



CAA Safety Investigation Report

Departure from controlled flight

ZK-MBX RANS Aircraft S-19

Near Hyde, Central Otago

25 June 2017

CAA Final Report 17/3767

10 Oct 2019

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Executive summary

A Rans Aircraft S-19 Class 2 Microlight ZK-MBX, was being operated on a private cross-country flight. The flight was part of a planned group fly away with seven other aircraft, from Taieri Aerodrome to Omarama Aerodrome for a group lunch on 25 June 2017.

At approximately 1129 hours¹, while in the cruise phase of flight at approximately 5200ft above mean sea level (AMSL), the aircraft departed controlled flight, subsequently impacting terrain.

The Rescue Coordination Centre (RCC) of New Zealand notified the Civil Aviation Authority (CAA) of the missing aircraft at approximately 1500 hours. The aircraft wreckage was located approximately three nautical miles south-east of Hyde in Central Otago. A rescue helicopter arrived at the wreckage site at approximately 1630 hours. The pilot received fatal injuries. The passenger, who was also a pilot, suffered severe injuries, was trapped inside the aircraft wreckage and was subsequently airlifted to hospital.

The safety investigation identified the following contextual factors:

- The pilot let the passenger fly the aircraft
- The passenger was not familiar with the Rans Aircraft S-19 cockpit ergonomic layout
- The sensitivity of the electric trim buttons may cause unintentional activation of the trim system
- The out of trim control stick forces can be significant.

¹ All times are New Zealand Standard Time (NZST).

Safety messages

There are risks associated with allowing someone who is not appropriately qualified to manipulate the controls of an aircraft

Pilots are reminded that the only time someone else who is not appropriately qualified can take the controls of an aircraft is in the presence of a qualified flying instructor.

Unlike the general pilot population, instructors are trained to recognise when things are going wrong, and to take the appropriate remedial action in a timely manner. Instructors also use procedures to hand over control of the aircraft to prevent situations whereby either both pilots are attempting to fly the aircraft at the same time, or nobody is in control of the aircraft.

Using flight following services can reduce time spent searching for a missing aircraft

Pilots are reminded of the safety benefit of using a flight following service. This could reduce the amount of time spent searching for an aircraft and subsequently increase the chance of survival while waiting for rescue.

The CAA publishes a *Good Aviation Practice (GAP) Booklet on Survival*. This booklet provides comprehensive information about survival and can be found at www.caa.govt.nz.

Introduction

This report describes our safety investigation into the accident. It includes:

- an incident timeline
- any relevant maps and photographs
- the findings from our safety investigation — categorised into human factors, equipment factors, and environmental factors
- a set of safety actions and messages.

Incident timeline

25 June 2017

- 08:35 (approx.) The pilot/owner arrives at Taieri Aerodrome and completes a pre-flight aircraft inspection
- 10:30 (approx.) Pilot attends a briefing and conducts pre-flight planning
- 11:09 (approx.) ZK-MBX departs Taieri Aerodrome for Omarama Aerodrome
- 11:20 (approx.) The pilot lets the passenger fly the aircraft
- 11:29 (approx.) The passenger is about to make a radio call when the departure from controlled flight occurs
- 11:30 (approx.) The aircraft impacts terrain and comes to rest upside down approximately three nautical miles south east of Hyde in Central Otago
- 13:00 (approx.) Pilots from the group fly away attempt to contact the pilot and passenger by cell phone
- 15:00 (approx.) RCCNZ notify the CAA Duty Investigator of the missing aircraft, an aerial search is underway
- 16:30 (approx.) RCCNZ report that the aircraft has been found. The passenger is taken to hospital by rescue helicopter.

