

**AIRCRAFT ACCIDENT REPORT**  
**OCCURRENCE NUMBER 08/1753**  
**AMATEUR-BUILT THORP MODEL S-18 W**  
**ZK-WMT**  
**WHENUAPAI MILITARY AERODROME**  
**26 APRIL 2008**



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## FOREWORD

Aviation safety investigations are conducted in New Zealand pursuant to New Zealand's international obligations under the Convention on International Civil Aviation 1944, also known as the Chicago Convention. Pursuant to Articles 26 and 37 of the Chicago Convention, the International Civil Aviation Organisation (ICAO) has issued Annex 13 to the Convention setting out International Standards and Recommended Practices in respect of the investigation of aircraft accidents and incidents. Paragraph 3.1 of Annex 13 describes the sole objective for the investigation of such accidents as follows:

*3.1 The sole objective of the investigation of an accident or incident shall be the **prevention** of accidents and incidents. It is **not** the purpose of this activity to **apportion blame or liability**.*

This philosophy of prevention for the future promotion of aviation safety is reflected in New Zealand domestic law by the provisions of the Civil Aviation Act and Part 12 of Civil Aviation Rules. CAA accident investigations are undertaken in accordance with this philosophy.

The sole objective of CAA accident investigations is the prevention of accidents by determining the contributing factors or causes and then implementing appropriate preventive measures – in other words, restoring safety margins to provide an acceptable level of risk.

The focus of CAA safety investigations is 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.

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## Glossary of abbreviations used in this report:

amsl	above mean sea level
ATC	Air Traffic Control
Avgas 100	aviation gasoline 100/130 octane
BFR	Biennial Flight Review
CAA	Civil Aviation Authority
CAR	Civil Aviation Rules
ELT	Emergency Locator Transmitter
fpm	feet per minute
GPS	Global Positioning System
IFR	Instrument Flight Rules
kts	knots
lbs	pounds
MHz	megahertz
METAR	aviation routine weather report
MOA	Military Operating Area
NASA	National Aeronautics and Space Administration
NZST	New Zealand Standard Time
PDF	Portable Document Format
PPL	Private Pilot Licence
RNZAF	Royal New Zealand Air Force
V <sub>ne</sub>	Never exceed speed
V <sub>y</sub>	Best rate of climb
UTC	Coordinated Universal Time
WGS 84	World Geodetic System 1984

## AIRCRAFT ACCIDENT REPORT

### OCCURRENCE No 08/1753

<b>Aircraft type, serial number and registration:</b>	Amateur-Built Thorp Model S-18W, WM101, ZK-WMT
<b>Number and type of engines:</b>	1 Lycoming O-360-A1A piston engine
<b>Year of manufacture:</b>	2004
<b>Date and time:</b>	26 April 2008, 1634 hours <sup>1</sup>
<b>Location:</b>	Whenuapai Military Aerodrome Latitude <sup>2</sup> : S 36° 47.433' Longitude: E 174° 37.473'
<b>Type of flight:</b>	Private
<b>Persons on board:</b>	Crew: 1 Passengers: 1
<b>Injuries:</b>	Crew: 1 fatal Passengers: 1 fatal
<b>Nature of damage:</b>	Aircraft destroyed
<b>Pilot-in-command's licence:</b>	Private Pilot Licence (Aeroplane)
<b>Pilot-in-command's age:</b>	62 years
<b>Pilot-in-command's total flying experience:</b>	745 hours, 501 on type
<b>Information sources:</b>	Civil Aviation Authority field investigation
<b>Investigator in Charge:</b>	Mr A M Moselen

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<sup>1</sup> All times in this report are NZST (UTC + 12 hours)

<sup>2</sup> WGS 84 co-ordinates

## Synopsis

The Civil Aviation Authority (CAA) was notified of the accident at approximately 1700 hours on 26 April 2008. The Transport Accident Investigation Commission was in turn notified, but declined to investigate. A CAA site investigation was commenced the following day.

