

SAFETY INVESTIGATION REPORT
CAA OCCURRENCE NUMBER 15/258
MICRO AVIATION BANTAM B22
ZK-SMC
DEPARTURE FROM CONTROLLED FLIGHT
2.5 NM EAST OF TIMARU AERODROME
23 JANUARY 2015



Photo by Dave Paull

Foreword

New Zealand's legislative mandate to investigate an accident or incident are 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 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 CA 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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Glossary of Abbreviations

ARO	Aviation Recreation Organisation
C	Celsius
CAA	Civil Aviation Authority
CAR	Civil Aviation Rule(s)
CMV	Certificate of Membership Validation
E	east
ESR	Institute of Environmental Science and Research
GP	General Practitioner
kg	kilogram(s)
km	kilometre(s)
mph	miles per hour
NM	Nautical Miles
NZDT	New Zealand Daylight Time
PMO	Principal Medical Officer
S	south
UTC	Coordinated Universal Time
VHF	Very High Frequency

Data Summary

Aircraft type, serial number and registration:	B22 Bantam, s/n 0129 ZK-SMC
Number and type of engines:	One, Bombardier-Rotax 582 LC
Year of manufacture:	1994
Date and time of accident:	23 January 2015, 1930 hours ¹ (approximately)
Location:	2.5 NM east of Timaru Aerodrome
	Latitude ² : S 44° 18' 20.98" Longitude: E 171° 16' 45.25"
Type of flight:	Training
Persons on board:	Crew: 2
Injuries:	Crew: 2 (fatal)
Nature of damage:	Aircraft destroyed
Pilot-in-command's licence	Senior Flight Instructor Microlight Pilot Certificate
Pilot-in-command's age	86 years
Pilot-in-command's total flying experience:	5125 hours
Investigator in Charge:	Mr S Rogers

¹ All times in this report are NZDT (UTC + 13 hours) unless otherwise specified.

² NZ Geodetic Datum WGS-84 co-ordinates.

Executive Summary

At approximately 1908 hours on 23 January 2015 ZK-SMC, a Bantam B22 Microlight aircraft, operating from a local microlight flying club, took off from Timaru Aerodrome on a dual training flight.

Approximately 20 minutes later witnesses observed the aircraft conducting manoeuvres including steep angles of bank, and then pitch down and enter a steep descent from which it did not recover, before striking the ground. The accident was not survivable.

The safety investigation concluded that the accident occurred as a result of the aircraft departing controlled flight. It could not be conclusively determined why the aircraft reached a point where the departure from controlled flight had occurred, or why recovery was not effected before the aircraft struck the ground. Two scenarios that could not be excluded are: a handling error; pilot incapacitation; or a combination of both.

As a result of the safety investigation two Safety Actions and one Safety Message have been raised regarding the following themes:

- Operational heights for air exercises,
- Medical certification procedures for microlight pilots, and
- Aircraft handling characteristics.

1. Factual Information

1.1 History of the flight

1.1.1 At approximately 1830 hours on the day of the accident the student picked up the instructor and drove to Timaru Aerodrome, where they prepared for a dual training flight. The instructor's briefing notes were later discovered in the microlight flying club premises, open at the briefing for the steep turn air exercise. ZK-SMC departed the aerodrome at 1908 hours for a training area to the east of the aerodrome.

1.1.2 At approximately 1930 hours five witnesses in four different locations saw the aircraft enter a rapid and steep descent. Three of the five witnesses had observed the aircraft executing manoeuvres that included high angles of bank immediately prior to the sudden descent. Three witnesses reported noticing some degree of rotation of the aircraft during the descent.

- 1.1.3 A witness who was situated approximately 1 km to the east of the accident site reported seeing the aircraft strike the ground in a vertical nose down descent.
- 1.1.4 Emergency services responding to the accident confirmed both occupants of the aircraft had received fatal injuries.
- 1.1.5 The accident occurred in daylight, at approximately 1930 hours, 2.5 NM east of Timaru Aerodrome, at an elevation of 30 feet. Latitude S 44° 18' 20.98", Longitude E 171° 16' 45.25".

