Safety Investigation Report

ZK-RGB, serious accident during flight training, Glentui, North Canterbury

Summary of occurrence

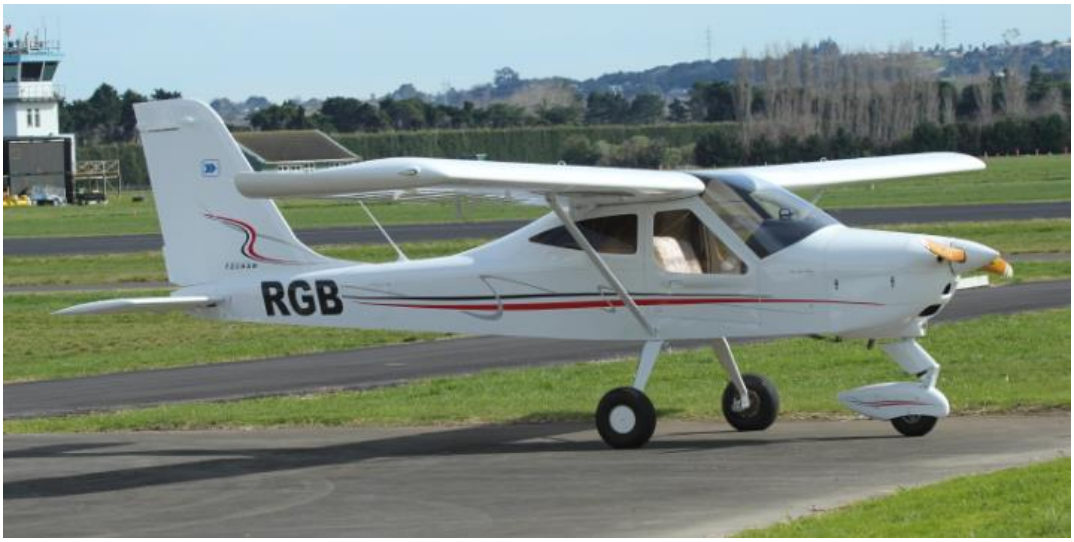

Figure 1. ZK-RGB, Tecnam P92 Echo Classic (picture copied from 'NZ Civil Aircraft' website).

ZK-RGB clipped powerlines during a dual training flight

On 28 April 2021, an instructor from a local club ("the club")[1], was conducting a lesson in ZK-RGB, a Tecnam P92 Echo Classic aircraft. The instructor was teaching a simulated forced landing without power exercise[2] followed by an engine failure after takeoff[3] exercise. During the engine failure after take-off demonstration, at around 30 feet (ft)[4], the aircraft clipped powerlines, departed controlled flight, and then impacted terrain in a nose-down attitude. The aircraft came to a rest approximately thirty metres past the powerlines. There was significant damage to the aircraft. The instructor and student sustained serious injuries, but were able to get out of the aircraft. The property owner and a neighbour attended to the pilots until rescue services arrived. Both pilots required hospital treatment for their injuries.

[1] The involved club is affiliated to the Recreational Aircraft Association of New Zealand (RAANZ), which is the CAA Part 149 organisation with designated oversight of aviation recreation organisations.

[2] This is a required skill for a pilot in the case of a partial or complete engine failure and teaches a student pilot to select an appropriate landing site and manage the aircraft's descent so that a successful landing can be achieved.

[3] This is a required skill for a pilot in the case of an engine failure after take-off and teaches the student pilot to adopt the recommended procedure in the event of an engine failure at low level.

[4] All heights referenced in this report are above ground level.