Incident map

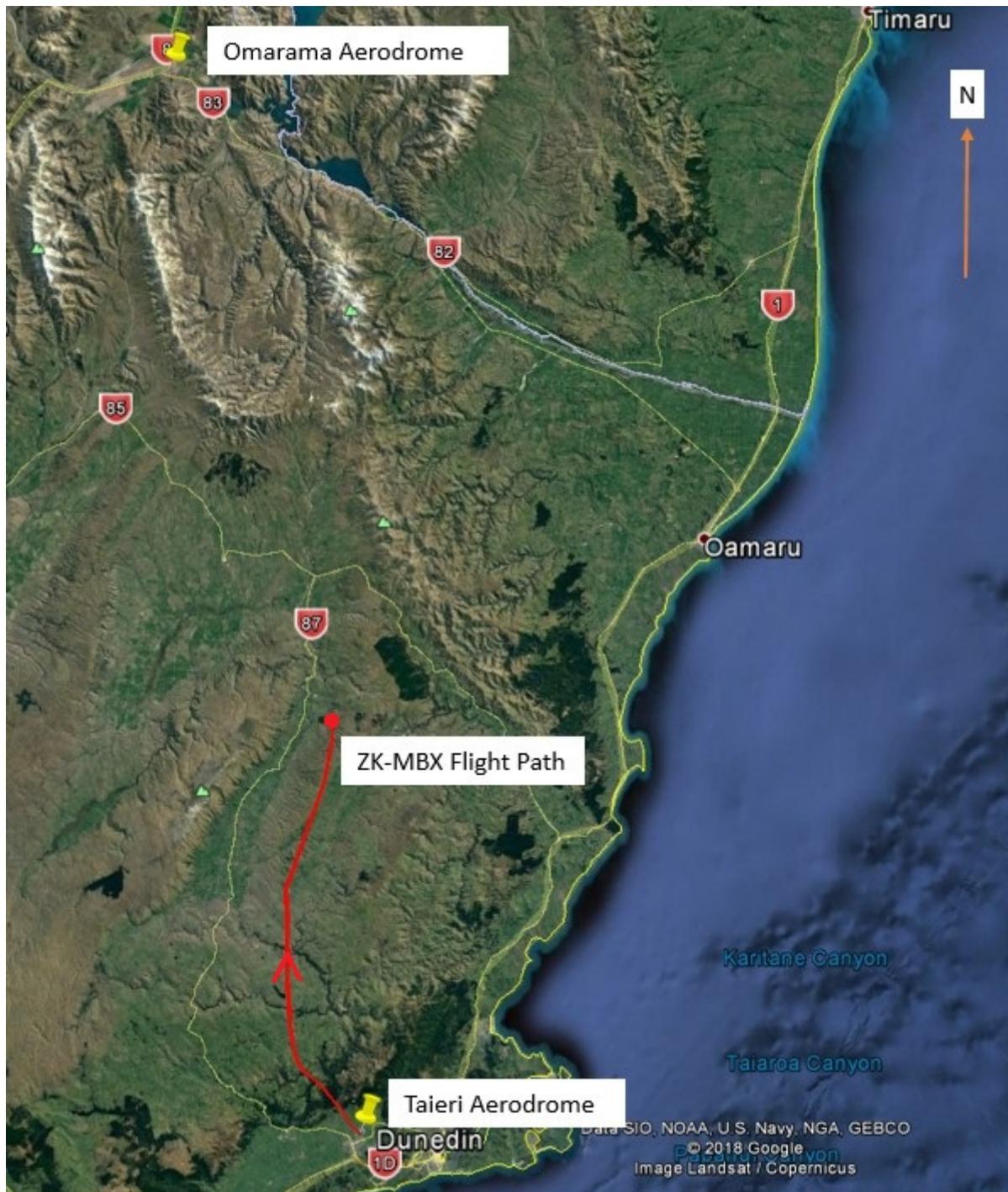


Figure 1: Map of flight path (Google Earth)

Findings and conclusions from the investigation

The safety investigation covered human factors, equipment factors, and environmental factors. The key findings are listed below and are then described in more detail.

