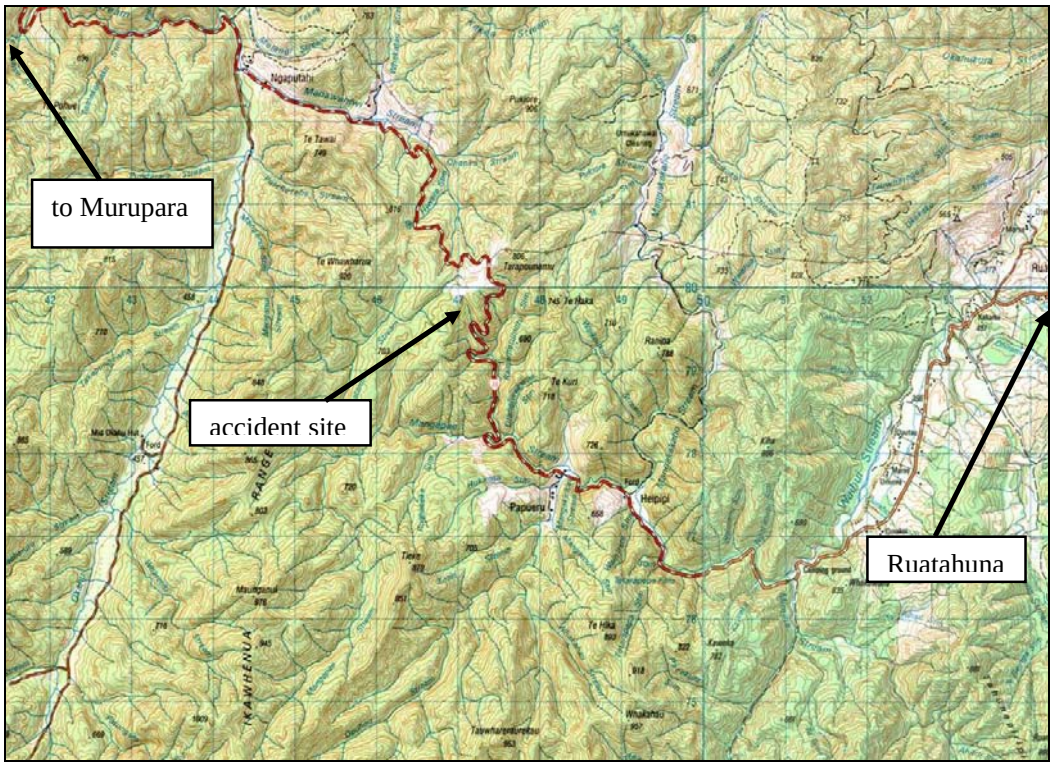

Figure 2
Location map 2

1.1.14 The student removed the fire extinguisher, first aid kit and emergency locator transmitter (ELT) from the aircraft. He thought the ELT had activated but manually turned it on to make sure. He then climbed up the valley to the ridgeline where he found a track that led to the road they had been following. He was soon located by passing motorists and was able to summon emergency services.

1.2 Wreckage and site information

1.2.1 The area around the accident site was not in a designated low-flying area. The accident site itself was on the eastern side of a steeply rising valley that was aligned about north-south; at an elevation of about 2200 feet above mean sea level (see Figures 3 and 4). The tree canopy was estimated to be from 80 to 100 feet high.

[7] An aeroplane stalls when the wing passes the critical angle of attack and the lift force reduces. This is typically indicated by buffeting and the aeroplane attitude suddenly lowering.

1.2.2 The top section of a tree had been broken off about 60 feet above the ground. The diameter of the tree where it had been broken was about 40 cm. Impact marks on the trees indicated that the aircraft had struck the trees while in a steep right turn. The aircraft then fell down to strike the ground in a steep nose-down attitude. Several branches and sections of a tree trunk had entered the aircraft cabin, mainly through the right side.

1.2.3 ZK-KID had incurred significant structural damage as it struck the trees and fell to the ground. All aircraft components were accounted for at the site. Both wings and the horizontal stabiliser displayed severe indentations along their leading edges. The empennage had separated forward of the fin and the left wing had nearly separated at the root. The engine had been forced upwards and backwards into the cabin area. The propeller had separated from the engine.

