CIVIL AVIATION AUTHORITY
OF NEW ZEALAND
Te Mana Rererangi Tūmatanui o Aotearoa

CAA Safety Investigation Report

Collision with terrain following a loss of control at low level

ZK-LAT, Cessna C172R

Hunua Ranges, Auckland

9 January 2018

CAA Final Report 18/64

20 September 2018

Executive summary

At approximately 1650 hours New Zealand Daylight Time (NZDT) on 9 January 2018, ZK-LAT a Cessna C172R crashed in the Hunua Ranges south of Auckland while conducting a dual training lesson in terrain awareness. During a turn at low level the aircraft stalled with insufficient height above the terrain to recover. The aircraft came to rest in the trees in a vertical nose-down attitude, approximately one metre above the ground.

The instructor and student received minor injuries, and were able to vacate the aircraft. The Emergency Location Transmitter (ELT) was turned to ON but did not transmit a signal. The instructor used a personal cell phone, once in reception, to alert the company and emergency services. The Rescue Coordination Centre New Zealand (RCCNZ) was notified by the pilot at approximately 1700 hours and commenced the search and rescue operation. The operator activated the company emergency plan.

Due to damage to the ELT aerial the signal was not being received by RCCNZ or the search aircraft. The instructor and student were found after approximately two hours of searching. The surrounding topography and forest canopy also hampered the search. The instructor and student were airlifted by rescue helicopter to hospital. The aircraft received major damage and was written off.

The main contributing factor to the accident was determined to be the instructor's inexperience in teaching the terrain awareness syllabus and the management of the aircraft's performance to safely operate in the valley chosen for the exercise.

The following was also considered to be a contributing factor to the accident:

- The operator's instructor training programe for terrain awareness.

The following factors have been investigated and excluded from the report as they are not considered contributing factors to the accident:

- Weather
- Aircraft serviceability.

Safety Messages

This accident highlights the importance of providing training and ongoing supervision that is commensurate with the instructor's skill level and experience.

Pilots are reminded of rule Part 91.311 *Minimum heights for VFR flight.* Consideration should be given to the suitability of the surrounding area, and the aircraft altitude when conducting training exercises. This is to allow time to manage changing environmental conditions, emergency situations and to ensure that escape route options are available.

Consideration should be given to personal survival equipment as part of any preflight preparation for flights beyond the circuit. Personal survival equipment will assist with survivability while waiting for rescue. In the case of this accident, it was mid-summer, daylight was still available and the pilots had only minor injuries. This assisted with survivability while the search was being conducted over dense forest. The CAA publishes *Good Aviation Practice (GAP)* Booklet – Survival. This booklet provides comprehensive information and can be found at www.caa.govt.nz

Introduction

This report describes the CAA safety investigation into the incident. It includes:

- an incident timeline
- any relevant maps and photographs
- the conclusions from the CAA safety investigation — categorised into human factors, equipment factors, and environmental factors
- safety actions and messages

Incident timeline

16:30 NZDT 9 Jan 2018	The instructor and student pilot depart Ardmore aerodrome, runway 21, for the Hunua Ranges, on a dual training flight in a Cessna C172R. The flight tracked via the Waterworks to the Hunua Valley and entered the Hunua Ranges at the Wairoa Reservoir.
16:45 approx	The instructor positioned the aircraft at the start of the valley that the accident occurred in to demonstrate the effects of updraughts at a reduced power setting.
16:45 approx	The instructor realised the aircraft did not have the performance to outclimb the terrain ahead. The instructor took control and attempted to make a 180 - degree turn to fly back down the valley. During the turn the aircraft stalled and crashed into the trees. The instructor shut the aircraft down and turned on the ELT. Both the instructor and student pilot vacated the aircraft.
17:00 Approx	The instructor made contact with RCCNZ and the operator by cellphone to notify them of the accident. The operator activated their emergency response plan and despatched a Cessna 172 to search for ZK-LAT. The exact location of ZK-LAT was unknown.
19:15	The instructor and student were located and airlifted by rescue helicopter.
20:10	The instructor and student arrived at Ardmore aerodrome and were transfered to hospitial.