- | | |
|-----------------------|--|
| Human factors | <ul style="list-style-type: none">· The pilot held the appropriate microlight pilot certificate to carry a passenger· The passenger held a microlight pilot certificate· The pilot let the passenger fly the aircraft· The passenger was not familiar with the cockpit ergonomic layout· The passenger was about to make a radio call when control of the aircraft was lost. |
| Equipment factors | <ul style="list-style-type: none">· No pre-accident defects were found with the aircraft· The sensitivity of the electric trim buttons may cause unintentional activation of the trim system· The trim actuator was close to the full nose down position· The out of trim control stick forces can be significant. |
| Environmental factors | <ul style="list-style-type: none">· The weather was suitable for the flight· It took approximately five hours to identify the aircraft was missing and locate it· The endurance (flight) testing program for ZK-MBX, lacked detailed documentation. |

Equipment factors

No pre-accident defects were found with the aircraft



The aircraft was a single engine Rans Aircraft S-19 Class 2 Microlight (See Fig 2). It was an all metal low wing microlight aircraft with fixed tricycle landing gear and two seats in a side by side configuration. It was fitted with an Electronic Flight Information System (EFIS) which displayed the aircraft instruments on two glass screens (See Fig 3). The safety investigation found no faults with the aircraft or its systems.

Figure 2: Example of a Rans Aircraft S-19



Figure 3: ZK-MBX Instrument Panel

The pilot/owner constructed the aircraft from a kit set. It was issued with a non-terminating Flight Permit in March 2014, in accordance with CAA Rule Part 103 – *Microlight Aircraft* –

Operating Rules. At the time of the accident, ZK-MBX had a valid Sports Aviation Corp Ltd (SAC) – Annual Condition Inspection Flight Permit Validation and no reported defects.

The sensitivity of the electric trim buttons may cause unintentional activation of the trim system

The aircraft was fitted with an all moving stabilator² tail plane and an antiservo trim tab³ which allows the pilot to adjust the pitch trim forces using an electric pitch trim system.

The electric pitch trim system consisted of a trim actuator (connected to the antiservo trim tab) and two electric flush fitted push button switches. The glass EFIS screens are configured to display the elevator trim position.

The pitch trim servo was activated by physically pressing either the up or down electronic trim buttons, located on the top of both control stick grips. (See Fig 4). This sent an electrical signal via an electronic circuit breaker system to the pitch trim actuator.

During the safety investigation it was noted that the push button switches, by design, are sensitive and susceptible to inadvertent activation. They only required a light touch to activate the trim.



Figure 4: Ray Allen G205 Stick Grip, as installed on ZK-MBX (Manufacture).

² Stabilator - A single piece horizontal tail surface on an airplane which serves the purpose of both the horizontal stabilizer and the elevators. – *Aviation Supplies & Academics, Inc. Dictionary of Aeronautical Terms.*

³ Antiservo trim tab - A tab installed on the trailing edge of a stabilator. The tab automatically moves in the same direction as the stabilator to produce a stabilizing aerodynamic force that tries to bring the surface back to a streamline position. Also known as an antibalance tab. – *Aviation Supplies & Academics, Inc. Dictionary of Aeronautical Terms.*

The trim actuator was close to the full nose down position

During the onsite wreckage examination, it was noted that the trim actuator was almost at the fully extended nose down position.

The aircraft's EFIS system recorded the flight parameters, which included the pitch trim movement. This data was analysed during the safety investigation and indicated that the pitch trim moved continually for six seconds to a point where it was almost in the full nose down position - it was at this point that the departure from controlled flight occurred.

The safety investigation could not conclusively determine what caused the trim actuator to move.

The out of trim control stick forces can be significant

The test pilot who conducted the test flying of ZK-MBX and the flight training of the pilot stipulated that on three separate occasions while the pilot was under training he inadvertently pressed the trim up button instead of the push to talk (PTT) button while making a radio call prior to commencing the take-off roll. The test pilot reported that on one occasion, once the aircraft became airborne, he had to use both his hands to overcome the trim forces in order to maintain control of the aircraft during the climb.

As part of the safety investigation, the owner of a similar aircraft was approached and offered comment on the control stick forces in his aircraft. He disclosed the aircraft has "very strong force[s] if out of trim". He reported that on one occasion a passenger had an open book resting on top of the control stick. This activated the trim button and the owner reported "really having to fight it". He reported having to apply "very high stick forces" to maintain control of the aircraft.