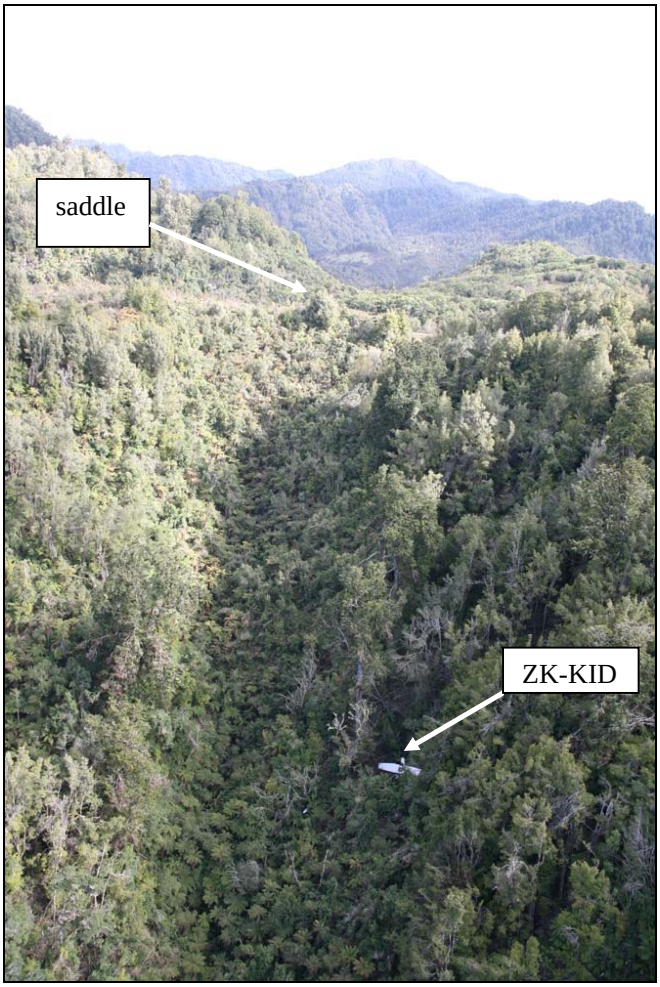

Figure 3
Accident site

1.2.4 The seats and harnesses were still attached to the aircraft and functioned as designed. The fuel tanks in the wings had ruptured and were empty of fuel. However, a smell of fuel was present at the site and some of the foliage around the aircraft had started to "brown-off" 2 days after the accident. There was no evidence of fire. Several control cables had separated and flaps were found fully retracted, which corresponded to the flap selector position.

1.2.5 Useful control positions and instrument readings included:

Throttle	– in full power position
Mixture	– fully rich
Master switch	– off (student reported turning it off post impact)
Ignition	– selected to both
Carbon monoxide indicator	– not activated (no indication of carbon monoxide present)
G meter	– reading +10 g and 0 g[8]

Figure 4
Approach to valley

1.2.6 The aircraft was removed from the site for further examination. Examination of the airframe found no evidence of any pre-existing conditions that might have contributed to the accident. A detailed inspection of the engine also identified no pre-existing faults and it was considered capable of producing full power at the time of the accident. The damage to the propeller indicated it was rotating at high speed when it struck a solid obstacle, either a tree or the ground.

1.2.7 The aircraft was declared a total right-off at an agreed value of $80 000.

[8] "g" is the measure of acceleration. For a pilot, positive g is felt as a force travelling down the body, while negative g is felt travelling up the body. At rest, an item is subject to +1g.

Weather information

1.2.8 On the day of the accident an anticyclone was approaching New Zealand, extending a ridge over the upper North Island and producing a generally westerly flow over the central North Island. The mountain forecast for Te Urewera National Park predicted "brisk westerlies, strong and gusty in exposed places". A cold front was expected to pass over the area early the next day.

1.2.9 The aviation meteorological forecast the student obtained covered the general area of the flight, and predicted generally westerly winds of between 20 and 30 knots (35-55 km per hour). No significant cloud was forecast apart from areas of broken cumulus and stratocumulus west of a line from Tauranga to Rotorua. Occasional moderate turbulence was also forecast at lower levels.

1.2.10 At 1600, about the time of the accident, the automatic weather stations at Tauranga, Rotorua and Whakatane Aerodromes all recorded westerly winds of between 16 and 22 knots (30-41 km per hour).

1.2.11 Witnesses located between Lake Waikaremoana and Murupara reported the weather as fine with some isolated high cloud. They described the wind as generally westerly, light but increasing during the afternoon and gusty in exposed places.

1.3 Aircraft information

1.3.1 ZK-KID was a Cessna A152 Aerobat, serial number A1520979, manufactured in the United States in 1981. The aircraft was an all-metal, high-wing, light aeroplane fitted with a fixed tricycle landing gear. It had seating for 2 and was powered by a single Lycoming O-235-L2C reciprocating engine, serial number L-13661-15, with a power rating of 110 brake horsepower. The engine was driving a standard McCauley 1A103/TCM6958 propeller.

