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

CAA Safety Investigation Report

Loss of control in flight

RANS S6-ES Coyote II ZK-TJE

1.5 NM east of Glenomaru

2 April 2017

CAA Final Report 17/1635

20 February 2019

Executive summary

On the morning of 2 April 2017 microlight aircraft ZK-TJE departed the pilot's home airstrip, situated nine nautical miles northwest of Balclutha, for a local scenic flight. Approximately an hour after take-off, ZK-TJE stalled[1] in a turn at low level over farmland, one and a half nautical miles east of Glenomaru. There was not enough height for the pilot to recover from the stall before the aircraft struck the ground. Neither the pilot nor passenger survived the accident.

The Civil Aviation Authority (CAA) safety investigation identified the following key factors contributing to the incident:

- The pilot was manoeuvring the aircraft below minimum altitude for VFR flight
- The pilot did not have the training or experience to mitigate the risks involved in low-level flying
- A weather front was passing through the area at the time the accident occurred.

Safety messages

Newly qualified pilots: One step at a time

The issue of a certificate or licence to fly is a licence to learn. At the time of first issue of a licence or certificate, a pilot should have a basic set of skills to operate an aircraft within the limits of the training they receive, and no more.

The need for pilots to set personal boundaries was identified after another microlight accident in April 2017.[2] The safety investigation into that accident identified that newly qualified pilots are disadvantaged as they have little experience to draw on to measure where they are operating compared with where the boundary of safe operation is. Compliance with Civil Aviation Rules provides the minimum level of safety. All newly qualified pilots need to adopt a conservative approach to all aspects of their flying, setting personal boundaries above the minimum.

All pilots: Maintain situational awareness

The advent of electronic media, and the near universal use of smartphones or other personal devices, has permitted easy and free access to aviation meteorological data.[3] Every pilot should review and actively consider the aviation and general meteorological forecasts and reports pertaining to the area in which they are going to fly.

Building an understanding of weather requires the combination of theoretical knowledge and experience. Tying the two together requires looking at the forecasts and reports and comparing them with the actual conditions experienced in flight.

[1] In simple terms, an aerodynamic stall occurs when the relative angle between the wing and the airflow (angle of attack) increases beyond a certain point referred to as the critical angle, and lift begins to rapidly decrease. An aerodynamic stall is not to be confused with stalling the engine.
[2] CAA Safety Investigation 17/1785 Montgomerie Bensen B8MR Gyroplane ZK-OOZ, 09 April 2017.
[3] http://ifis.airways.co.nz/ as an example.