Incident maps, plans, and photographs

Figure 1: ZK-LAT after it had been lowered from the trees. (Supplied by the recovery company)

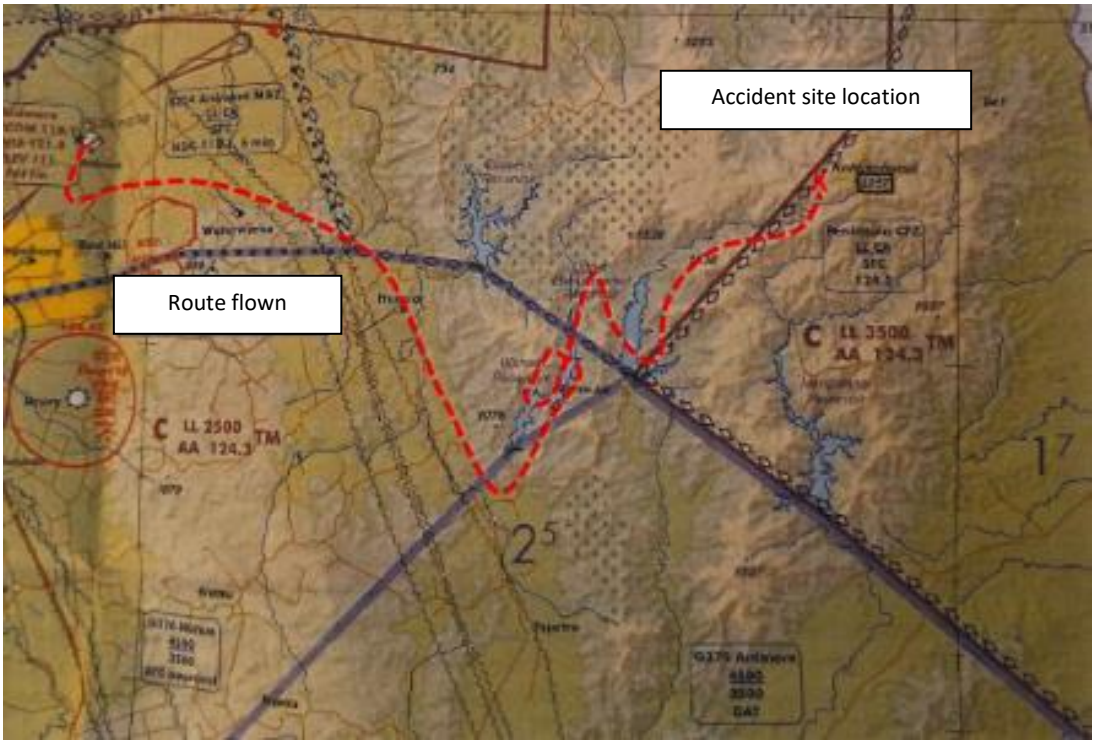

Figure 2: Approximate route flown and the position of the accident site (Supplied by the operator).

Figure 3: Aerial view of the Hunua Ranges and accident location (Google Earth).

Figure 4: Aerial view of the Wairoa Reservoir, Upper Mangatawhiri Reservoir and accident location (Google Earth).