1.3.2 The Cessna A152 Aerobat was approved for aerobatic manoeuvres with flight load factor limits of +6.0 g to -3.0 g with the flaps retracted. The pilot's operating handbook for the A152 recorded a basic stall speed[9] at maximum approved weights of between 36 knots and 40 knots indicated airspeed with the flaps retracted. The variation depended on the weight distribution for the aircraft. At 60º angle of bank the stall speed increased to between 51 knots and 57 knots.

1.3.3 The Civil Aviation Authority of New Zealand (CAA) had issued ZK-KID with a standard category Certificate of Airworthiness. The Certificate was non-terminating provided the aircraft was maintained and operated in accordance with the pertinent manuals.

1.3.4 The maintenance records for ZK-KID showed it had flown 13 575 hours at the time of the accident. The last scheduled servicing, a 100-hour check, had been completed on 20 September 2007 when the aircraft had flown 13 511 hours. The check had been completed in accordance with the Cessna Continued Airworthiness Programme and approved service manual for the aircraft. The aircraft had 36 hours to run to the next scheduled servicing.

1.3.5 The last Annual Review of Airworthiness had been completed on 8 February 2007. On 26 October there were no reported defects that would have affected the conduct of the flight. The aircraft was calculated to be within its centre of gravity limits and about 155 pounds below its 1670 pound maximum weight limit when it departed Tauranga.

[9] Straight and level with power off.

1.4 Personnel information

Instructor:	aged 21
licence and ratings held:	commercial pilot licence (CPL) (aeroplane) instrument rating, category C instructor rating
aircraft ratings:	Cessna A152 and 172 Piper PA28 and PA34
medical certificate:	class 1, valid until 5 December 2007
flying experience:	total aeroplane 543 hours total Cessna 152 429 hours previous 7 days 3.4 hours previous 90 days 93 hours (61 hours on C152)

1.4.1 The instructor started flying in January 2005 and completed all of her flying training with the operator. She gained her private pilot licence (PPL) on 26 October 2005 and her PPL cross-country endorsement on 10 November 2005. After further training, she passed her CPL flight test on 12 May 2006, having accrued nearly 210 hours' flying time.

1.4.2 On 29 November 2006, the instructor obtained her category C flight instructor rating. She had flown some 291 flying hours at this time and her logbook showed she received instruction on maximum rate turns and low flying. In addition to the normal limitations placed on a newly rated category C flight instructor,[10] the operator required instructors to complete at least 6 months and 100 hours of instructional flying under the "direct supervision" of a senior A or B category instructor. This meant that new instructors were required to operate in the local Tauranga area only and were not permitted to undertake cross-country training flights during that time. Training was essentially limited to giving instruction to PPL students on basic flying exercises.

1.4.3 By 11 June 2007 the instructor had flown 100 hours of instructional flying and on 12 June she completed a cross-country check with a senior instructor for the operator. On 1 July 2007 the operator approved her to undertake instructional flights away from the local area, including cross-country training flights.

1.4.4 The instructor's logbook showed she had completed her biennial flight review on 21 August 2007, as part of her night-flying check. She had flown 13 cross-country instructional flights totalling nearly 39 flying hours. A flight on 17 September 2007 covered a similar route to the accident flight. The student who flew this flight with the instructor believed that the weather had been a lot better than on the day of the accident. The student commented that the aircraft had been flown in the valleys but was at an adequate height for the conditions. At the time of the accident, the instructor had flown about 186 hours of instructional flying.

1.4.5 The instructor was regarded by the operator, her fellow instructors and students to be a competent pilot and instructor. No concerns were expressed about her flying ability. She was reported to have been in good health on the morning of the accident.

1.4.6

Student:	aged 19
licence held:	PPL (aeroplane)
aircraft ratings:	Cessna A152 and 172 Piper PA28
medical certificate:	class 1, valid until 5 December 2007
flying experience:	total aeroplane 126 hours total Cessna 152 110 hours

[10] Civil Aviation Rules required instructors to obtain specific approval before being able to instruct advanced exercises such as night flying, aerobatics and spinning.

1.4.7 The student started flying in February 2007, with the operator, and obtained his PPL on 20 June 2007. At the time of the accident he was working towards obtaining his CPL qualification and was undertaking cross-country training as part of that qualification. He had met the instructor soon after starting his flying training and had flown with her on 19 previous occasions. The student reported he was in good health and fit to fly on the day of the accident.

Medical and pathological information

1.4.8 Autopsy results for the instructor identified nothing that could have contributed to the accident. Toxicology results were likewise unremarkable and were negative for any performance impairing substances.