Relevant locations

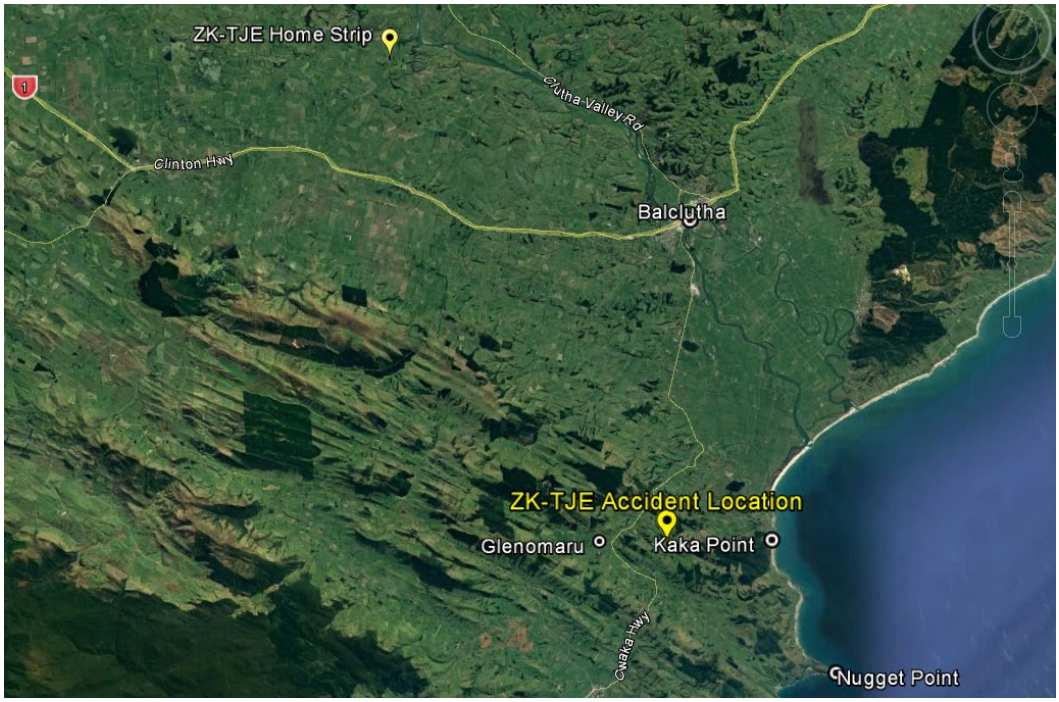

Figure 1: ZK-TJE Accident Location (source Google Earth ™)

Incident timeline

2 April 2017 Approx. 0850	The pilot and passenger depart in ZK-TJE from the home strip at Baverstock Road, nine nautical miles northwest of Balclutha
0920	Wind speed at Nugget Point MetService weather station starts to increase with approaching front
Approx. 0930	A witness sees ZK-TJE approximately five nautical miles west of Balclutha
Approx. 0940	The pilot of ZK-TJE has a brief exchange of radio calls with another aircraft flying in the vicinity, receiving information of an approaching change in the weather
Approx. 0945	A witness sees ZK-TJE over Cannibal Bay
Approx. 0950	A witness, approximately five nautical miles west of Balclutha, notices an increasing northwesterly wind
Approx. 1005	A witness on the farm approximately 400 metres west of the accident location sees ZK-TJE in a turn at low level
Approx. 1006	A second witness on the farm, approximately 100 metres north of the accident location, sees in their peripheral vision, ZK-TJE in the last stage of a steep descent, and runs to the accident site
1000-1010	Wind speed at Nugget Point MetService weather station averaging 20 knots, minimum lull 17 knots, maximum gust 32 knots

Findings and conclusions from the investigation

The investigation examined human, equipment, and environment factors. The key findings are listed below and then described in more detail:

- At the time of the accident the pilot was flying below the prescribed minimum height of 500 feet[4]
- The pilot was flying too low to recover the aircraft from a stall
- The pilot started remote operations while he was still under training, with reduced opportunity for direct supervision
- Some aspects of the pilot's training were not in compliance with the training section of the aviation recreation organisation[5] (ARO) exposition.
- No pre-accident defects were found with the aircraft
- Accident site observations were consistent with an unrecovered aerodynamic stall at low level
- Weather forecasts indicated that a frontal system, with associated wind and turbulence, was expected to move through the area during the morning.

Human factors

The pilot was flying below the prescribed minimum altitude

ZK-TJE was seen flying low over farmland immediately before the accident. Witness statements and wreckage signatures indicate the aircraft stalled at low level during a downwind turn.

Flying at low level involves risks such as visual illusions caused by drift and a false horizon, which can lead a pilot to make incorrect control inputs and increase the chance of stalling.

Wind at low levels is frequently more turbulent, with potential for sudden changes in direction and/or speed, referred to as wind shear. The presence of these conditions further increases the risk of aerodynamic stall, particularly when manoeuvring.

Aviation studies have shown that an aerodynamic stall in a turn is a common factor in low flying accidents, with both novice and experienced pilots falling victim.[6]

Unexpectedly stalling in a turn is likely to result in the loss of significant height even before recovery actions can be initiated. The height the pilot was seen flying at immediately prior to the accident indicates he was too low to recover from the stall.