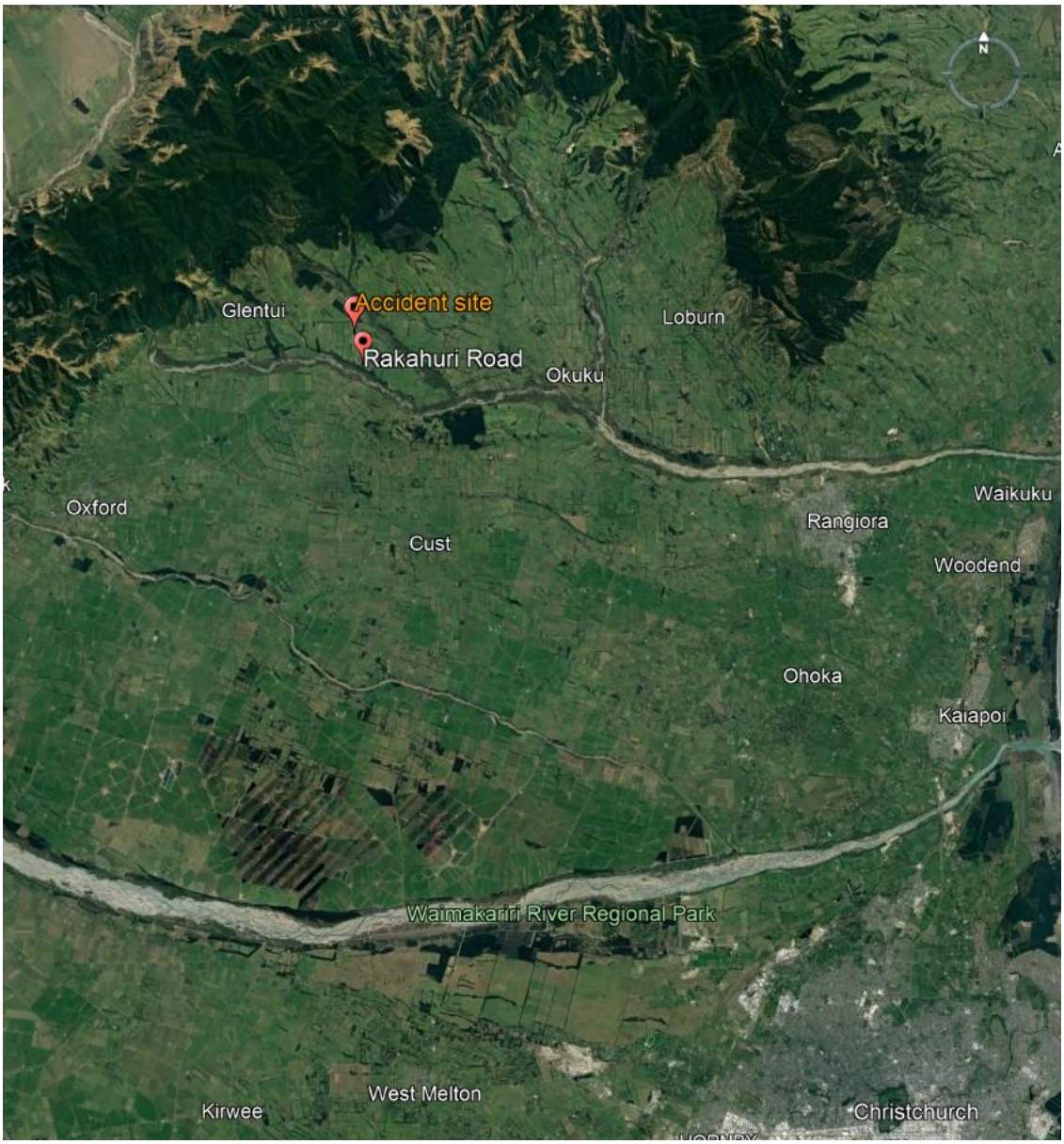

Figure 2. Location of accident. Adapted Google Earth™ image.

An area that looked suitable for simulated engine failure exercises was chosen

The instructor reported they were not very familiar with the area and usually conducted simulations elsewhere. Due to the calm weather on the day, however, the instructor determined the area was appropriate for the exercise.