1.5 Organisation and management information

Mountain-flying accidents

1.5.1 About 60% of New Zealand terrain is classified as mountainous (see Figure 5). The rest, with some exceptions, is typically undulating. Pilots generally could spend a majority of their time flying over or at times through topography that was varied, demanding and unforgiving. For those electing to fly through mountainous terrain, such flying in particular placed unique demands on pilots' skills.

1.5.2 On 25 October 1993, ZK-NOM, a GAF N22 Nomad (Transport Accident Investigation Commission (TAIC) Report 93-014), impacted on the Franz Josef Glacier while on a scenic flight from Glentanner to Queenstown. Two pilots and 7 passengers were killed in the accident. The investigation found that neither pilot had received any mountain-flying training and that they had little experience flying in the area.

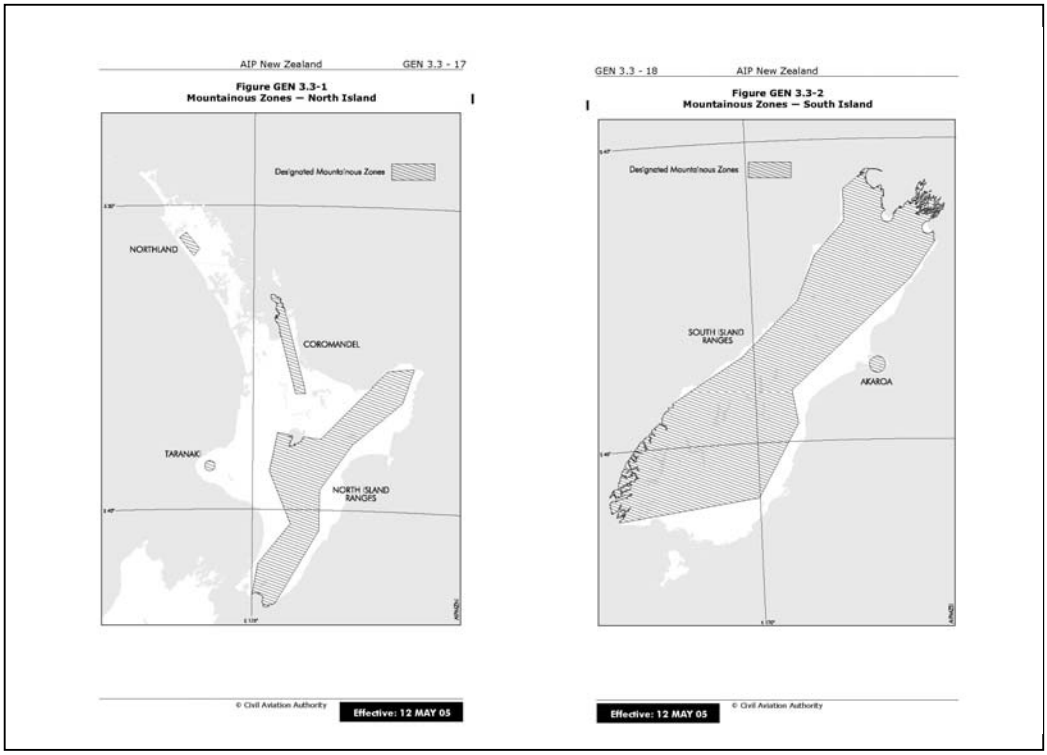

Figure 5
Designated mountainous terrain in New Zealand
(courtesy of Airways New Zealand)

1.5.3 As part of the investigation into that accident, the Commission made several safety recommendations to the CAA, including recommending that: "The training syllabus for 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 requirements be applicable prior to the validation or conversion of foreign Pilot Licences to equivalent New Zealand Pilot Licences" (safety recommendation 078/93). The CAA responded: "These recommendations will be given due consideration during a review of CAR [Civil Aviation Rule] Part 61 and the development of new CAR Part 135".

1.5.4 On 3 January 1997, ZK-KIM, a Cessna 310 (TAIC Report 97-002), entered a spin or spiral dive shortly after taking off from Queenstown. The pilot and 5 passengers were killed when the aircraft struck the ground near the aerodrome. The investigation determined that "inadvertent mishandling of the aircraft by the pilot probably resulted from his inexperience and lack of mountain flying skills".

1.5.5 On 6 May 1997, the Commission recommended to the Director of Civil Aviation that he: "Include mountain flying in the training syllabus for Private Pilot and Commercial Pilot Licences (Aeroplane), as is the case for helicopter licences (safety recommendation 033/97). The CAA replied that the Director of Civil Aviation was prepared to accept the recommendation and it would be implemented "by considering the recommendation as a request for the amendment of the relevant Advisory Circular to Part 61".