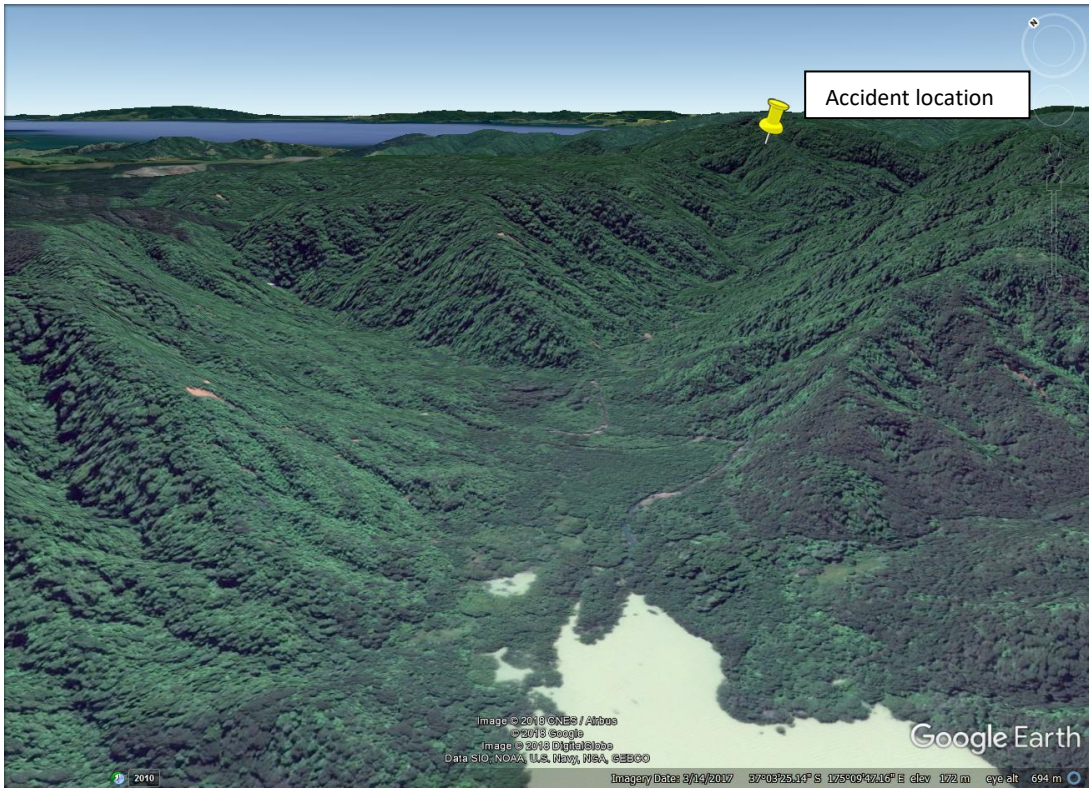

Figure 5: Aerial view from the northern end of the Upper Mangatawhiri Reservoir looking up towards the accident location (Google Earth).

Conclusions from the investigation

As a result of the CAA safety investigation the following conclusions were determined relevant to the pilot and the operational environment:

Human factors	• The instructor was new to teaching the terrain awareness syllabus
Environmental factors	• The operator's terrain awareness instructor training programme did not include written guidance or practical training opportunities for trainee instructors
Equipment factors	• Damage to the ELT aerial compromised the ELT's transmission function

Human factors

The instructor held the appropriate instructor rating for the training flight

At the time of the accident the instructor held a Commercial Pilot Licence, B Category Instructor Rating and a current class 1 medical. The instructor completed most of their training with the operator including terrain awareness and mountain flying. The instructor passed their B Category Instructor Rating on 01 November 2017.

Before 09 January 2018 the instructor had logged the following flying hours:

Total time		832
Total pilot in command		619
Instructing		451
Instructing terrain awareness		6.6

The instructor was new to teaching the terrain awareness lesson

Before the accident flight the instructor had instructed six terrain awareness lessons. The instructor's logbook was reviewed by a CAA Aviation Examiner and it was determined that the instructor met the requirements of CAA Advisory Circular AC61-3 Appendix IV and obtained their terrain awareness instructor privilege on 25 November 2017.

Environmental factors

The purpose of the terrain awareness and mountain flying syllabus

The purpose of the terrain awareness and mountain flying syllabus is to provide the pilot with a basic set of skills to enable them to fly safely if they find themselves in unfamiliar terrain environments. It is important that pilots and instructors stay within their own limits.

The CAA Mountain Flying Training Standards guide states the following:

*For **Private Pilots** the training should apply a conceptual approach to develop **'terrain awareness'** and **'weather appreciation'** which facilitates safe flying in an environment where their experience and training may otherwise be inadequate. For **Commercial Pilots** the initial approach is to develop **'basic mountain flying'** skill and techniques. (…) For **Instructors** the approach is **'training provision'** therefore direction is provided to maximise the instructors experience and ability to provide a learning environment that challenges and extends the pilot **without operating outside the instructors own limitations**.*[1]

The operator's instructor training programme did not include written guidance or practical training opportunities for trainee instructors

Terrain awareness training took place with the trainee instructor sitting in the rear of the aircraft for one or more flights. The trainee instructor would observe another instructor delivering the lesson to a student, or observe another instructor being assessed for their terrain awareness endorsement by a Flight Examiner. The trainee instructor would then fly with a Flight Examiner to demonstrate competency in delivering the terrain awareness syllabus. Once competency had been demonstrated, the instructor's logbook was certified by the flight examiner stating that they were approved to instruct the private pilot licence terrain awareness syllabus.

At the time of the accident the operator did not provide instructors who were new to teaching terrain awareness, with written company guidance material or standard operating procedures (SOPs) for the structure of the terrain awareness lessons. Knowledge was passed on to new terrain awareness instructors verbally during and after their initial terrain awareness instructor training. The operator's instructor training syllabus for terrain awareness did not include training opportunities for the instructor to practise delivering the lessons before the competency flight with the examiner.