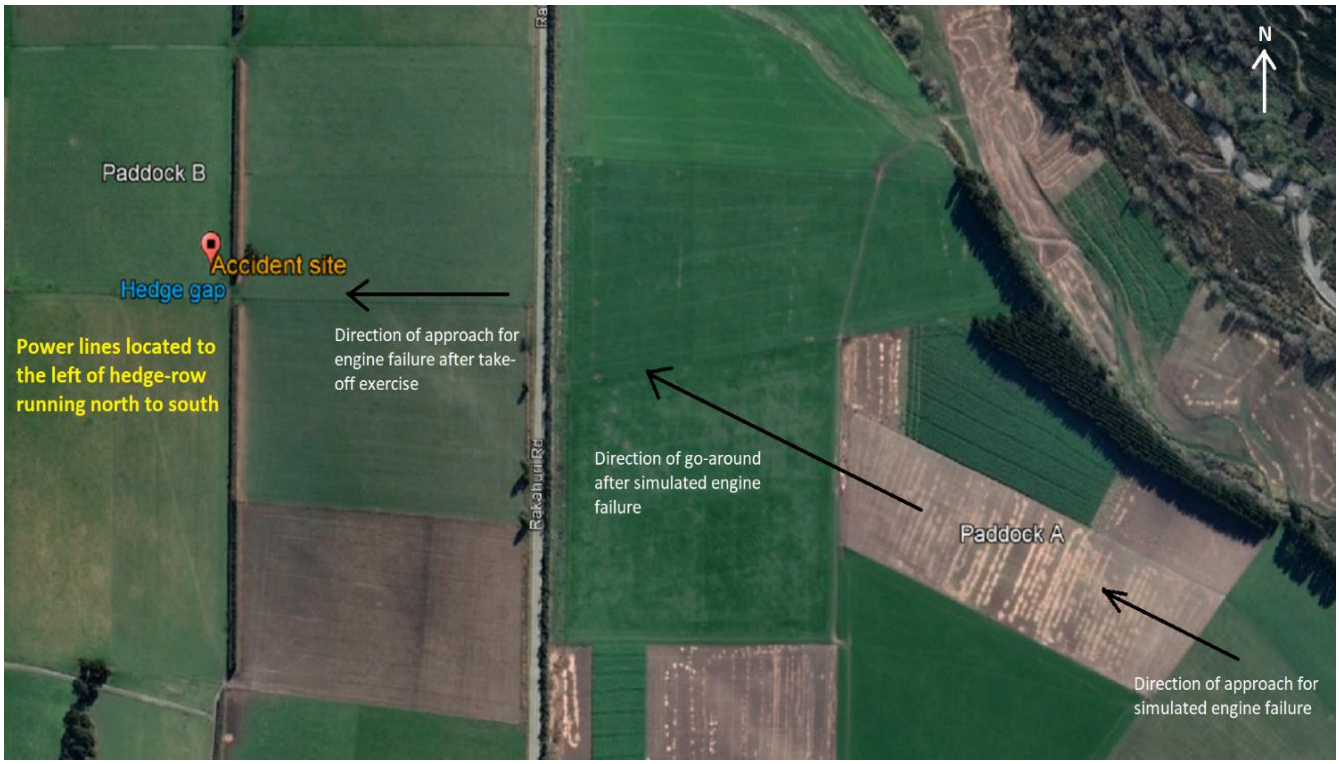

Figure 3. Simulated exercises diagram. Adapted Google Earth™ image.

The first part of the exercise was a simulated forced landing into Paddock A. The instructor reported having their hands on the control stick with the student 'following through' on the controls. The student was instructed to close the throttle to simulate the engine failure. On the completion of this simulation, the instructor then talked through a go-around.

At approximately 150 ft the student was instructed to close the throttle again to simulate an engine failure after take-off into Paddock B. During the simulation it was noted the aircraft did not have quite enough altitude to make it over the hedge. There was, however, a sizeable gap in the hedge and the instructor suggested aiming for that. As the aircraft glided towards the paddock over the gap, the instructor explained that landing diagonally across the paddock would increase the potential landing distance, and they initiated a small right turn. It was at this point the right wheel clipped unseen powerlines that were strung across the gap.

The powerlines were difficult to see in the gap between the hedges

From the direction of approach, the power poles and lines were largely obscured behind the hedgerow. The tops of some power poles were visible along the length of the hedge. The power lines across the gap in the hedge, however, did not stand out against the green background of the paddock and hills. Without the visual cues provided by power poles, and with the powerlines obscured by, or blending into, background colours, neither the instructor nor the student could see the powerlines.

Figure 4. View from ground level of powerlines across gap in hedgerow

The instructor said the weather was clear, with light and variable winds. These observations were supported by Metservice weather information obtained during the investigation. Weather was not considered a contributing factor in the accident. Sun glare was also considered but was determined not to have affected the instructor or student.

The instructor was operating within the rules at the time of the accident

CAA Rule 91.311, *Minimum heights for VFR flights* (c) allows for descent below 500 ft where the bona fide purpose of the flight requires the aircraft to be flown at a height lower than 500 ft (Appendix 1). A CAA interpretation of this rule considers that dual instruction for the purpose of simulating forced landings after engine failure is a bona fide purpose (Appendix 2). The following conditions must be met to comply with the rule:

1. *"The flight is performed without hazard to persons or property on the surface; and*
2. *only persons performing an essential function associated with the flight are carried on the aircraft; and*
3. *the aircraft is not flown at a height lower than that required for the purpose of the flight; and*

4. *the horizontal distance that the aircraft is flown from any obstacle, person, vessel, vehicle, or structure is not less than that necessary for the purpose of the flight, except that in the case of an aeroplane, the aeroplane remains outside the horizontal radius of 150 metres from any person, vessel, vehicle, or structure that is not associated with the operation."*

The rule does not stipulate a minimum height above ground level that the aircraft may descend to.