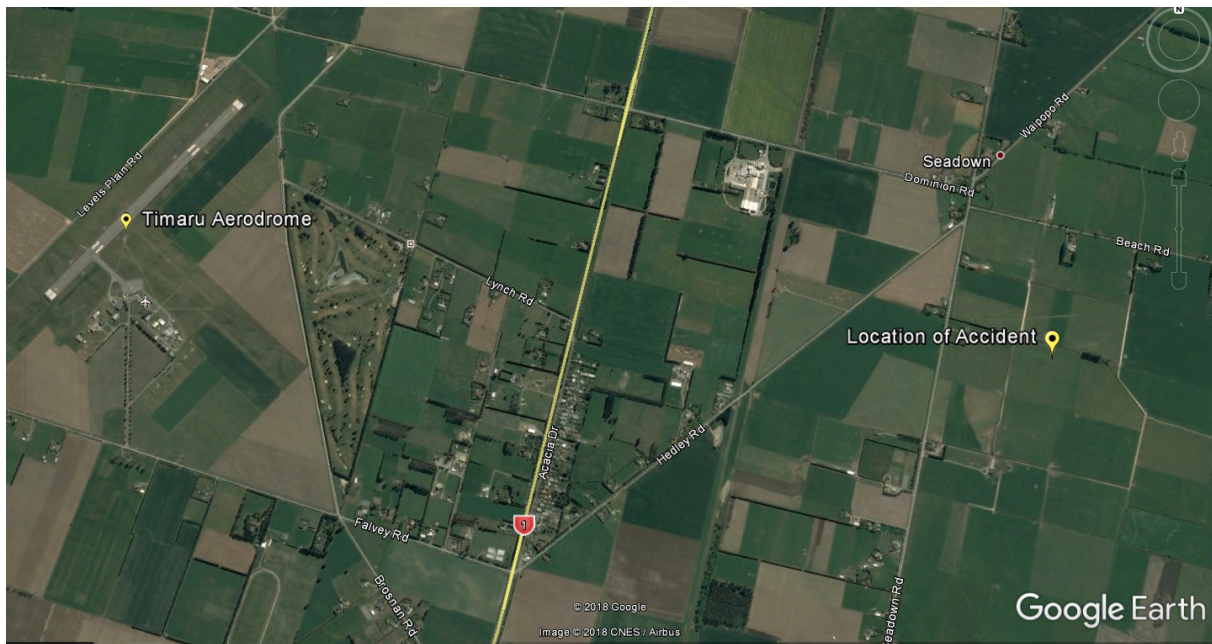


Figure 1. Location of accident

1.2 Injuries to persons

Injuries	Crew	Passengers	Other
Fatal	2	0	0

Table 1. Injuries to persons

1.3 Damage to aircraft

- 1.3.1 The aircraft was destroyed.

1.4 Other damage

- 1.4.1 Nil.

1.5 Personnel information

Pilot in Command - Instructor

Flying hours	All Aircraft	Microlight Aircraft
Last 24 hours	0	0
Last 7 days	0	0
Last 30 days	0	0
Last 90 days	2hr 10min	2hr 10min
Total hours	Approximately 5125	570 (minimum 124 on Bantam B22)

Table 2. Instructor flight hours recorded in Pilot Logbook

- 1.5.1 The instructor, aged 86, held a Senior Flight Instructor Microlight Pilot Certificate and was a member of a Civil Aviation Rule (CAR) Part 149 certificated Aviation Recreation Organisation (ARO). His Certificate of Membership Validation (CMV) at the time of the accident was issued on 25 October 2014 and valid for 12 months.
- 1.5.2 The instructor held a Medical Declaration with an expiry date of 19 August 2016. This was indicated on his CMV, in accordance with the ARO's procedures.
- 1.5.3 The instructor met the recent experience requirements of having conducted three take offs and landings in the last 90 days, required for exercising the privileges of his Senior Flight Instructor Microlight Pilot Certificate. The last flight in his Pilot Logbook was dated 22 December 2014.
- 1.5.4 The instructor accrued his flying experience in many types of aircraft over the course of a long flying career, during which he had held a Commercial Pilot Licence. At the time of the accident, the total flight time recorded in the instructor's Pilot Logbook was approximately 5125 hours. Approximately 570 hours were recorded on microlight aircraft, of which a minimum of 124 were in the Bantam B22 aircraft.
- 1.5.5 The instructor was recognised for his contribution to flight instruction in 1996 by the Federation Aeronautique Internationale, who awarded him the Air Sport Medal for his outstanding contribution to aviation. The instructor was presented with the 2012 Greg Vujcich Memorial Award for Excellence in General Aviation Instruction by the New Zealand Air Line Pilots' Association.