1.5.6 On 19 January 2002, ZK-SEV, a Cessna 207 (TAIC Report 02-001), collided with the side of a mountainous valley near Gertrude Saddle while en route from Te Anau to Milford Sound. The pilot and 5 passengers were killed in the accident. The investigation determined that "the aircraft probably had not reached a suitable altitude to safely cross over the saddle, and the pilot probably left his decision too late to turn back in the valley in order to gain more height".

1.5.7 A safety issue identified in the investigation was the lack of mandatory mountain-flying training aeroplane pilots had to undergo. On 19 July 2002 the Commission recommended to the Director of Civil Aviation that he implement previous safety recommendations 078/93 and 033/97 (safety recommendation 023/02), and also: "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 (safety recommendation 024/02)".

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

> 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.
>
> 024/02 I accept this recommendation and will include in Advisory Circulars detailed mountain-flying training guidance information to assist operators whom 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.

1.5.9 At the time of the accident involving ZK-KID, no changes had been made to the syllabi requirements to include mountain or adverse terrain training for private, commercial or instructor aeroplane pilot qualifications. The CAA issued advisory circulars for pilot licences and ratings also contained no mountain-flying experience requirements for pilots of aeroplanes.

1.5.10 The Commission has also investigated 2 other fatal accidents in the past 10 years where poor mountain-flying techniques were probably a contributing factor. These were Cessna 206 ZK-EKJ, impact with mountainous terrain by Mount Suter, 17 km south of Milford Sound on 18 April 1999 – 5 fatalities (TAIC Report 99-004) and Piper PA28-140 ZK-CIK, loss of control and impact with terrain, Amuri Range near Hanmer Springs on 19 December 2000 – 3 fatalities (TAIC Report 00-015).

The regulator

1.5.11 Civil Aviation Rules Part 61 directed the general eligibility requirements, privileges and limitations for the various licences that pilots could hold. These were expanded upon in CAA Advisory Circulars AC 61-3 Pilot Licences and Ratings – Private Pilot Licence, and 61-5 Pilot Licences and Ratings – Commercial Pilot Licence, both issued on 9 May 2007.

1.5.12 The requirements included a breakdown of the flying hours required by pilots. PPL applicants were required pilots to fly at least 50 hours, which included 10 hours cross-country navigation training. The cross-country requirement was reduced for PPL helicopter pilots, with only 4 hours required. However, helicopter pilots were required to undertake 5 hours of mountainous terrain flight training. No similar requirement existed for aeroplane pilots.

1.5.13 CPL (Aeroplane) applicants were required to have flown at least 200 hours,[11] which was to include at least 30 hours of cross-country navigation. Again, no mountainous terrain experience requirement was stipulated. A minimum of 10 hours' mountainous terrain flight training was required to be undertaken by CPL (Helicopter) applicants.

1.5.14 The CAA also produced flight test standards guides, which gave instructors and flight test examiners direction on how the Advisory Circulars were to be complied with and the standards expected.

1.5.15 Following the accident, a CAA representative briefed the Commission on the progress of amendments to pilot training syllabi, and in particular mountainous terrain training.

1.5.16 On 12 June 2008, the Commission wrote to the Director of Civil Aviation seeking "the current status of the CAA action in response to the previous safety recommendations".

1.5.17 On 7 August 2008, the CAA replied:

> The CAA has undertaken a significant amount of work to increase the knowledge of aviators about mountain flying. Specifically:
>
> - Between 1993 and 2008, 9 articles on the principles and practice of mountain flying have been included in Vector;[12]
> - In 1999 a Good Aviation Practice [mountain flying] booklet was printed, and 12 000 copies were circulated and in 2006 this booklet was updated and a further 5000 copies have been distributed;
> - In 2005 a draft Mountain Flying Guide (Aeroplane) in the guise of flight test standards guides was developed; and
> - On 1 August 2008 amendments to three advisory circulars were published relating to the helicopter mountain flying syllabus for private pilot licence (PPL), commercial pilot licence (CPL) and instructor rating.

[11] Some variations were allowed for.
[12] The CAA bi-monthly safety magazine issued free to all CAA licence holders.