The instructor wanted to provide a realistic demonstration of actions in the event of an engine failure

The CAA recognises that providing realistic simulated engine failure training at varying locations is essential to build a pilot's skills. Allowing an aircraft to descend below 500 ft for the purposes of engine failure training recognises this need. Depending on the stage of training, it can be appropriate for these lessons to be conducted to a very low height. For example, a flight examiner or instructor of an advanced student may wish to ensure, without doubt, that the pilot can conduct successful landings in the event of engine failure.

The objective of a simulated forced landing or engine failure after takeoff lesson, is to learn how to manage an aircraft's descent profile to ensure a safe landing can be carried out off-aerodrome. Once it can be assessed the aircraft is going to be successful in landing on the chosen spot, a go-around is initiated, and the simulation is discontinued. The height at which this assessment can accurately be made is at the discretion of the instructor. Prudent practice suggests an approach should never go below the highest obstacle in the go-around unless committing to land.

The investigation considered whether it was good operating practice at such an early stage of training, to descend ZK-RGB to approximately 30 ft to satisfy the purpose of this lesson. See (3) above. Consultation with CAA flight examiners and aviation safety advisors indicated the success of the exercise can generally be assessed at around 200 ft. In consideration of the early stage of training, while ZK-RGB was being operated within the rules, descent was continued to a height lower than necessary to demonstrate the success of this simulation.

The instructor was not following recommended lesson content guidelines

The student's logbook was reviewed. The student was on his third lesson and all three lessons had included demonstrations of simulated engine failures. In addition to engine failure simulations, each lesson had included several different skills such as effects of controls, straight and level, turning, climbing and descending, and circuits. This was not in line with the RAANZ or CAA flight instruction guidelines.

The instructor said he wanted to demonstrate to students a wider range of exercises to capture their interest and keep students enthused about coming back for subsequent flights. He also said some students have a fear of what would happen if the engine failed and that demonstrating this, early in training, helps allay these fears. Some other club instructors reportedly followed a similar lesson structure.

Similar lesson content issues were identified in another microlight accident

In July 2021 an accident occurred during a dual instruction flight for a pre-solo student in Masterton. The investigation identified that:

- the instructor introduced an advanced exercise during a pre-solo lesson
- introducing advanced skills at such an early stage in training would likely have overwhelmed the student
- non-adherence to the recommended lesson content probably reduced the effectiveness of learning outcomes for the student.

Introducing advanced skills to pre-solo students is not best operating practice

Consultation with CAA flight examiners indicated that introducing advanced flight exercises in the first few lessons does not support effective learning and is not compatible with good instructional technique principles. Students would likely become overwhelmed with the lesson content and would be unable to achieve meaningful learning. A trial flight is generally used as a student's first introduction to flying. In this flight, exercises can be varied to capture a student's interest.

Lesson guidance provided on the RAANZ website[5] (Appendix 3) generally mirrors the CAA Flight Instructor Guide[6]. The sequence of lessons is designed so one lesson provides the capability for the next skill to be taught and learned effectively. It relies on prior knowledge and the aims of the appropriate lesson being met before moving to the next stage. This method of structured learning helps the student achieve success and is more likely to sustain their interest.

If a student is fearful of engine failure, the CAA considers that a simple demonstration of the aircraft in a glide while at altitude would be enough to allay this fear.

[5] RAANZ training syllabus

[6] CAA Flight Instructor Guide

Survivability

Several factors influenced the survivability of the aircraft occupants

- The aircraft was operating at 55-60 knots airspeed, which is at the lower end of the range of flight speeds.
- The impact with the powerlines snapped one of the lines and the nearest power pole. This would have dissipated some of the forward energy of the aircraft.
- The height the aircraft clipped the powerline was approximately 30 ft.
- The aircraft sustained substantial damage, however, the cockpit maintained sufficient survivable space for the occupants.
- Seats and seatbelts were intact with little seat distortion observed.

