

AIRCRAFT ACCIDENT REPORT
CAA OCCURRENCE NUMBER 11/2157
AUTOFLIGHT DOMINATOR
ZK-RAW
DEPARTURE FROM CONTROLLED FLIGHT
7.5 KM NORTH-WEST of KAITAIA
14 MAY 2011



Foreword

As a signatory to the Convention on International Civil Aviation 1944 (the Chicago Convention) New Zealand has international obligations in respect of the investigation of accidents and incidents. Pursuant to Articles 26 and 37 of the Chicago Convention, the International Civil Aviation Organisation (ICAO) issued Annex 13 to the Convention setting out International Standards and Recommended Practices in respect of the investigation of aircraft accidents and incidents.

New Zealand's international obligations are reflected in the Civil Aviation Act 1990 (the Act) and the Transport Accident Investigation Commission Act 1990 (the TAIC Act).

Section 72B(2)(d) and (e) of the Civil Aviation Act 1990 Act also provides:

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](#):
- (e) To notify the Transport Accident Investigation Commission in accordance with section [27](#) of this Act of accidents and incidents notified to the Authority:

Following notification to the Transport Accident Investigation Commission (the Commission) of any accident or incident which is notified to the Authority, an investigation may be conducted by the Commission in accordance with the TAIC Act. CAA may also investigate subject to the requirements of the TAIC Act.

The purpose of an investigation by the Commission is to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future, rather than to ascribe blame to any person.

CAA however investigates aviation accidents and incidents for a range of purposes under the Act. Investigations are primarily conducted for the purpose of preventing future accidents by determining the contributing factors or causes and then implementing appropriate preventive measures - in other words to restore safety margins to provide an acceptable level of risk. The focus of CAA safety investigations is therefore to establish the causes of the accident on the balance of probability.

Accident investigations do not always identify one dominant or 'proximate' cause. Often, an aviation accident is the last event in a chain of several events or factors, each of which may contribute to a greater or lesser degree, to the final outcome.

CAA investigations may also inform other regulatory-safety decision making or enforcement action by the Director.

In the case of a fatal aviation accident, the final CAA investigation report will generally be highly relevant to an inquiry, and in some circumstances, an inquest, conducted by a Coroner.

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Glossary of abbreviations

ASA	Aviation Safety Advisor
ARC	Aviation Related Concern
C	Celsius
CAA	Civil Aviation Authority
CAR	Civil Aviation Rule(s)
FAA	Federal Aviation Administration
ft	foot or feet
km	kilometre(s)
m	metre(s)
mm	millimetre(s)
MHz	megahertz
NZ	New Zealand
NZST	New Zealand Standard Time
RAANZ	Recreational Aircraft Association of New Zealand
RPM	Revolutions per minute
UTC	Coordinated Universal Time
VHF	very high frequency

Data summary

Aircraft type, serial number and registration:	Autoflight Dominator, s/n 003, ZK-RAW
Number and type of engines:	One, Subaru EA81 turbo charged piston engine
Year of manufacture:	2003
Date and time of accident:	14 May 2011, 1055 hours ¹ (approximately)
Location:	Farmland 7.5 km north-west of Kaitaia Latitude ² : S 35° 03' 48.4" Longitude: E 173° 13' 26.3"
Type of flight:	Private, Day VFR
Persons on board:	Crew: 1 Passengers: 1
Injuries:	Crew: 1 (Fatal) Passengers: 1 (Seriously injured)
Nature of damage:	Aircraft destroyed
Pilot-in-command's licence	Recreational Aircraft Association of New Zealand, Microlight Pilot Certificate, Intermediate Class, Passenger Rating
Pilot-in-command's age	50 Years
Pilot-in-command's total flying experience:	469.8 hours
Information sources:	Civil Aviation Authority Field Investigation
Investigator in Charge:	Mr D Foley

¹ All times in this report are NZST (UTC + 12 hours) unless otherwise specified.

² NZ WGS-84 co-ordinates.