1.5.18 The CAA further advised that "work is nearing completion on a mountain flying training advisory circular for fixed wing aircraft. The mountain flying information will be incorporated into the existing AC119-3 which covers the certification of Part 119/135 air operators".[13]

1.5.19 The CAA also responded that regulatory requirements to enable changes for mountain-flying training to be made compulsory would be incorporated in the rule-making process for Parts 61 and 141.[14] These 2 rule-making projects were being progressed at the time of writing this report. A history of the projects was summarised as follows:

- 1997. Following input from industry, Part 61 was initially amended to require ground and flight training for instrument and aerobatic ratings to be conducted by the holder of a Part 141 certificate
- 1999. Owing to insufficient Part 141 certificated organisations, the CAA issued exemptions for the above ratings
- 2000. The Part 61 rule project started. A draft Notice of Proposed Rule Making (NPRM) was produced but required significant analysis and development before it could be published
- 2004. Owing to the size of the work, the project was broken into 3 stages. Stage 1 incorporated the"easy" change to Part 61 and these amendments came into force on 11 May 2006. Stage 2 contained the remainder of the Part 61 changes and Stage 3 the amendments to Part 141
- 2006. Part 61 was amended to remove the requirement for instrument and aerobatic ratings to be done under a Part 141 certificate
- 2006/07. A new NPRM was issued for Part 61/141, followed by consultation with industry. Industry feedback resulted in the draft rule being amended, which was then considered too complex and required further work
- 2008. A draft NPRM was developed for Part 61/141 and was again being discussed with industry
- other additional work included preparing for category A instructors to be assessed for "examiner privilege" to conduct instructor mountain-flying training endorsements, in anticipation of introducing PPL (Aeroplane) and CPL(Aeroplane) requirements in late 2009 as part of their biennial checks.

1.5.20 In amplification of the above, the CAA advised that the rule programme had been established via an "Agreement for Rules Development Services", which was jointly signed by the CAA and the Ministry of Transport (MoT). The Agreement was negotiated and signed annually and the MoT was kept informed of rule project progress on at least a monthly basis. The CAA advised that much of the delay to progressing changes to the Part 61 pilot training syllabus in order for it to be submitted to the MoT was due to a lack of CAA staff resources.

The operator

1.5.21 The operator was a limited liability company established in 1996 and was based in Tauranga, with an ancillary operation in Port Vila, Vanuatu. The operator undertook recreational flying, flight training, flight testing, and instructor and instrument renewals. The Tauranga operation included a fleet of 7 Cessna 152 aircraft, a twin-engine PA34 Seneca and a further 3 single-engine aircraft (Cessna 172 and Piper PA18 and PA28).

[13] Part 119 – Air Operator Certification, Part 135 – Air Operations Helicopters and Small Aeroplanes.
[14] Part 61 – Pilot Licences and Ratings, Part 141 – Aviation Training Organisations.

1.5.22 The operator had about 18 staff, including 15 full-time and part-time flight instructors and lecturers. The chief flying instructor, who also held the position of operations manager, was a category a flight instructor.

1.5.23 The operator was a recognised pilot training organisation approved by the New Zealand Qualifications Authority. At the time of the accident the operator was in the process of gaining certification under CAA Part 141 - Aviation Training Organisations for pilot flight testing approval. In the meantime flight tests were being conducted by an independent CAA-approved flight test organisation.

1.5.24 To support the various flight training programmes, the operator had produced a range of training guides for pilots and instructors to use. The guides complemented the various CAA documents and were designed as practical references. However, like the CAA Advisory Circulars and Flight Test Standards Guides, they contained no reference to flight in mountainous terrain.

1.5.25 None of the operator's flying instructors spoken to had received formalised mountain-flying training. They acknowledged that much of the terrain over which they flew during cross-country navigation training was adverse terrain and posed additional risks. The operator and instructors agreed that the minimum height requirement of 500 feet above the surface, as described in Civil Aviation Rule 91.311 dated 22 November 2007, needed to be viewed as a minimum and often aircraft should be flown at significantly greater heights above the terrain.

1.6 Additional information

Survival information

1.6.1 The National Rescue Coordination Centre later confirmed that there were no reports of any ELT signals being received. However, the pilot of the helicopter that attended the accident did report hearing a weak signal when approaching the accident area.

1.6.2 The model of ELT installed in ZK-KID contained no in-built aerial and instead relied on the transmitter being connected to the external aerial attached to the aircraft to achieve maximum signal strength.

1.6.3 From 1 July 2008 the Civil Aviation Rules required more modern 406 megahertz ELTs to be fitted to aircraft, which allowed for a satellite fix in about 50 seconds when activated. Civil Aviation Advisory Circular 43-11 provided for ELT installation enhancements to improve the chances of a signal being transmitted following an accident.

Radar information

1.6.4 Airways New Zealand radar recorded portions of the flight of ZK-KID on the day of the accident. The radar recordings showed ZK-KID flying south from Whakatane towards Lake Waikaremoana, but the radar signal ceased about 15 km northeast of the lake with the aircraft descending past 4800 feet.[15] The aircraft radar signal reappeared about 16 minutes later at 1534, as ZK-KID was about 5 km north of Lake Waikaremoana and heading northwest towards Ruatahuna.