ZK-RGB had a modified seatbelt anchor point

Anecdotally, several club members and instructors had reported issues with the original Tecnam seatbelt design. Some club pilots felt the original design (Figure 5) allowed the lap belt to ride up during flight. Concerns were raised that in an accident the seatbelt may not meet its design function to securely hold pilots in the seat, and that sliding out under the lapbelt was a possibility. As a result of these concerns, the Chief Flying Instructor designed and modified the anchor point in conjunction with a local IA[7] (Figure 6).

A review of the aircraft documentation found appropriate procedures were followed in introducing the modification.

[7] Inspection Authorisation. This is a person approved as an authorised inspector for major repairs or modifications under CAA Part 103.

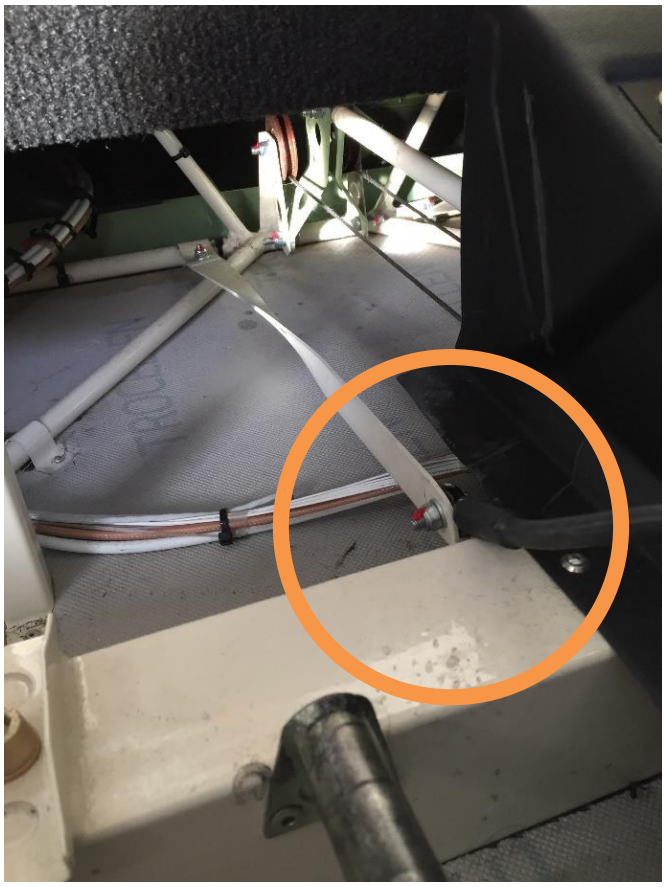

Figure 5: Original Tecnam seatbelt anchor design

Note: Seatbelt (buckle side) is connected to a metal strip, which is not anchored to the spar. This allows vertical movement of the seatbelt