Personnel Information

Student

- 1.5.6 The student pilot, aged 51 years, held a Novice Microlight Pilot Certificate from the same ARO as the instructor. His CMV, current at the time of the accident was issued on 28 June 2014 and valid for 12 months. The student's Medical Declaration could not be located during the safety investigation, however his GP was able to confirm examining him on 25 June 2014 for a Microlight Pilot medical.
- 1.5.7 The student's Pilot Logbook recorded approximately 17 hours total flight time, of which approximately 8 hours were dual instruction, and 9 hours solo flight. All of the student's dual instruction was recorded as being conducted in ZK-SMC and with the instructor he was flying with on the day of the accident.
- 1.5.8 The flights recorded in the student's Pilot Logbook show the student completed his first solo flight on 9 August 2014, and he was working towards the flight hours and training requirements needed for a flight test for an Intermediate Microlight Pilot Certificate.

1.6 Aircraft information

- 1.6.1 Bantam B22, serial number 0129, ZK-SMC was a Class 2 Microlight aircraft, designed and manufactured by Micro Aviation New Zealand Limited. It was a high-wing monoplane with conventional controls, two-place side-by-side seating and was powered by a 64-horsepower Bombardier-Rotax 582 LC engine driving a fixed-pitch three blade Warp Drive carbon fibre propeller.
- 1.6.2 The aircraft was registered with the CAA in March 1994 and at the time of the accident the aircraft had accrued approximately 1460 hours total time, as recorded in the Aircraft Logbook. The most recent maintenance was an Annual Aircraft Condition Inspection, completed on 4 January 2015.
- 1.6.3 Pilots operating ZK-SMC had access to Bantam B22 Pilot Notes, which gave technical and operational guidance for the aircraft. The Pilot Notes stated that the maximum gross weight for the aircraft was 376 kg. It was calculated that the aircraft would have weighed approximately 392 kg at the time of the accident.

- 1.6.4 The Bantam B22 aircraft type is not a certificated aircraft. Minor changes in design were made in order to meet New Zealand certification requirements, with a subsequent type designation of Bantam B22S. A Flight Manual for the B22S was first approved by the CAA on 6 May 1996.
- 1.6.5 The B22 and B22S are very similar, and fundamentally the same aircraft. Although the B22 aircraft is not specifically covered by the B22S Flight Manual, the guidance provided in that document would still apply to the B22.
- 1.6.6 The Bantam B22S Flight Manual states that the aircraft has low inertia and relatively high drag characteristics.
- 1.6.7 The Flight Manual contains the following statement in Section 4, *Normal Procedures*:

Caution:

‘The aircraft gives little warning of an impending stall³. Depending on the configuration (load, power setting, flap setting – also fabric tightness) the aircraft may or may not exhibit any pre-stall buffet.’

Section 4 further states:

‘The onset of the stall is evidenced by a drop in the nose attitude together with a loss of altitude. If the aircraft is unbalanced there may be a tendency for a wing to drop’.⁴

1.7 Meteorological information

- 1.7.1 At the time of the accident a large anticyclone was centred over New Zealand. Light winds and clear skies were forecast in the area where the accident occurred.

³ 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.

⁴ A wing drop stall occurs when there is a greater loss of lift on one wing, resulting in the aircraft rolling towards that wing. If not promptly recovered, the nose of the aircraft may pitch down steeply during, or immediately following the roll.

1.7.2 The Timaru Aerodrome automatic weather station at 1930 hours on the day of the accident recorded light variable winds, with visibility 30 km, a temperature of 20°C and no cloud below 25000 feet.