1.6.5 The radar information indicated that after leaving Lake Waikaremoana the aircraft was climbed to about 4500 feet before steadily descending. The last radar recording was at 1540, about 5 km southeast of Ruatahuna. The aircraft was descending through 3300 feet at this time. This equated to between 500 feet and 1000 feet above the highest terrain in the immediate area.

[15] The altitude information displayed on the radar recording was above mean sea level.

2 Analysis

2.1 The flight began as a routine cross-country training flight, which had been properly briefed and planned. The plan did not include low flying below 500 feet above terrain in any designated low-flying area or any mountain flying. The weather was suitable and the instructor had flown the same exercise along a similar route before.

2.2 The flight proceeded normally and, by the student's account, in accordance with the required rules until partway through the lost procedure. The lost procedure initially flown by the instructor, followed by the student establishing a holding orbit while locating his position, was an approved and effective method of teaching the exercise. The use of a simulated cloud base to stop a student climbing and identifying other locating features was common practice.

2.3 However, eyewitness accounts suggest that the aircraft was flown significantly below the minimum height requirement of 500 feet above terrain as it orbited about Ruatahuna. The aircraft may have been 500 feet above the floor of the valley, but by holding the same altitude throughout the orbit, the height above the terrain reduced rapidly as it flew over the western slopes of the valley. Accurately assessing 500 feet above terrain can at times be challenging, but with training and experience it can be made easier. Should there be any doubt, a pilot is obliged to err on the side of safety and climb.

2.4 After departing Ruatahuna, the undulating terrain rose steadily as the aircraft followed the general path of the road towards Murupara. Although calm in Ruatahuna, the general westerly airflow would have produced low-level turbulence and localised downdraughts as the wind crossed the high terrain to the west. Entering the increasingly turbulent conditions the instructor took control of the aircraft, possibly to try to find smoother conditions as they followed the road. The instructor did take control before the aircraft entered the final valley but the estimate of 2 or 3 minutes should be viewed as a maximum. Nevertheless, the opportunity was not taken during this time to establish a climb above the terrain, possibly through an orbit, to provide an additional height buffer and safety margin. This meant that the aircraft flight path was being constrained by the surrounding high terrain.

2.5 Once ZK-KID had been flown past the switchback in the road and entered the narrow, rising and tightening valley, the opportunity was lost to turn and escape. Already at full power, and the speed probably having steadily reduced as the aircraft was climbed and manoeuvred along the road, the turn performance of the aircraft was such that it could not turn out of the valley and an impact with the side of the valley became inevitable.

2.6 The accident site was at about 2200 feet above mean sea level. The evidence of the student was that the aircraft remained at the same altitude as the instructor attempted to turn and exit the valley. It would therefore be reasonable to assume that the aircraft entered the valley at an altitude of about 2200 feet, possibly lower if climbing. With the saddle to cross at the end of the valley being about 2400 feet, ZK-KID should have been at least at 2900 feet when it entered the valley to comply with minimum height requirements. In turbulent conditions a higher altitude would have been prudent to ensure adequate safety margins were maintained.

2.7 The aircraft was capable of normal flight and performance at the time of the accident, and there was no evidence of any mechanical failure or defect that could have contributed to the accident. The Cessna 152 type of aircraft, although not highly powered, was suitable for cross-country instruction. But a pilot needed to be aware of its performance capabilities and plan the flight path accordingly.

2.8 The evidence showed that the accident occurred because the instructor made a decision to carry out or allow unnecessary low flying against Civil Aviation Rules in mountainous terrain, for which she was not trained. Consequently she unwittingly allowed the aircraft to enter a narrow valley at a height at which, given the performance capabilities of the aircraft, it was not possible to turn around or out-climb the rising terrain.

The operator

2.9 The operator was a close-knit organisation. Instructors had typically started their flying training with the operator and progressed through the various qualifications to become category C, and possibly later category B, flying instructors. This enabled pilots to gain some remuneration while accruing flying hours towards possible different commercial pilot careers. The result was a high level of interaction and supervision between management and fellow instructors.

2.10 The operator had taken its responsibilities seriously by placing additional supervision requirements on newly appointed flying instructors. This was extended to instructors completing a cross-country check with a senior instructor before being approved to instruct on cross-country flights. However, there was no formalised mountain-flying training, nor was there required to be, for trainee pilots or instructors.

2.11 Fellow instructors had read, or were aware of the material produced by the CAA on mountain flying. They were therefore knowledgeable on some of the hazards, but few had experience of flying in mountainous terrain and putting into practice the techniques described in the Good Aviation Practice booklet.