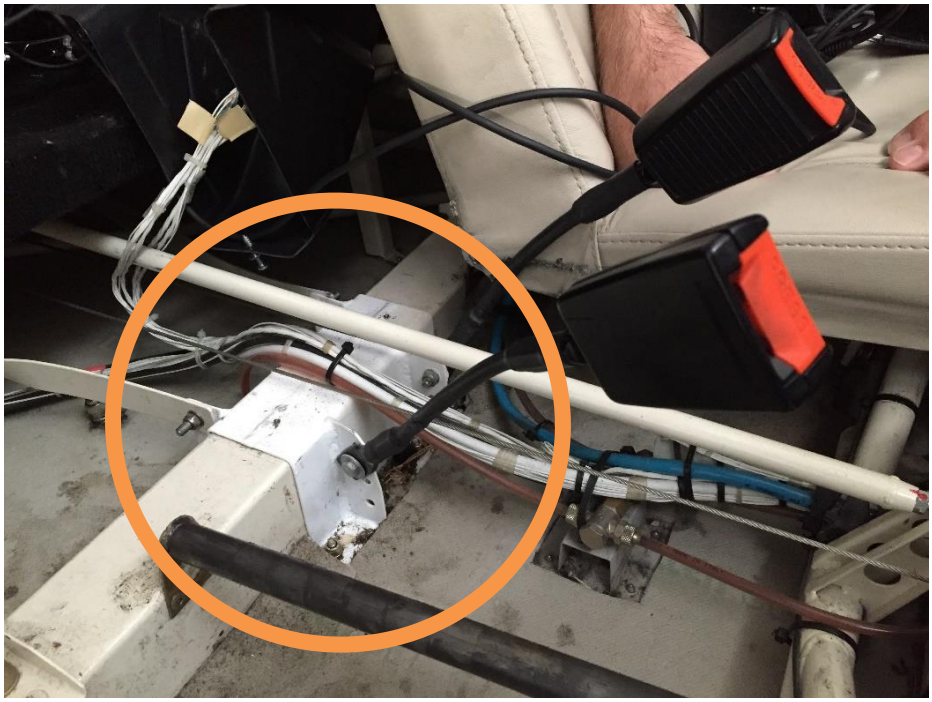

Figure 6: Modified seatbelt anchor point. Seatbelt buckle unable to lift, holding seatbelt more securely across lap.

Both pilots had been firmly held in their seats during the accident sequence. The CAA was unable to state with certainty that the new seatbelt design led to a safer outcome for the aircraft occupants than the original design would have provided. However, after discussing the issues of the original design with the club's senior leadership, observing both the original and the new designs together, and consulting the New Zealand Tecnam representative, the CAA considers the modified design is worthy of consideration as a design improvement by owners and operators of the P92 Classic model.

The New Zealand Tecnam representative provided photographic images to the CAA showing the new P92 Echo MkII model seat-belt anchor point design. This new design is similar to the modification made to RGB.

Conclusions

The CAA made the following findings as a result of the investigation:

- The instructor was appropriately qualified and current at the time of the accident.
- Weather was not a factor in the accident.
- The aircraft was legally operating below 500 ft.
- For early-stage training, the instructor had descended lower than was considered necessary to determine the success of the exercise.
- The instructor and student did not see the powerlines.
- The hedge largely obscured the power poles and lines and there were limited visual cues for the pilots to identify that powerlines were present.
- The instructor was not following lesson content guidelines as recommended by RAANZ and the CAA.
- A Part 103 instructor not following lesson content guidelines was identified in another accident investigation.
- Introducing advanced skills to pre-solo students is likely to overwhelm the student and limit the effectiveness of learning.
- A combination of factors positively influenced accident survivability.
- Owners and operators of the P92 Echo Classic may wish to consider modifying the seat-belt anchor point.

Safety actions

Actions already taken

- The club has introduced a 200 ft minima for the practice of simulated engine failure exercises conducted off-aerodrome.
- The club has agreed to follow lesson delivery guidelines as outlined on RAANZ and CAA websites.
- RAANZ has communicated to its members its expectations for the conduct of flight instruction, in accordance with RAANZ and CAA guidelines.

Further actions to be taken

- RAANZ will conduct a non-routine audit of training to ensure training activities are conducted in accordance with RAANZ and CAA rules and guidelines.

Administrative information

Aircraft manufacturer and model		Tecnam P92 Echo Classic
Registration		ZK-RGB
Location of incident		Glentui, North Canterbury S43 13 47.88 E172 20 11.78
Date and time of incident (UTC)		27 April 2021 23:30
Civil Aviation Rules applying		Part 91 *Visual Flight Rules* Part 103 *Microlight Aircraft Operating Rules* Part 149 *Aviation Recreation Organisations Certification*
Occurrence number		21/2368
Injuries	Crew	2. Serious injuries.
	Passengers	N/A
	Others	N/A

Pilot-in-command information

Age and gender		64 Male
Pilot licences		RAANZ and SAC
Flying experience (hours)	Total time	2222.45
	Total time on type	520
	Total instructing	650
	In last 7 days	1.4
	In last 90 days	77
	In last 12 months	89

Meteorological information and flight plan

Conditions at accident site	Wind	Light and variable
	Visibility	Unlimited
	Cloud	Nil
	Pressure	1018
	Temperature	13 degrees
Departure point		Rangiora Airfield
Destination		Rangiora Airfield

Wreckage and impact information

Aircraft damage	Substantial
ELT activated?	No. Not fitted nor required to be.
ELT signal received by Rescue Coordination Centre (RCCNZ)?	N/A
Aircraft recovered?	Yes
Location	Glentui, North Canterbury S43 13 47.88 E172 20 11.78

APPENDICES

Appendix 1: CAA Rule 91.311 Minimum heights for VFR flights

91.311 Minimum heights for VFR flights

(a) A pilot-in-command of an aircraft must not operate the aircraft under VFR—

(1) over any congested area of a city, town, or settlement, or over any open air assembly of persons at a height of less than 1000 feet above the surface or any obstacle that is within a horizontal radius of 600 metres from the point immediately below the aircraft; or

(2) over any other area—

(i) at a height of less than 500 feet above the surface; or

(ii) at a height of less than 500 feet above any obstacle, person, vehicle, vessel, or structure that is within a horizontal radius of 150 metres from the point immediately below the aircraft; and

(3) for any operation, at a height less than that required to execute an emergency landing in the event of engine failure without hazard to persons or property on the surface.