Human factors

The pilot held the appropriate microlight pilot certificate to carry a passenger

The pilot commenced his pilot training in 2010 and flew intermittently until 2012 at which point his flight training stopped. He recommenced flight training in 2014 and flew consistently in ZK-MBX, gaining approximately 267 hours of flight time.

At the time of the accident the pilot held a current SAC Advanced Microlight Pilot Certificate, with an approval to carry a passenger and held a valid Medical Certificate and Declaration.

The passenger was not qualified to fly the Rans Aircraft S-19

The passenger was also a pilot and held an SAC Advanced Microlight Pilot Certificate. He had accrued 106 hours of flight time, with most of his flying experience on a Rans S-6, and more recently a VANS RV-12. He did not hold a type rating on the Rans Aircraft S-19.

The pilot let the passenger fly the aircraft

Once established in the cruise phase of the flight, the passenger indicated that the pilot said “do you want to have a go flying the plane”. The passenger said when interviewed, “All I had to do was just hold the joystick because he’d [the pilot] trimmed the plane nicely”.

The pilot was not an instructor and was not authorised to let another person manipulate the aircraft’s controls. However, it would appear this is not an uncommon practice. The passenger had also not received formal training to fly an aircraft from the right-hand seat.

The passenger was not familiar with the cockpit’s ergonomic layout

The passenger had not previously flown in a Rans Aircraft S-19 and was not familiar with its cockpit layout.

The passenger normally flew an aircraft with conventional instruments. ZK-MBX was fitted with an EFIS which displayed the aircraft instruments on two glass screens (See Fig 3).

ZK-MBX had two dual control sticks which were located in front of both seats (See Fig 3). The flush fitted electric trim buttons are located on top of both control sticks. The forward button activated the nose down trim and rear button activated the nose up trim (See Fig 4). The PTT button is located on the front of the control stick.

The passenger had recent flying experience in the RANS S-6 and VANS RV-12 aircraft. Both of these aircraft are fitted with dual controls sticks and are located in front of both seats. The PTT buttons are located on the top of both control sticks (See Fig 5). The PTT buttons have a large stroke length which provides positive feedback when compared to the short stroke length of electric trim buttons, such as those on ZK-MBX’s control sticks.



Figure 5: VANS RV-12 control stick with the push to talk button located on top.

The passenger was about to make a radio call when control of the aircraft was lost

As ZK-MBX was approaching Middlemarch at approximately 5200 feet AMSL and 110 knots indicated airspeed, the pilot and passenger discussed making a position report radio call.

The passenger was flying the aircraft while the discussion was happening and the pilot was map reading. During the interview the passenger stipulated that “we tried to work out our distance from Hyde which we thought was about five miles to the east of us I think it was. At that point I was just going to make the radio call”.

The passenger indicated “I just had my finger on the button to make the call when” the departure from controlled flight occurred. During the interview the passenger indicated pushing the nose down trim button, rather than the PTT button. The passenger further stated that he could not recall if he pushed the button or not.

The passenger described the moment of the departure from controlled flight “the plane lurched violently down. It tipped over frontwards”. He indicated that both of his hands went straight up into the air because of the forces and the aircraft was in a “tumbling” motion. This tumbling motion continued for approximately 30 seconds to a minute before the aircraft came into contact with the ground.

The passenger indicated he was attempting to regain control of the aircraft when it “clipped” the ground and came to rest upside down. The passenger was unsure if the pilot was also attempting to regain control of the aircraft but did hear him say “how are we going to get out of this”.

Environmental factors

The weather was suitable for the flight

The safety investigation has found no evidence to indicate the weather contributed to this accident.

The passenger indicated that the weather conditions leading up to the time of the loss of control were smooth with no turbulence. During the interview the passenger stipulated that “The plane wasn’t buffeting around the sky, it was just a nice smooth flight”.

Statements from the other seven pilots who were flying in a similar geographical area at a similar time also indicted the weather conditions were smooth.

It took approximately five hours to identify the aircraft as missing and locate it

The flight was part of a planned group fly away with seven other aircraft from Taieri Aerodrome (NZTI) to Omarama Aerodrome (NZOA) for a group lunch. The group staggered their departure time to allow for differences in aircraft speed, departing NZTI between approximately 1030 and 1100 hours. The intention was to meet at NZOA for lunch with no specific arrival time set.