[4] Civil Aviation Rule (CAR) Part 91.311 *Minimum heights for VFR flights*
http://www.caa.govt.nz/assets/legacy/rules/Rule_Consolidations/Part_091_Consolidation.pdf

[5] AROs certified under Civil Aviation Rule Part 149 administer the issue of the personnel certificates and ratings, in the area of recreational aviation in which the particular organisation specialises.

[6] As examples: https://aviation-safety.net/wikibase/wiki.php?id=150293
https://taic.org.nz/inquiry/ao-2014-004
http://www.caa.govt.nz/assets/legacy/Accidents_and_Incidents/Accident_Reports/ZK-FTP-Fatal.pdf

Remote operations and the inexperienced pilot

At the time of the accident the pilot had logged the following flight time:

Total time		98.7 hours
Total pilot-in-command		59.9 hours

The pilot of ZK-TJE began operations at his own airstrip in November 2016 after accruing approximately 38 hours flying experience. At this time the pilot had completed the basic aircraft handling exercises, passed the required theory examinations, and was gaining the experience and training required for an advanced microlight pilot certificate.

The instructor reported that, while operating from his home strip during the advanced training stage, the pilot phoned the instructor before and after each flight for a briefing and debriefing. The instructor also had direct interaction during the dual navigation flights required for the advanced training stage. Pilots operating from their own airstrip is common practice.

Without the support of more experienced pilots around them, the inexperienced pilot is at greater risk of misjudging hazardous conditions or actions. Significant flight experience allows a pilot to be alert for potential threats to their safety. The inexperienced pilot, however diligent, may not recognise or fully understand the implications of a set of circumstances or actions.

Peer interaction supports development

Pilots who conduct their training and building of flying experience at the premises of a flying club or flying school have the advantage of 'on the spot' oversight of their instructor, and opportunity for face-to-face feedback after each flight.

A 2014 recreational aviation risk survey by the Finnish Transport Safety Agency[7] (Trafi) noted that:

> '*On the flight itself, the student's focus is usually simply on performing the flight. It is in the debriefing after the flight, where events are reviewed and linked to the topics being taught and to good airmanship that the actual learning takes place*.'

The Trafi survey also noted that traditionally, recreational aviation is a highly communal activity. The study states that 'hanging out at the club' and exchanging experiences is crucial in transferring tacit information from more experienced aviators to those lesser experienced.

Pilot's training and compliance with ARO training procedures

Managing the risks of low level flight requires specific training. Training for microlight pilots in low level flight is limited, being focused on avoiding the need for flight at low level, except during take-off and landing. The pilot of ZK-TJE had neither the training nor experience to be flying at the height the aircraft was seen at, immediately before the accident.

The training section of the ARO exposition outlines the requirements for the novice, intermediate, and advanced training stages involved in gaining an advanced microlight pilot certificate.

[7] https://arkisto.trafi.fi/filebank/a/1424690316/fcb85968eb56089a4792a77b93156c15/16928-TRafi_Recreational_aviation_risk_survey.pdf
Or internet search: Recreational aviation risk survey 2014

Instructors are required to be fully familiar with, and instruct in accordance with, the training requirements published in the ARO exposition.

Both the pilot's and instructor's pilot logbooks recorded the individual elements of the training syllabus as having been taught. However, a number of anomalies were noted in the training when compared with the training section of the ARO Exposition.

The exposition promulgates a flight test at completion of the intermediate and advanced stages of training.

The flights the pilot had recorded in his pilot logbook did not indicate any flight test for the issue of an intermediate microlight pilot certificate. The pilot successfully completed a flight test for the issue of an advanced microlight pilot certificate on 9 February 2017. The record of this flight was completed in accordance with the ARO procedures, with the appropriate certificate being placed in his pilot logbook.

Endorsements relating to navigation exercises required to be placed in the pilot logbook, in accordance with the training section of the ARO exposition, were found to be absent.