(b) Paragraph (a) does not apply to a pilot-in-command of an aircraft—

(1) conducting a take-off or landing; or

(2) conducting a balked landing or discontinued approach; or

(3) taxiing.

(c) Paragraph (a)(2) does not apply to a pilot-in-command of an aircraft if the *bona fide* purpose of the flight requires the aircraft to be flown at a height lower than that prescribed in paragraph (a)(2), but only if—

(1) the flight is performed without hazard to persons or property on the surface; and

(2) only persons performing an essential function associated with the flight are carried on the aircraft; and

(3) the aircraft is not flown at a height lower than that required for the purpose of the flight; and

(4) the horizontal distance that the aircraft is flown from any obstacle, person, vessel, vehicle, or structure is not less than that necessary for the purpose of the flight, except that in the case of an aeroplane, the aeroplane remains outside a horizontal radius of 150 metres from any person, vessel, vehicle, or structure that is not associated with the operation.

Appendix 2: CAA Legal Information Bulletin Number 1

Legal Information Bulletin Number 1

CIVIL AVIATION AUTHORITY OF NEW ZEALAND

Interpretation of CAR 91.311(c)

Effective Date: This ruling is effective from September 2004

Catchwords: low flying

flight instruction and flight examining

Sponsoring area: Personnel Licensing and Aeronautical Services

Issue

The purpose of this bulletin is to state the CAA's position on the interpretation of CAR 91.311(c) with respect to flight training and examination activity conducted otherwise than in accordance with the exception to the low flying rule provided in 91.311(d).

Background

The "low flying rule", CAR 91.311(a), provides as follows:

> (a) A pilot-in-command of an aircraft must not operate the aircraft under VFR—
>
> (1) over any congested area of a city, town, or settlement, or over any open air assembly of persons at a height of less than 1000 feet above the surface or any obstacle that is within a horizontal radius of 600 metres from the point immediately below the aircraft; or
>
> (2) over any other area—
>
> (i) at a height of less than 500 feet above the surface; or
>
> (ii) at a height of less than 500 feet above any obstacle, person, vehicle, vessel, or structure that is within a horizontal radius of 150 metres from the point immediately below the aircraft; and
>
> (3) for any operation, at a height less than that required to execute an emergency landing in the event of engine failure without hazard to persons or property on the surface.

Exceptions are provided to the rule in CAR 91.311(b), (c) and (d).

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(b) Paragraph (a) does not apply to a pilot-in-command of an aircraft—

(1) conducting a take-off or landing; or

(2) conducting a balked landing or discontinued approach; or

(3) taxiing.

(c) Paragraph (a)(2) does not apply to a pilot-in-command of an aircraft if the *bona fide* purpose of the flight requires the aircraft to be flown at a height lower than that prescribed in paragraph (a)(2), but only if—

(1) the flight is performed without hazard to persons or property on the surface; and

(2) only persons performing an essential function associated with the flight are carried on the aircraft; and

(3) the aircraft is not flown at a height lower than that required for the purpose of the flight; and

(4) the horizontal distance that the aircraft is flown from any obstacle, person, vessel, vehicle, or structure is not less than that necessary for the purpose of the flight, except that in the case of an aeroplane, the aeroplane remains outside a horizontal radius of 150 metres from any person, vessel, vehicle, or structure that is not associated with the operation.

(d) Paragraph (a)(2) does not apply to a pilot-in-command—

(1) who is the holder of, or authorised by the holder of, a current instructor rating issued under Part 61 and who is conducting flight training or practice flights consisting of—

(i) simulated engine failure after take-off commencing below 1000 feet above the surface; or

(ii) simulated engine failure commencing above 1000 feet above the surface provided that descent below 500 feet above the surface is conducted within a low flying zone in accordance with 91.131; or

(2) who is the holder of a current instrument rating issued under Part 61 and who is conducting IFR training, testing, or practice flights under VFR, but only if the pilot-in-command conducts the flight in accordance with 91.413, 91.423 and 91.425; or

(3) operating an aircraft within a low flying zone in accordance with 91.131; or

(4) operating an aircraft at an aviation event in accordance with 91.703.