Synopsis

At approximately 1035 hours on Saturday 14 May 2011 an Autoflight Dominator (gyroplane), registered ZK-RAW, took off from a private paddock approximately 7.5 km north-west of Kaitaia on a private sightseeing flight, with two people on board. After approximately 20 minutes of sightseeing, the gyroplane returned to the general area of the paddock used for the take-off and was seen to perform a series of abrupt manoeuvres. During an abrupt turn the gyroplane descended rapidly and struck the ground. The gyroplane was destroyed and the pilot received fatal injuries. The passenger received serious injuries.

The Civil Aviation Authority (CAA) was notified of the accident at approximately 1153 hours on 14 May 2011. The Transport Accident Investigation Commission was in turn notified, but declined to investigate. A CAA field investigation was commenced the same day.

1. Factual information

1. History of the flight

- 1.1.1 On the morning of the day of the accident while waiting for the passenger to arrive, the pilot refuelled the gyroplane and conducted a pre-flight inspection and engine run-up on the premises of a private residence adjacent to the take-off area.
- 1.1.2 The purpose of the flight was for private sightseeing. The passenger, who was not known to the pilot, wanted to be flown over his property so that he could take photographs and video footage of his house, in the vicinity of Dunkan Road, Kaiangaroa, approximately 12 km north-east of the paddock used for take-off.
- 1.1.3 On arrival the passenger was fastened into the gyroplane by the pilot, and a pre-flight briefing was given. The location of the passenger's house, the intended flight route and the possibility of conducting some flight manoeuvres on returning from the sightseeing phase, were also discussed.
- 1.1.4 Video footage, taken by the passenger during the flight, indicates that the take-off and sightseeing flight were conducted uneventfully, with the gyroplane arriving back in the vicinity of the departure point after approximately 20 minutes.
- 1.1.5 During the first approach to the paddock, the pilot can be heard on the video footage telling the passenger that they are going to conduct some "yea hars".
- 1.1.6 Family and friends of the pilot and passenger situated at a nearby residence, observed the gyroplane fly low level overhead and then conduct two oval circuits with abrupt pull-up and steep reversal turns. These flight manoeuvres lasted approximately two and a half minutes. The wife of the pilot stipulated that the "final turn appeared steeper than normal."
- 1.1.7 The video footage shows that following the second low approach and overshoot, the gyroplane entered a commanded steep climb and as the airspeed decreased, the

gyroplane commenced a right hand turn. At this point, approximately 120 feet above the ground, a departure from controlled flight occurred and the gyroplane's nose pitched towards the ground. The steep nose down attitude continued until the gyroplane struck the ground.

1.1.8 Family members who were first on the scene found the pilot deceased and the passenger seriously injured. First aid was administered and emergency services were called.

1.1.9 The accident occurred in daylight, at approximately 1055 hours, on farmland 7.5 km north-west of Kaitaia. Latitude S 35° 03' 48.4", longitude E 173° 13' 26.3".

1.2 Injuries to persons

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Other</i>
Fatal	1	0	0
Serious	0	1	0
Minor/None	0	0	

1.3 Damage to aircraft

1.3.1 The gyroplane was destroyed.

1.4 Other damage

1.4.1 Minor damage was sustained to a wire farm fence and an associated electric fence.

1.5 Personnel information

1.5.1 The pilot held an Intermediate Microlight Pilot Certificate with Passenger Rating, issued by the Recreational Aircraft Association of New Zealand (RAANZ). As of the 5th February 2011 he had logged a total of 469.8 hours flight time. The pilot had a current Microlight Medical Certificate and Medical Declaration at the time of the accident.

1.5.2 The pilot had come to the attention of CAA on several occasions. Some of these were raised as aviation related concerns (ARC):

- On the 16 September 2009, for allegedly conducting beach take-off and landings, and low flying, CAA 10/ARCG/29.
- On the 23 September 2009, for allegedly making repeated low passes over the Kaitaia College and Hospital in his gyroplane, CAA 10/ARCG/33.
- On the 27 March 2010, for conducting a demonstration flight at the Waikato Microlight Club's air show. A CAA Aviation Safety Adviser (ASA), who attended the air show as a CAA representative, spoke with the pilot following his display. The ASA stipulated that "the flight was carried out at an

inappropriately low level, too close to the crowd and with total disregard for the structural integrity of the gyroplane. The flight consisted of high speed turns and pull-ups.”