1.7.3 Meteorological conditions were not considered likely to be a contributory factor to the accident.

1.8 Aids to navigation

1.8.1 Not applicable.

1.9 Communications

1.9.1 A light weight portable VHF air band radio was installed in the aircraft, as well as an intercom system between the instructor and student to facilitate communication.

1.9.2 The accident occurred in airspace that did not require a radio. No Mayday call was heard from the instructor or student.

1.10 Aerodrome information

1.10.1 Not applicable.

1.11 Flight recorders

1.11.1 Not applicable.

1.12 Wreckage and impact information

1.12.1 The accident occurred on a level farm paddock adjacent to Seadown Road near Timaru. The aircraft wreckage signatures indicate the aircraft struck the ground in a nose down attitude of between approximately 80° and 90°. Significant crush damage to both wings, and some angular displacement of the keel was evident. Despite some witness reports of the aircraft rotating during the descent, the wreckage signatures showed there was little evidence of this at the time of impact.

1.12.2 Ground witness marks indicated an upwards curvature of the leading edges of both wings at the point of impact. This was likely a result of loads imparted by the keel during the accident sequence, however some degree of positive aerodynamic load on the wings immediately prior to impact could not be discounted.

- 1.12.3 The propeller hub and drive gear assembly had detached from the gearbox, all three carbon fibre propeller blades remaining attached to the hub. Damage to the propeller blades indicate that although they were rotating at impact, it was unlikely they were doing so under high engine power.
- 1.12.4 Limited information could be derived from the aircraft instruments, except both magnetos were found selected on, and the airspeed indicator needle was observed to be indicating approximately 82 mph.
- 1.12.5 All control surfaces were accounted for at the accident site. Pre-impact control integrity was established as far as possible. No pre-existing defects which may have affected normal flight were identified during the safety investigation.
- 1.12.6 It was not possible from analysis of the wreckage to determine whether the instructor or student was manipulating the aircraft controls at the time of the accident.

1.13 Medical and pathological information

- 1.13.1 Autopsy reports prepared by the pathologist indicated that the occupants died of multiple injuries sustained in the accident.
- 1.13.2 The pathologist stated in the report on the instructor that: ‘There was an old apical posteroseptal full thickness myocardial infarct⁵ scar but no new or recent apparent further infarct’, also noting the presence of a ‘surgically treated aortic abdominal aneurysm’.
- 1.13.3 The Institute of Environmental Science and Research (ESR) Forensic toxicology report for the instructor indicated that 5 milligrams per 100 millilitres of alcohol was present in the instructor’s vitreous fluid. The ESR Forensic toxicologist stated that low levels of alcohol may be due to means other than deliberate ingestion.
- 1.13.4 The CAA Principal Medical Officer (PMO) was asked to review the autopsy report on the student, and commented that apart from the traumatic injuries sustained in the accident, the report for the student was otherwise unremarkable. Toxicology reports by the scientists at ESR Forensic indicated that no alcohol was detected in the vitreous fluid of the student.

⁵ Commonly referred to as a heart attack.

1.13.5 It was not possible to determine from the autopsy reports whether the instructor or student was manipulating the controls at the time of the accident.

1.14 Fire

1.14.1 Fire did not occur.

1.15 Survival aspects

1.15.1 Although the occupants were wearing helmets and restrained by the aircraft harnesses, the impact forces sustained during the accident were not survivable.

1.16 Tests and research

1.16.1 A strip down inspection of the engine was conducted by a specialist under CAA supervision. During the inspection it was determined that the engine was capable of delivering power at the time of the accident. There was sufficient fuel of the correct two stroke mixture available to the engine.

1.17 Organisational and management information

1.17.1 The oversight of microlight personnel certification, including medical standards, is delegated to organisations certified to meet the requirements of CAR Part 149.

1.17.2 The medical requirements for holding a microlight pilot certificate consist of a self-declaration of medical fitness by the pilot, and an examination by either a CAA Designated Medical Examiner or the applicant's General Practitioner (GP). This is to be conducted in accordance with the NZ Transport Agency guidelines for medical requirements for a Class 1 Private Motor Vehicle driving licence.⁶

1.18 Additional information

1.18.1 In an effort to ensure standardisation in flight training, the CAA produces a Flight Instructor Guide which is publicly available on the CAA web site⁷. The guide includes briefings for air exercises, such as steep turns. The briefing for this

⁶ The ARO Medical Declaration and Certificate form states that: 'The Land Transport Authority document 'Medical Aspects of Fitness to Drive' at <http://www.nzta.govt.nz/resources/medical-aspects/> for a Class 1 Private Motor Vehicle shall be used as a basis for examination.'