CAA Position

The exceptions to the low flying rule listed in 91.311 are not expressed as applying exclusively to the situation described in each exception. Accordingly, the rule does not preclude pilots engaged in flying training activities from relying on the exception in 91.311(c) despite the express reference to flight training in 91.311(d).

Where the bona fide purpose of the flight is dual flight training or during a flight examination in the exercise of forced landings without power which may require an aircraft to be operated at height lower than that described in 91.311(a)(2), the pilot-in-command may rely on the exception provided in 91.311(c) as long as the requirements in that rule are complied with.

Appendix 3: RAANZ training syllabus

Training Syllabus

The following is a suggested syllabus and sequence for ab initio microlight training.

Note:

- Each lesson consists of a briefing on the theoretical aspects of the lesson, flight lesson including instructor demonstration and student practice, and debriefing to dicsuss and consolidate the lesson learned.
- The number of briefings/flights to complete each stage will vary.
- The sequence may be altered to suit the conditions and progress of the student.
- Lessons 1 to 9 are to be carried out **dual prior to first solo**.
- Some lessons will require repetition until the student reaches the required standard.
- There is a considerable period from first solo through to Intermediate pilot certificate at 25 hours. It is suggested that a dual lesson be given followed by a solo practice.
- Solo consolidation should be a minimum of 2 hours in the circuit prior to moving on to advanced exercises.
- Where a pilot has previous flying experience the syllabus can be changed to suit, however it is still important that the pilot be briefed by an instructor and competence be demonstrated by the student.
- The final decision always rests with the Instructor.

Lesson	Topic	Notes
1	Introductory flight	To provide air experience and confidence
2	Pre-flight & ground handling	To learn how to prepare the aircraft for flight
3	Taxiing	To learn how to safely maneuver the aircraft on the ground
4	Effect of controls	To learn the effects of the controls and to study the effects of slipstream, airspeed and inertia
5	Straight and level, climbing and descending	To fly the aircraft on a constant heading and airspeed while in level, climbing and descending flight
6	Slow flight	To demonstrate the range of speeds that the aircraft can be safely maneuvered
7	Basic stalling	To recognize the symptoms of the stall and to learn the correct technique for recovery at onset which will result in minimum loss of height
8	Takeoff, circuit, landing	To learn the correct procedure and safe techniques for takeoff, flight in the aerodrome traffic circuit, approach and landing
9	Emergency procedures	To familiar the student thoroughly with the drills to be used in an emergency- eg EFATO, glide approaches and go around
First solo		
10	First solo/solo consolidation	For the student to gain confidence and improve skills in solo circuit flying
11	Circuit joining procedure	To join the circuit in a safe, systematic and approved fashion
12	Flapless landings	To make an approach and landing without the use of flaps
13	Crosswind operations	To takeoff and land the aircraft safely in crosswind conditions
14	Precautionary and forced landings	To select a suitable landing area and and land safely in the event of bad weather or an engine failure
15	Short takeoff and precision landings	To learn the correct technique for taking off and landing in a confined area
16	Steep turns	To learn tuning at high angles of bank
17	Advanced stalling	Stalling with various power and flap settings, wing drop stalls
18	Low flying	To fly the aircraft safely, accurately and with confidence at lower altitudes includingt terrain and weather awareness
Intermediate pilot test		
19	Map reading and compass turns	To use the map and compass as an aid to cross-country flying
20	Cross-country flying	To learn the correct procedures for the preparation and undertaking of cross-country flight
Advanced pilot test		
21	Type rating	To familiarize an experienced pilot and ensure proficiency in a new aircraft typ

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 Act).

Following notification of an accident or incident, TAIC may open an inquiry. 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

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.

About this safety investigation report

The purpose of this brief is to identify to the aviation community:

- what happened
- factors contributing to the accident, and
- any relevant safety messages.

Civil Aviation Authority of New Zealand
Level 15, Asteron Centre
55 Featherston Street
Wellington 6011

OR

PO Box 3555, Wellington 6140, NEW ZEALAND

Tel: +64-4-560 9400 Fax: +64-4-569 2024
www.aviation.govt.nz