- 1.5.3 Following each of these occurrences, and on several other occasions, the CAA contacted the pilot for an explanation. In September 2010 the CAA made final contact with the pilot who was strongly advised at this time to “tone down” his flying, as the CAA believed he was demonstrating at risk behaviours. The pilot appeared to be unaffected by this advice and stated that “he wants people to be amazed by what a gyroplane can do so that they will be encouraged to own and fly their own gyroplane.” Given the pilots response the CAA decided to monitor for any further reports involving the pilot.

1.6 Aircraft information

- 1.6.1 The gyroplane was manufactured in New Zealand in 2003, based on an American design (Rotor Flight Dynamics Dominator), utilising a similar airframe, engine and propeller configuration.
- 1.6.2 The gyroplane had a tricycle undercarriage and was capable of carrying two people in an open cockpit with the passenger being seated behind the pilot. The gyroplane was fitted with dual controls. The main rotor utilised a semi-rigid teetering rotor head with two blades providing a disc diameter of approximately 56 feet. The rotor head was canted aft of the vertical mast by nine degrees. Roll control was provided by tilting the rotor head from side to side using the control column.
- 1.6.3 Centreline forward thrust was provided by a modified Subaru EA81 turbo charged automotive engine, driving a composite three bladed 72 inch diameter propeller.
- 1.6.4 For take-off, the rotor blades were initially turned by a mechanical pre-rotator coupled to the engine via belts and pulleys. Once adequate rotor RPM was obtained, the pre-rotator was disengaged by activating a control lever on the left side of the pilot’s seat. The gyroplane was then accelerated using thrust from the propeller while vertical lift was provided by the rotating rotor blades.
- 1.6.5 Civil Aviation Rules (CARs) require that all Class 2 Microlights have a Flight Permit. The gyroplane was first inspected and issued with a Flight Permit by the CAA in May 2003. At that time it was registered ZK-RAM.
- 1.6.6 CAR 103.207 *Issue of flight permit*, prescribes that in order to obtain a Flight Permit an application is required to be submitted to the CAA. This application is normally reviewed in conjunction with assessment of the gyroplane and its associated documentation to determine if the gyroplane is airworthy.
- 1.6.7 An application for a Flight Permit was submitted for ZK-RAM and, as part of the associated inspection, all items on the application had been marked as satisfactory. The application identified the gyroplane type as a ‘Rotor Flight Dynamics Dominator’. This was an administrative error as the gyroplane type was an ‘Autoflight Dominator’.

- 1.6.8 A further pre-requisite for the issue of a Flight Permit is compliance with CARs requiring associated maintenance records, documenting and certifying maintenance and modifications, to be generated. Specifically, CAR Part 91.616 *Maintenance logbooks* requires an operator of a Class 2 Microlight to provide appropriate maintenance logbooks. No such documentation for the gyroplane appears to have ever been generated. Despite this, the CAA issued a Flight Permit. A CAA safety action (CAA 13A1005) has been raised recommending that the CAA review the process of conducting and issuing Flight Permits for Microlight aircraft.
- 1.6.9 CAR Part 103.217 *Maintenance and inspection* prescribes that the gyroplane is to undergo a Microlight Annual Aircraft Condition Inspection every 12 months which is to be carried out by an appropriately authorised person.
- 1.6.10 Records showed the gyroplane had been inspected regularly in accordance with the Microlight Annual Aircraft Condition Inspection using forms issued by the Recreational Aircraft Association of New Zealand (RAANZ). The safety investigation identified that the RAANZ form used for the inspections referenced CARs that are no longer current. A CAA safety action (CAA 13A1007) has been raised recommending that RAANZ review the Microlight Annual Aircraft Condition Inspection Form.
- 1.6.11 CAR Part 103.217 also requires that details of the Microlight Annual Aircraft Condition Inspection are entered into the appropriate maintenance records. As no such maintenance records exist, the CARs were not complied with.
- 1.6.12 Review of the associated RAANZ Microlight Annual Aircraft Condition Inspection and Flight Permit Validation Application Form, Section 3 *Regulatory Compliance Check* indicated that ZK-RAW had no maintenance log. Despite this discrepancy, continual Annual Condition Inspections have been completed and ZK-RAW was deemed airworthy by RAANZ maintenance inspectors.
- 1.6.13 The gyroplane had a number of major modifications completed at various times, none of which had been recorded in the maintenance documentation, as required by the CARs. These modifications included the addition of a turbo charger and intercooler, nose wheel steering, a passenger windscreen, non-standard rotor blades and a propeller change.
- 1.6.14 Due to a change of ownership in 2008, the registration was changed to ZK-RAW.
- 1.6.15 In June 2010 an email request was made to the CAA to amend the gyroplane's Flight Permit to correct administrative inaccuracies and also to inform of an alternative propeller installation. Due to this propeller change, a re-issue of the Flight Permit occurred.
- 1.6.16 The last recorded maintenance on the gyroplane was carried out on 1 March 2011 which consisted of conducting a Microlight Annual Aircraft Condition Inspection by a person authorised by RAANZ. At this time a Microlight Flight Permit Validation Label was issued by RAANZ. The inspection records indicated that there were no defects with the gyroplane.