⁷ <http://www.caa.govt.nz/fig/index-2/>

manoeuvre advises applying any organisational minimum altitudes⁸ for the conduct of the exercise.

- 1.18.2 The instructors briefing notes referred to checking height⁹ before commencement of the steep turn exercise, however no specified minimum altitude was indicated.
- 1.18.3 The ARO training manual, *Principles of Flight* section states, 'The increase in stall speed dictates a higher entry airspeed into the steep turn. Failure to maintain sufficient airspeed in the turn could result in a stall. To stall in a steep turn invariably results in a rapid change in direction and loss of height (and may possibly develop into a spin). More height may be needed to recover from such a stall and steep turns **must** be avoided near the ground'.
- 1.18.4 The CAA Flight Instructor Guide also offers advice on stalling exercises, stating that they should be conducted at such a height that permits recovery from the stall by not less than 2500 feet above ground level.
- 1.18.5 The instructors briefing notes indicated stalling exercises should be conducted at a height that permits recovery by 3000 feet.

1.19 Useful or effective investigation techniques

- 1.19.1 Nil

2. Analysis

- 2.1 Evidence gathered by the safety investigation indicated that whilst conducting manoeuvres the aircraft departed controlled flight. The safety investigation could not conclusively determine why the aircraft reached a point where the departure from controlled flight had occurred, or why recovery was not effected before the aircraft struck the ground.
- 2.2 Two scenarios that could not be excluded are: a handling error; pilot incapacitation; or a combination of both.

⁸ In simple terms altitude is the vertical distance above mean sea level.

⁹ Height is the vertical distance above the surface over which the aircraft is flying. Except for specialised low level operations, a pilot must fly at an altitude which results in a safe height above the surface for the operation they are engaged in.

- 2.3 The safety investigation was unable to determine whether the instructor or student was manipulating the aircraft controls at the time of the accident.
- 2.4 Irrespective of who was manipulating the controls at the time the aircraft departed controlled flight the instructor is the Pilot in Command, and responsible for the safe conduct of the flight.
- 2.5 Evidence such as; witness observation; the instructor's briefing notes open to the steep turns lesson and the stage of the student's training all indicate that, at the time of departure from controlled flight, it was likely the aircraft was engaged in an air exercise such as steep turns.
- 2.6 Aircraft with low inertia and relatively high drag, such as the Bantam B22, have potential to lose substantial airspeed in steep turn manoeuvres.
- 2.7 Witness statements and subsequent calculations indicate the aircraft was likely operating at a height below 1000 feet above ground level when it departed controlled flight.
- 2.8 Instructors experienced on the Bantam aircraft type, consulted during the safety investigation, stated that the aircraft generally displays docile stall characteristics when stalled with power at idle and the aircraft in balanced straight and level flight. Stalling from a steep turn in an out of balance condition is reported to incur risk of a sudden wing drop stall, which would require rapid recovery action to prevent significant height loss.
- 2.9 On the day of the accident the aircraft was calculated to be approximately 16 kg above the maximum gross weight published in the Bantam B22 Pilot Notes. This may have resulted in a small increase in the airspeed at which the aircraft will stall at.
- 2.10 Any manoeuvres that may cause a loss of airspeed, such as steep turns, if mishandled have the potential to result in the aircraft departing controlled flight. Any delay in recovering from a departure from controlled flight may result in rapid transition to an unusual aircraft attitude, and likely a significant height loss.
- 2.11 Management of the risks associated with training manoeuvres and low level flight are the subject of extensive flight training material. While guidance on the specific level at which steep turns should be conducted is generally absent, enough material is

available to permit instructors to make informed judgements for any particular set of circumstances. The safety investigation could not conclude, given the guidance available, why an experienced instructor elected to conduct a manoeuvre such as a steep turn at an altitude which may not have allowed sufficient height for recovery following a departure from controlled flight.