Mountain flying

2.12 An often-quoted rule of mountain flying is to "always have an escape route". To achieve this, pilots needed to ensure that they had airspeed, height and flight path under control. Low airspeed, lack of height and poor flight path selection can limit a pilot's options to the extent that there may be no escape from a dangerous situation.

2.13 In the case of ZK-KID, the low airspeed limited its turn performance and prevented the conversion of any excess speed to height. The height at which ZK-KID was being flown meant that a turn back had to be initiated early as the climb performance of the aircraft prohibited any attempt to out-climb the terrain. The decision to follow the road initially and then enter the valley eliminated any options the instructor had of conducting a successful escape manoeuvre.

2.14 The Commission has investigated 5 accidents in the past 15 years where 29 people have been killed as a direct result of inappropriate decision-making which had their origins in inadequate mountain-flying training. Given the extent of mountainous terrain covering New Zealand, general aviation commercial pilots would inevitably at some time fly through this type of terrain and needed to be equipped to handle the different and demanding challenges that it could pose.

2.15 That the instructor undertook low flying, did not climb early and entered the valley at a height that made escape impossible, indicated a lack of knowledge about the dangers of flying in mountainous or adverse terrain. The educational material readily available provided a good resource for pilots in gaining the necessary skills to operate safely in such terrain. However, mountain-flying accidents in New Zealand have continued to occur and lives have been lost, showing that the distribution of this material alone has not been effective in preventing such accidents.

2.16 The skill level of general aviation commercial aeroplane pilots flying around New Zealand needs to be raised by having formalised practical flying training on appropriate mountain-flying techniques, similar to that for helicopter pilots. Such training should help ensure that aeroplane pilots can identify and manage the risks and challenges associated with operating in the mountains, and avoid placing themselves in dangerous situations.

2.17 Given the Commission's recommendations over the years and the assurances given by the CAA, the slow progress in establishing formalised mountain-flying training for commercial aeroplane pilots is disappointing. The complexity of the rule change process and the manpower shortages cited by the CAA have contributed to the slowness, but both the CAA and the MoT need to ensure that these changes are progressed as quickly as possible.

2.18 Had the instructor received formalised mountain-flying training, it is arguable that she could have exercised sound judgement as a result of that training, and thus recognised the limitations of the aircraft and the terrain and not put the aircraft into such a compromising situation.

Survival

2.19 The accident was survivable, as demonstrated by the student sustaining moderate injuries but still being able to walk out and summon help. However, the random intrusion of trees or branches into the cabin, meant that injury could likewise be random as shown by the instructor being killed on impact.

2.20 The student's plan of taking the ELT with him when he walked out was well intentioned. However, the type of ELT installed in ZK-KID needed to be fitted to an external aerial to be able to transmit a strong signal for detection by satellite or searching aircraft. The student would, therefore, have been better to ensure the ELT was activated and remained connected to the aerial fitted to the aircraft.

3 Findings

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

3.1 The aircraft was suitable for the purposes of the flight, was airworthy and performed in accordance with design specifications.

3.2 The instructor was correctly licensed, authorised and fit to conduct the planned flight.

3.3 The weather was suitable for the intended purposes of the flight.

3.4 The route flown was over adverse and mountainous terrain, and any flight through that terrain posed additional challenges and risks for which the instructor was not trained.

3.5 The initial low flying during the conduct of the lost procedure was unnecessary and not approved under civil aviation regulations.

3.6 The accident occurred because the instructor allowed the low flying to continue while flying through rising mountainous terrain for which she was not trained, consequently entering the valley and putting the aeroplane into a position from which recovery was impossible.

3.7 Despite a number of recommendations by the Commission to the CAA in the past decade, formalised mountain-flying training has yet to be introduced to the aeroplane pilot training syllabi.

3.8 Formalised mountain-flying training should be included in various pilot training syllabi as a means of reducing the accident rate, by enhancing pilot knowledge and skill for better decision-making regarding flying in mountainous terrain.

4 Safety Recommendation

4.1 On 19 March 2009 the Commission recommended to the Director of Civil Aviation that he address the following safety issue:

The continuing lack of any formalised aeroplane pilot mountain-flying training, which has not equipped pilots with the requisite skills for sound decision-making for flying in mountainous terrain. This lack of training has been implicit in a number of fatal mountain-flying accidents over the past 15 years with at least 29 lives lost. (010/09)

4.2 Response not available on the time of publication.

Approved on 19 March 2009 for publication

Hon W P Jefferies
Chief Commissioners

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06-004	Robinson R44 *Raven* ZK-HUC, wire strike, Motukutuku Point, near Punakaiki, Westland, 9 November 2006
06-002	Piper PA 23-250 Aztec, ZK-FMU, wheels-up landing, Napier Aerodrome, 13 April 2006

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