1.7 Meteorological information

- 1.7.1 On the day of the accident the automatic weather station at Kaitaia Aerodrome, approximately 6 km away, recorded the wind direction as 260 degrees magnetic, at eight knots with a temperature of 20 degrees Celsius. A pilot of another aircraft flying at the time of the accident estimated that the conditions in the vicinity of the accident site consisted of a stable westerly wind of approximately 15 knots and no cloud.
- 1.7.2 The meteorological conditions were not deemed to have been a contributing factor in this accident.

1.8 Aids to navigation

- 1.8.1 Not applicable.

1.9 Communications

- 1.9.1 Communication between the pilot and the passenger was conducted through an intercom system, which was fitted to the pilot and passenger's headsets. The video footage indicates that before the local flight manoeuvres were conducted the pilot turns his head and shouts through the intercom to the passenger. According to the passenger the pilot tells him that they are going to do some "yea hars".
- 1.9.2 It is likely that the gyroplane transited through the Kaitaia Mandatory Broadcast Zone (MBZ) B170, during the cross country phase of the flight. As such the pilot should have broadcast his position and intentions every 5 minutes on the VHF radio frequency of 119.1 MHz. Voice recording obtained from Kaitaia Aerodrome indicated that no radio transmissions were heard from the pilot of ZK-RAW.
- 1.9.3 No radio calls were heard from the pilot during the accident sequence, which is understandable given the expeditions nature of it.

1.10 Aerodrome information

- 1.10.1 The paddock was approximately 415 m long, orientated north-east to south-west, and had a 40 ft Bamboo wind break on the northern boundary. The paddock that the gyroplane operated from on the day of the accident was appropriate for this type of operation.

1.11 Flight recorders

- 1.11.1 No flight recorder system was installed on the gyroplane, however, the passenger took numerous photographs during the flight. The passenger also took several segments of video footage, including the local flight manoeuvres following the sightseeing phase. The accident sequence was included in this footage.

1.12 Wreckage and impact information

- 1.12.1 The gyroplane initially struck the ground with a steep nose-down attitude, at high speed, penetrating approximately 600 mm into the ground, on a northerly heading.

The front instrument panel, rudder pedal assembly, pilot's control column hand grip, nose wheel assembly and forward structure of the gyroplane were found at this location.

- 1.12.2 After the initial impact, ground witness marks indicate that the gyroplane pitched forward on to the mast and rotor assembly then became inverted, finally coming to rest on its left side.
- 1.12.3 Between the initial ground impact and the final resting position of the gyroplane was a 2.8m strike mark which corresponded to the advancing rotor blade. Adjacent to this mark was a wire farm fence and associated electric fence. Sections of this fence wire were tangled within the gyroplane wreckage.
- 1.12.4 The gyroplane's fuel tank, which is incorporated into the passenger seat, had split at various points in its lower section allowing fuel to drain away.
- 1.12.5 Control integrity was established at the accident site. Of note was the throttle lever, which was found to be in the closed or power off position.