- 2.12 CAA Safety Action 18A866 was raised for the CAA to improve awareness within AROs of the potential for rapid and significant height loss, in the event of unexpected departure from controlled flight, when conducting manoeuvres which have the potential to result in a substantial loss of airspeed.
- 2.13 With regard to pilot incapacitation, the ARO Medical Declaration and Certificate form includes a list of conditions, including high blood pressure and coronary heart disease, which are required to be declared if present. The form states that if an applicant has a medical condition listed on the form, the condition is stabilised by medication, and the medical practitioner considers the applicant may be fit to fly, then the applicant may sign acknowledging that they may only fly after meeting all of the obligations placed on the certificate by the medical practitioner.
- 2.14 The instructor's medical records documented a long history of high blood pressure and resulting cardio vascular problems, however no reference was made to these on the Medical Declaration current at the time of the accident, either by the instructor or his GP. The CAA PMO commented that, even if the instructor was assessed as fit to fly: 'I believe the pilot and the [GP] should have made mention of the pilot's long term and very serious cardiovascular history'.
- 2.15 The safety investigation did not establish why neither the instructor nor his GP disclosed his cardio vascular disease on his Medical Declaration form. As such, CAA Safety Action 18A867 was raised recommending a review be conducted, by the CAA, in conjunction with AROs, to establish if there is appropriate guidance and clarity for GPs regarding the use of driver licence medical standards in an aeromedical setting.
- 2.16 The CAA PMO examined the pathologist report, CAA medical files and subsequent medical records for the instructor. These documented a long history of high blood pressure problems resulting in his needing major vascular surgery as well as suffering a heart attack and needing coronary artery stenting. After detailed analysis

the CAA PMO concluded that the instructor ‘...had a high likelihood of suffering a medical incapacitation event’.

2.17 Medical incapacitation could not be excluded as a possible contributing factor to the accident.

3. Conclusions

3.1 The accident occurred as a result of the aircraft departing controlled flight, and entering a steep descent from which it did not recover before striking the ground.

3.2 The safety investigation was unable to conclusively determine the reason the aircraft reached a point where departure from controlled flight occurred, or why recovery was not effected before the aircraft struck the ground.

3.3 Two scenarios that could not be excluded are: a handling error; pilot incapacitation; or a combination of both.

3.4 It could not be determined which pilot was manipulating the aircraft controls at the time of the accident.

3.5 The instructor was the Pilot in Command, and responsible for the safe conduct of the flight.

3.6 The aircraft was engaged in manoeuvres that had potential to bring it close to its stalling speed.

3.7 The aircraft was seen conducting manoeuvres, including steep angles of bank, at an altitude that provided minimal safety margin in the event of a departure from controlled flight.

3.8 Operating the aircraft above the maximum gross weight may have resulted in the aircraft stalling at a higher airspeed.

3.9 The instructor did not disclose his ongoing cardio vascular disease on his Medical Declaration.

3.10 Medical incapacitation of the instructor could not be excluded as a possible contributing factor in the accident.

3.11 The instructor was licenced to conduct the flight and met the minimum currency requirements to exercise the privileges of his Microlight Pilot Certificate.

3.12 The accident was not survivable, due to the impact forces.

4. Safety Actions

4.1 CAA Safety Action 18A866 was raised for the CAA to improve awareness within AROs of the potential for rapid and significant height loss, in the event of unexpected departure from controlled flight, when conducting manoeuvres which have the potential to result in a substantial loss of airspeed.

4.2 CAA Safety Action 18A867 was raised recommending a review be conducted, by the CAA, in conjunction with AROs, to establish if there is appropriate guidance and clarity for GPs regarding the use of driver licence medical standards in an aeromedical setting.

5. Safety Message

5.1 Aircraft displaying low inertia and high drag characteristics may lose airspeed very quickly during certain manoeuvres, with increased risk of inadvertent departure from controlled flight. A CAA Safety DVD which addresses inertia, momentum and drag can be borrowed within New Zealand from CAA for free. Details can be found at: <http://www.caa.govt.nz/safety-info/dvds/>

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