The group returned from lunch and noted that ZK-MBX had not arrived at NZOA. Members of the group attempted to contact the pilot and passenger of ZK-MBX by cell phone but this was unsuccessful.

No flight plans were filed or specific flight following activated other than the mutual knowledge of the group of pilots involved.

At approximately 1500 hours the New Zealand Rescue Coordination Centre advised the CAA that ZK-MBX was reported as overdue and up to eight aircraft were involved in the search and rescue effort. ZK-MBX was located upside down in a field close to Middlemarch at approximately 1630 hours.

The flight testing program for ZK-MBX, lacked detailed documentation

Endurance testing was carried out on the aircraft in accordance with Rule Part 103.211 *Endurance testing*.

Rule Part 103.213 (1) *Statement of Airworthiness* stipulates that details of every manoeuvre completed during the endurance testing together with details of the demonstrated flight speeds are entered into maintenance records.

The safety investigation could not identify any evidence identifying what manoeuvres were conducted during the endurance testing. It should be noted, however; this is not thought to be a contributing factor to the accident, it is simply being raised as a safety observation.

Safety actions already taken

CAA *Vector* magazine article – Stay in Control

A *Vector* article – Stay in Control was published in the July/August 2018 issue of the CAA *Vector* magazine. The article aims to raise awareness of the risks associated with allowing someone who is not appropriately qualified to manipulate the controls of an aircraft.

<https://www.caa.govt.nz/assets/publications/vector/Vector-2018-4.pdf>

The CAA formally requested Part 149 organisations communicate the *Vector* article with their members.

The *Vector* article relates to the following factors from the safety investigation:

- The pilot let the passenger fly the aircraft
- The passenger was not familiar with the Rans Aircraft S-19 cockpit ergonomic layout.

The importance of flight following services will be communicated to Part 149 Organisations

The topic of group flyaways and the need for SAR watches, flight following and the safety benefit of having a leader in the group who would provide some form of leadership/direction, was raised by CAA staff members at the Dunedin user group meeting held at Taieri Aerodrome in late 2018. It was also raised at the Flying NZ, Part 149 Organisations conference in mid 2019.

In the Summer 2019 edition of *Vector*, an article will be published reminding pilots of the importance of flight following.

The CAA formally requested Part 149 Organisations to communicate to their members the importance of flight following services and the management and oversight of group flyaways. This relates to the fact that it took approximately five hours to identify the aircraft was missing and locate it.

The design of the control stick grip offers no protection to inadvertent trim commands

The design of the control stick, and associated trim buttons, offers no protection to inadvertent trim commands. The safety investigation has identified occurrences of inadvertent trim actuations. As such, the CAA has issued a Continuing Airworthiness Notice – 27-013 Control Sticks fitted with a G205 Stick Grip manufactured by The Ray Allen Company (See Appendix 1).

The sensitivity of the electric trim buttons may cause unintentional activation of the trim system has also been raised as a safety observation. This has been brought to the attention of the stick grip manufacturer, as a formal Safety Observation (CAA 20A177).

Control stick forces have been brought to the attention of the aircraft manufacturer

Considerable aircraft stick control forces, whilst in an out of trim state, have been identified by this safety investigation. As such the CAA has issued a Continuing Airworthiness Notice – 27-013 Control Sticks fitted with a G205 Stick Grip manufactured by The Ray Allen Company (See Appendix 1).

The CAA has also brought this observation to the attention of the manufacturer, as a formal Safety Observation (CAA 20A178).

There is, currently, only one other similar aircraft operating in New Zealand. This safety observation has already been raised with that owner.