1.13 Medical and pathological information

- 1.13.1 Post-mortem examination showed that the pilot died of injuries consistent with a high-energy impact.
- 1.13.2 Toxicological tests conducted on the pilot showed no evidence of higher than normal levels of carbon monoxide. In addition, the toxicology report recorded that there was no evidence of alcohol, or medicinal and recreational drugs.

1.14 Fire

- 1.14.1 Fire did not occur.

1.15 Survival aspects

- 1.15.1 Given the significant vertical component and nose attitude of the gyroplane, the accident was not survivable for the pilot, who was occupying the front seat. Owing to the front of the gyroplane crumpling and dissipating the large impact forces, thus reducing the decelerations forces, the accident was survivable for the passenger, who was occupying the rear seat.
- 1.15.2 It was noted that the pilot was only wearing the lap belt of his seat harness, and not the shoulder straps. This coupled with the disruption to the front end of the gyroplane, rendered the restraints inadequate and ultimately led to the ejection of the pilot, when the gyroplane struck the ground. It is considered unlikely that the failure to wear the shoulder straps of his seat harness would have had any bearing on the survivability for the pilot.
- 1.15.3 The passenger was wearing both his shoulder straps and lap belt, and it is believed that this helped with his survivability. The passenger was located at the accident scene still fully restrained in his seat. The passenger had chemical burns by the effects of being soaked in fuel.

1.15.4 Both the pilot and passenger were wearing helmets, and it is likely that, for the passenger, this prevented trauma to the head area.

1.16 Tests and research

1.16.1 Video footage of the accident sequence was analysed by a specialist Police agency. Of interest to the safety investigation was the change in engine sound with reference to what appeared to be a departure from controlled flight. The results of the analysis were, however, inconclusive.

1.16.2 The gyroplane's Engine Control Unit (ECU) was sent to a specialist agency for analysis. The analysis of the ECU found no fault with the unit, and it considered that the unit was operating as expected at the time of the accident.

1.16.3 The gyroplane's engine was taken to a specialist Subaru agent for examination. The report from the Subaru agent noted there was no discrepancy that could have caused an 'engine failure or stoppage due to a mechanical fault.'

1.17 Organisational and management information

1.17.1 Gyroplane activities in New Zealand are administered by a recreational aviation organisation. The Director of Civil Aviation delegates authority for the issue of Pilot Certificates to a nominated senior person in a Part 149 Certificated Recreational Aviation Organisation. RAANZ is a Part 149 Recreational Aviation Organisation, certificated by the CAA to administer the issue of Pilot Certificates by the individual delegation holder.

1.17.2 The RAANZ Field Operations Handbook, in regard to Passenger Ratings, stipulates that: *Passenger Ratings are the most significant responsibility that a pilot accepts and to reflect this, a passenger rating is only available to Advanced Local and Advanced National Certificate pilots.*

1.17.3 The pilot should not have been issued with a Passenger Rating while holding an Intermediate Microlight Pilot Certificate, therefore, RAANZ were not in compliance with their Field Operations Handbook.

1.17.4 RAANZ has been notified of the non-compliance and confirmed that no other pilots operating on an Intermediate Certificate have been issued with a Passenger Rating. A CAA safety action (CAA 13A1004) has raised, seeking RAANZ to review the process and monitoring of Pilot Certificates and Rating.

1.18 Additional information

- 1.18.1 In a gyroplane, the combination of the relative airflow through the rotor blades, and the weight of the gyroplane, provides an aerodynamic load on the rotor blades. If this load is removed for more than a second or two during flight, commonly called “unloading the rotor”, the rotor speed will reduce and control of the gyroplane is likely to be limited, or non-existent. Furthermore, recovery from this situation is, unlikely.
- 1.18.2 Research of video footage on the internet, showed two flight demonstrations, conducted by the pilot in his gyroplane. The video footage shows a series of manoeuvres similar to the manoeuvres which were conducted prior to the accident.
- 1.18.3 The overseas based designer of the Rotor Flight Dynamics Dominator Gyroplane saw the video footage, on the internet, of the pilot flying ZK-RAW. The designer stated that he was sufficiently concerned with the flight manoeuvres being performed that he contacted the pilot and advised him of his concerns.