Safety action 19A462 has been raised for the CAA to work with AROs to ensure instructors are fully familiar with the requirements of the training processes and requirements, as published in their ARO expositions.

Equipment factors

No pre-accident defects were found with the aircraft

The aircraft and flight records indicated it had accrued approximately 24 hours flight time since its last maintenance inspection on 11 January 2017, when an annual condition inspection certificate was issued. No record was found of any defects since the last maintenance inspection.

Wreckage signatures indicate an unrecovered aerodynamic stall

Wreckage signatures indicate the aircraft struck the ground on an easterly heading, in a nose-down attitude of approximately 40°. After striking the ground the aircraft rotated to the right, coming to rest approximately five metres from the point of impact on an approximately northwesterly heading. The aircraft was contained within an approximate 15 metre radius of the impact point, with the exception of some lightweight debris (see Figure 2).

The wreckage signatures found are consistent with the aircraft pitching nose down at the stall, with some evidence the aircraft was begining to enter a spin.

Pre-impact control integrity was established as far as possible. No pre-existing defects were identified during the safety investigation that may have affected normal flight.

Figure 2: The accident site (Source: CAA field investigation)

Environmental factors

A weather front was forecast to move through the area during the morning

The aviation weather forecast available before the pilot departed his airstrip indicated that a frontal system, with increasing wind and turbulence, was expected to pass through the area during the morning (See Figure 3).

Another pilot flying in the vicinity approximately 20 minutes before the accident had a brief radio conversation with the pilot of ZK-TJE. This included that pilot's observation of an approaching change in the weather. A witness, who believes they sighted the aircraft in the vicinity of the accident, reported observing a cloud build-up on the hills, and the wind "start puffing". The witness also said the aircraft they saw was "bouncing around a bit".

Satellite imagery and wind recordings from the MetService Nugget Point weather station, situated approximately six nautical miles south-east of the accident site, confirm the presence of the weather front in the immediate vicinity at the time of the accident (see Figure 4). A MetService specialist who analysed the data from the Nugget Point weather station stated that: "Nugget Point is quite close to the incident location, so I would expect these changes [in wind velocity] to have been experienced there, too" (see Figure 5).

The combination of weather data and witness statements indicates that at the time of the accident there was significant wind and turbulence, with wind shear[8] likely at low level. Wind shear is known to increase the risk of a departure from controlled flight.

[8] Wind shear is a result of any sudden change in wind speed and/or direction.

The pilot had set up an account with the MetService internet aviation weather service. However there was no record of any log in activity. It was not possible to determine how the pilot assessed the weather before the accident flight.