Accident Data Summary

Aircraft make and model, registration and serial number:	Rans Aircraft S-19, 051100102
Engine(s) make and model, type of engine(s):	Rotax 912 ULS 3
Year of manufacture:	2014
Accident date and time:	25 June 2017, approximately 11:30 NZST
Location:	Central Otago Latitude S45°20'17.56" Longitude E170°18'12.48"
Altitude:	1492 feet above mean sea level
Type of flight:	Private
Injuries:	1 fatal 1 serious
Nature of damage:	Substantially damaged
Pilot's licence:	Advanced Microlight Pilot Certificate
Pilot's age:	73
Pilot's total flying experience:	267 hours
Information sources:	Civil Aviation Authority field investigation
Investigator in Charge	Mr D Foley

Appendices

Appendix I

Continuing Airworthiness Notice – 27-013



Control Sticks fitted with a G205 Stick Grip manufactured by The Ray Allen Company

21 August 2019

Issued by the Civil Aviation Authority of New Zealand in the interests of aviation safety. A Continuing Airworthiness Notice (CAN) is intended to alert, educate, and make recommendations to the aviation community. A CAN contains non-regulatory information and guidance that does not meet the criteria for an Airworthiness Directive (AD). The inspections and practices described in this CAN must still be carried out in accordance with the applicable NZCAR Parts 21, 43 and 91 - CAN numbering is by ATA Chapter followed by a sequential number for the next CAN in that ATA Chapter.

Applicability:

Aircraft with a control stick fitted with a G205 stick grip manufactured by The Ray Allen Company.

Affected stick grips are known to be installed on, but not limited to Rans aircraft models fitted with a horizontal stabiliser electric pitch trim system.

Purpose:

This Continuing Airworthiness Notice (CAN) is issued to bring attention to an airworthiness concern with G205 stick grips manufactured by The Ray Allen Company fitted on aircraft with a horizontal stabiliser electric pitch trim system.

This CAN is also applicable to other aircraft fitted with an all-moving horizontal stabiliser, which may have a horizontal stabiliser electric pitch trim system with a similar control stick configuration prone to the same safety concern.

Background:

This CAN is prompted by a fatal accident involving a Rans S-19 aircraft. The preliminary investigation found the horizontal stabiliser electric pitch trim actuator almost in a full nose down position.

The aircraft EFIS system on the accident aircraft records certain flight parameters, including the horizontal stabiliser electric pitch trim position. Analysis of this data indicated that the horizontal stabiliser electric pitch trim continually moved for six seconds, to an almost full nose down position, with the aircraft then departing controlled flight.

The owner of a similar aircraft disclosed that control stick forces on his aircraft are "very strong if out of trim". He reported that on one occasion a passenger had an open book resting on top of the control stick. This activated the trim button and required a high input force on the control stick to maintain aircraft control.

On Rans S-19 aircraft the dual control sticks are floor mounted in front of the seats. Both control sticks are fitted with flush mounted electric trim buttons on top of the stick grip. The forward button activates the nose down trim and the aft button activates the nose up trim. The Push-to-Talk (PTT) button is located on the forward side of the control stick grip. For further details, refer to the photograph below.

Due to the design/configuration of the horizontal stabiliser electric pitch trim buttons located on the top of the control stick grip, with no protection from inadvertent trim commands, unintentional activation of the horizontal stabiliser electric pitch trim is possible. The CAA has brought this to the attention of the stick grip manufacturer.

With unintentional activation of the horizontal stabiliser electric pitch trim system and the sensitivity/speed of the electric trim, the trim system is capable of quickly trimming the aircraft into a state of an out of trim condition, which will require a significant input force on the control stick to maintain aircraft control. The aircraft manufacturer is aware of the considerable control stick force on affected aircraft in an out of trim condition.

Recommendation:

The intent of this CAN is to ensure that operators of affected aircraft are aware of the following:

- The ergonomic layout of the electric trim push buttons located on top of the control stick grip on affected aircraft offer no protection against inadvertent trim activation.
- The trim push buttons are also quite sensitive and only require a light touch to activate the electric trim.
- Due to possible inadvertent activation and the speed of the electric trim system, the trim system is capable of quickly trimming the aircraft into a state of an out of trim condition.
- Control stick forces can be significant in an out of trim condition.



The Ray Allen Company, G205 Stick Grip

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 of an accident or incident with the purpose of minimising or reducing the risk to an acceptable level of a similar occurrence. 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 the CAA 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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