[1] CAA - Mountain Flying Training Standards guide, https://www.caa.govt.nz/assets/legacy/pilots/Instructors/Mt_Flying_Trg_Std_Guide.pdf

CAA Instructor guidance material for terrain awareness training

The CAA provides the following guidance material and syllabuses for terrain awareness and mountain flying training:

CAA Advisory Circular AC61-3 appendix IV—Aeroplane Terrain and Weather Awareness Syllabus and CAA Advisory Circular AC61-5 appendix V - Aeroplane Basic Mountain Flying Training Syllabus details the syllabus requirements for private pilot licence and commercial pilots licence.

https://www.caa.govt.nz/rules/acs/#Part_61

The CAA Flight Instructor Guide provides training guidelines for terrain and weather awareness, and basic mountain flying.

https://www.caa.govt.nz/fig/advanced-manoeuvres/basic-mountain-flying

The CAA Mountain Flying Training Standards Guide provides competency guidance for the private pilot licence, commercial pilot licence, and flight instructor rating.

https://www.caa.govt.nz/assets/legacy/pilots/Instructors/Mt_Flying_Trg_Std_Guide.pdf

Equipment factors

Damage to the ELT aerial compromised the ELT's transmission function

Before vacating the aircraft, the instructor selected the ELT switch to ON. The Rescue Coordination Centre was however unable to locate the aircraft using the ELT signal. This was probably caused by the ELT aerial being snapped off during the accident sequence, along with possible signal shielding caused by the tree canopy and surrounding terrain.

Although cellphone coverage was very poor the instructor was able to make sporadic calls to RCCNZ. The delay in locating the aircraft and the potential for the delay to have an impact on survivability, highlights the benefit of additional personal locator beacons being carried by pilots, and/or flight tracking devices being installed in the aircraft.

The Australian Transport Safety Bureau has conducted a review into the effectiveness of ELTs. In accidents where ELTs did not work effectively (if at all) it was found their performance could be affected by a number of factors, including:

- Disconnection of the coaxial antenna cable from the unit during impact
- Damage and/or removal of the antenna during impact
- An aircraft coming to rest inverted after impact[2].

[2] Australian Transport Safety Bureau, Transport Safety Report - A review of the effectiveness of emergency locator transmitters in aviation accidents https://www.atsb.gov.au/media/4126629/ar-2012-128_final.pdf

Safety actions already taken

Refresher training for Flight Examiners

The CAA Personnel and Licencing Unit included terrain awareness and mountain flying training as a topic at the recent 2018 Flight Examiner seminar. The purpose was to provide refresher training for flight examiners and address any possible industry drift from the intended purpose of the terrain awareness and mountain flying syllabus.

Terrain awareness and mountain flying instructor training

The operator has adjusted their instructor training programme for new terrain awareness instructors, to incorporate two dual training practice lessons with senior instructors before the competency assessment. The purpose of the dual lessons is to give the trainee instructor exposure to the lesson content and surrounding training environmental conditions.

The operator has developed Standard Operating Procedures for terrain awareness and mountain flying

The operator has introduced comprehensive Standard Operating Procedures and instructor guidance for the terrain awareness and mountain flying awareness syllabus.

Accident Data Summary

Aircraft make and model, registration and serial number:	Cessna, C172R, ZK-LAT, 17281164
Engine(s) make and model, type of engine(s):	1 Continental CD-155 diesel, piston engine
Year of manufacture:	January 2003
Accident Date and time:	9 January 2018, 17:00 hours NZDT
Location:	Hunua Ranges, South Auckland Latitude: S 37° 2’ 33.27” Longitude: E 169° 20’ 42.08”
Altitude:	1598 feet AMSL
Type of flight:	Flight instruction
Injuries:	Instructor: Minor Student: Minor
Nature of damage:	Substantially damaged
Pilot’s licence:	Commercial pilot
Pilot’s age:	27
Pilot’s total flying experience:	832 total hours 451 total hours instructing
Student Pilot:	33.8 total hours
Information sources:	Civil Aviation Authority field investigation The operator

About the CAA

New Zealand's legislative mandate to investigate an accident or incident is prescribed in the Transport Accident Investigation Commission Act 1990 (the TAIC Act) and Civil Aviation Act 1990 (the CA Act).

Following notification of an accident or incident, TAIC may conduct an investigation. CAA may also investigate subject to Section 72B(2)(d) of the CA Act which prescribes the following:

> **72B Functions of Authority**
>
> (2) The Authority has the following functions:
>
> (d) To investigate and review civil aviation accidents and incidents in its capacity as the responsible safety and security authority, subject to the limitations set out in section 14(3) of the Transport Accident Investigation Commission Act 1990

The purpose of a CAA safety investigation is to determine the circumstances and identify contributory factors to an accident or incident with the purpose of minimising or reducing the risk to an acceptable level, of a similar occurrence arising in the future. The safety investigation does not seek to ascribe responsibility to any person but to establish the contributory factors to the accident or incident based on the balance of probability.

A CAA safety investigation seeks to provide the Director of Civil Aviation with the information required to assess which, if any, risk-based regulatory intervention tools may be required to attain CAA safety objectives.

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