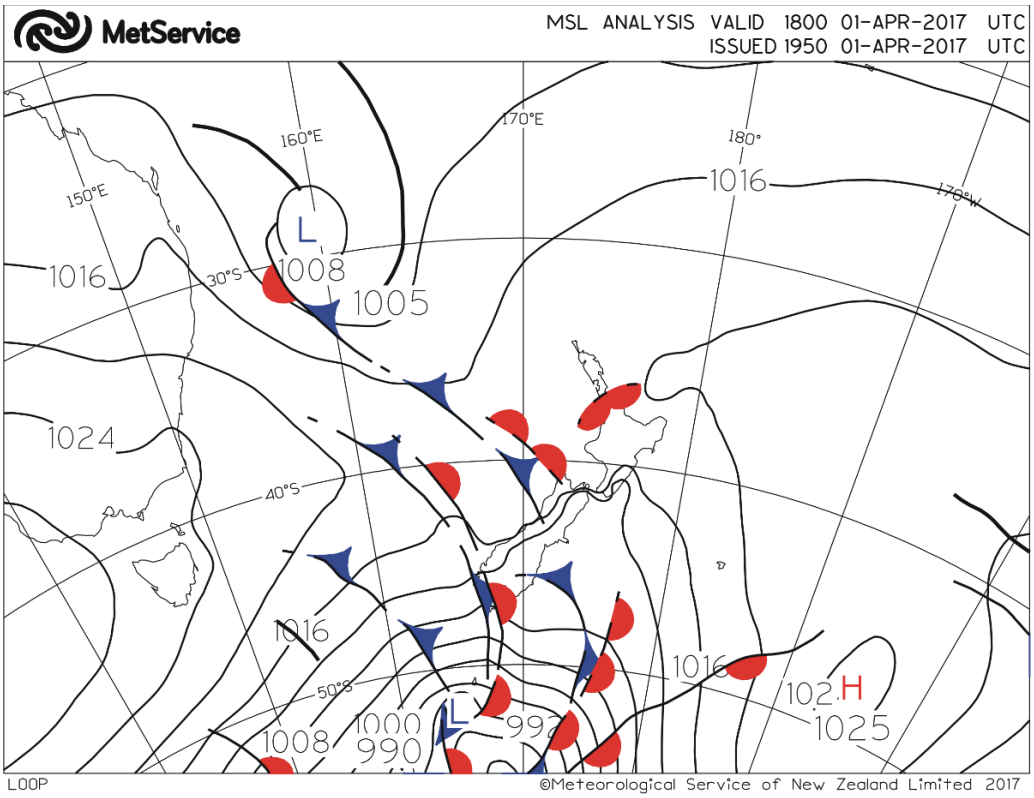

Figure 3: The mean sea level analysis valid around the time of the accident (Source: MetService)

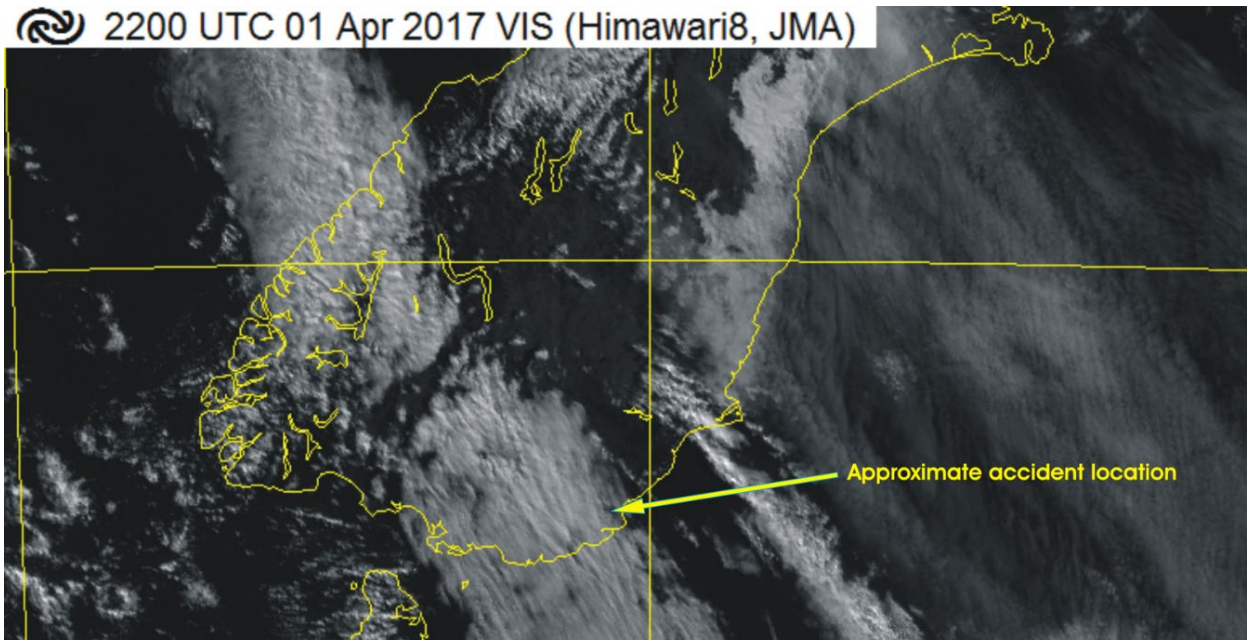

Figure 4: Satellite imagery at the time of the accident (Source: MetService)