1.19 Useful or effective investigation techniques

- 1.19.1 N/A

2. Analysis

- 2.1 Evidence gathered by the safety investigation indicates that the accident occurred as a result of the gyroplane departing from controlled flight with insufficient height available for recovery.
- 2.2 The departure from controlled flight probably occurred because the gyroplane’s rotor was unloaded during a 180 degree reversal manoeuvre, attempted by the pilot. As a result of unloading the rotor, controllability of the gyroplane was lost. The gyroplane continued in a nose down attitude until striking the ground, approximately one second later.
- 2.3 Analysis of the video footage indicates that the departure from controlled flight occurred approximately half a second before a decrease in engine RPM can be heard. The specialist Police agency who conducted the analysis of the video footage stipulated that, ‘while engine deceleration appears to follow the aircraft departure, it does not take into account the time it could take for the engine to react audibly. The results of this analysis are therefore inconclusive’.
- 2.4 The reason for the reduction in engine RPM could not be positively determined, however it was most likely due to the pilot instinctively closing the throttle following the departure from controlled flight. This would have had the effect of reducing the acceleration towards the ground and subsequent severity of the impact with the ground.

- 2.5 The manoeuvres conducted prior to the accident, were similar to those that had been performed at air shows and on the internet, by the pilot. However, these were usually conducted without a passenger. It is possible that the additional weight of the passenger may have affected the handling characteristics of the gyroplane, particularly at the extremes of the flight envelope.
- 2.6 RAANZ had incorrectly endorsed the pilot's Intermediate Microlight Pilot Certificate with a passenger rating, which meant that the pilot was permitted to take a passenger in his gyroplane when he should not have been able to do so.
- 2.7 At the time of the accident the gyroplane had a current Flight Permit, however the gyroplane was not airworthy, as it did not have the associated maintenance records as required in accordance with CAR 91.616 *Maintenance logbooks*. The status of the airworthiness of the gyroplane was not considered to have been a contributing factor in the accident.
- 2.8 CAR Part 103.217 *Maintenance and inspection requirements* requires that on completion of a Microlight Annual Aircraft Condition Inspection, the details are entered into the appropriate maintenance records. As the gyroplane did not have any maintenance records i.e. logbooks, the gyroplane should not have passed the Microlight Annual Aircraft Condition Inspection. As such the CAA has raised a safety action (CAA 13A1007), seeking RAANZ to review the process of Microlight Annual Aircraft Condition Inspections.

3. Conclusions

- 3.1 The gyroplane was not airworthy, due to a lack of documentation, however, this was not considered to have been a factor in the accident.
- 3.2 During numerous Annual Aircraft Condition Inspections, the opportunity to rectify the lack of aircraft maintenance documentation was not recognised.
- 3.3 RAANZ incorrectly authorised the pilot to carry a passenger in his gyroplane.
- 3.4 The accident occurred as a result of the gyroplane departing from controlled flight.
- 3.5 The departure from controlled flight probably occurred because the gyroplane's rotor was unloaded during an initiated 180 degree reversal manoeuvre.
- 3.6 Once the rotor was unloaded, it is most likely that the gyroplane was uncontrollable.
- 3.7 For the pilot, the accident was not survivable.

4. Safety actions

- 4.1 Safety action (CAA 13A1005) has been raised for the CAA to consider appropriate action to ensure that the process of inspecting and issuing Flight Permits is in compliance with CARs.
- 4.2 Safety action (CAA 13A1007) has been raised recommending that RAANZ review the process of conducting and monitoring Annual Inspections and the associated documentation.
- 4.3 Safety action (CAA 13A1004) has been raised recommending that RAANZ review the process and monitoring of Pilot Certificates and Ratings.

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Date 25 March 2013

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