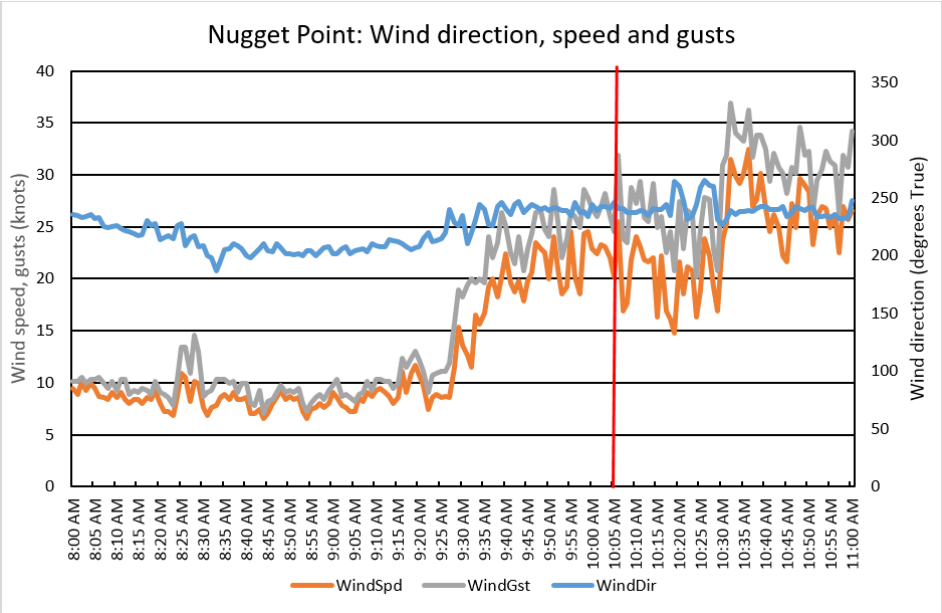

Figure 5: Recorded wind at Nugget Point with time of accident highlighted (Source: MetService)

Safety actions

Actions already taken

The CAA is working with AROs to raise safety awareness

A number of recent accidents have highlighted various areas of concern within recreational aviation, including:

- Weather awareness
- Non-adherence to minimum safe heights
- Fitness to fly
- Maintenance of aircraft.

During routine audit activity by the CAA, an ARO raised the possibility of organising joint field days with other AROs , for the purpose of education and raising awareness of safety issues amongst microlight pilots. The field day environment is believed by the ARO to be more likely to appeal to private owners operating from their own airstrips.

CAA *Good Aviation Practice* (GAP) booklets, available in pdf form on the CAA website, cover a variety of safety-related subjects, including spin avoidance and recovery, and VFR meteorology[9].

Additional Safety Action

Safety action 19A462 has been raised for the CAA to work with AROs to ensure instructors are fully familiar with the requirements of the training processes and requirements, as published in their ARO expositions.

[9] https://www.caa.govt.nz/safety-info/good-aviation-practice/

Accident data summary

Aircraft make and model, registration and serial number:	RANS S-6ES Coyote II, ZK-TJE, 02991305
Engine(s) make and model, type of engine(s):	Bombardier-Rotax Gmbh – 912 UL
Year of manufacture:	December 1999
Accident date and time:	2 April 2017, 1005 hours NZST
Location:	1.5 NM east of Glenomaru Latitude: S 46° 23’ 13.72” Longitude: E 169° 42’ 41.82”
Altitude:	401 feet above mean sea level
Type of flight:	Private
Injuries:	Pilot: Fatal Passenger: Fatal
Nature of damage:	Aircraft destroyed
Pilot’s licence:	Advanced microlight pilot certificate
Pilot’s age:	30 years
Pilot’s total flying experience:	98.7 hours total
Information sources:	CAA field investigation

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 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 of 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 of 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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