The pilot had carried out a touch and go landing on Runway 08 at Whenuapai Military Aerodrome, and had commenced the downwind leg of the published circuit. A number of eyewitnesses then observed the aircraft bank to the right and descend rapidly. The aircraft struck the ground then immediately caught fire. The pilot and passenger were fatally injured.

## 1. Factual information

### 1.1 History of the flight

- 1.1.1 During the afternoon of Saturday 26 April 2008 the pilot and a number of aviation enthusiasts met at the Aviation Sports Club, RNZAF Base Auckland, to discuss a planned single engine flight to Australia. After the meeting concluded the pilot carried out a pre-flight inspection of ZK-WMT in anticipation of two scenic flights. The flights were to include the carriage of a passenger. After the departure of a military aircraft, Whenuapai Base Operations cleared the pilot for the flights.
- 1.1.2 For the first scenic flight, the aircraft departed at 1522 hours from Runway 08 at Whenuapai Military Aerodrome and flew towards the North Shore area. Data later retrieved from the aircraft onboard GPS indicated the aircraft tracked towards Mount Victoria whilst climbing to 3000 feet<sup>3</sup>. Alongside Mount Victoria, and during a four second time period, the aircraft turned left through 100 degrees of heading change whilst in a high rate of descent. The aircraft passed overhead the mountain and then tracked via the eastern North Shore coastline at 2500 feet. The aircraft then tracked along the shoreline for approximately three nautical miles before turning west and back towards Whenuapai.
- 1.1.3 The pilot carried out a touch and go on Runway 08 at Whenuapai Military Aerodrome, then continued with a low level circuit followed by a landing. The flight duration was approximately 14 minutes. When interviewed, the passenger related that during the short flight the pilot performed a “barrel roll and gave the passenger partial control of the aircraft during the cruise for a short period. The pilot had remained in control of the rudders” [*sic*].
- 1.1.4 On completion of the first scenic flight the aircraft was refuelled. The pilot departed Whenuapai Military Aerodrome at approximately 1615 hours with another passenger who was a qualified pilot. The retrieved GPS data and a Skyline Aircraft Track Plot, sourced from recorded ATC radar returns, indicated that the aircraft tracked to Auckland City at an altitude of 2500 feet with a brief climb to 2800 feet. Recorded GPS data also revealed that whilst travelling south

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<sup>3</sup> All heights are referenced to **amsl**

over the city the aircraft appeared to have been manoeuvred in a steep descending turn through 180 degrees at a bank angle exceeding 60 degrees. The aircraft then tracked north to North Shore, descending to 500 feet along the eastern shoreline for approximately the same distance as the first scenic flight, before turning west toward Whenuapai.

1.1.5 The aircraft entered the Whenuapai MOA at 1629 hours where the pilot radioed his intention to join downwind right-hand for a touch and go on Runway 08. The pilot completed the touch and go, turned cross wind then radioed he was “downwind low level to land 08”. In the background of the radio transmission laughter could be heard from the passenger. At the time of the radio transmission the aircraft was directly overhead the Whenuapai Golf Course.

1.1.6 Eye witnesses observed the accident flight from various locations. Some witnessed the entire accident sequence from the Whenuapai Aviation Sports Club premises. Others looked to the sky after hearing a change in the engine noise. Observations common to the majority of witness accounts were:

- a steep climbing turn after the touch and go,
- the engine ‘going quiet’ downwind,
- a nose pitch up then a right hand bank,
- a nose drop shortly after,
- a continuing right hand spiral descent,
- an increase in noise,
- the aircraft passing out of sight behind trees, and
- the sound of impact with the ground.

1.1.7 Review of the GPS data revealed that at the time of the last radio transmission the aircraft had continued in an oval type circuit pattern, at a height of 600 feet and constant groundspeed for 16 seconds. The next two position plots were timed four seconds and three seconds apart. See Figure 1.

The first plot included the following information:

- ground speed reduced from 108 knots to 81 knots during the four seconds,
- a height increase of 20 feet and a heading change to the right through 30 degrees.

The second plot:

- ground speed 51 knots,
- a height loss of 100 feet, and
- a further change of heading to the right through 50 degrees.



Figure 1

Oval type circuit pattern.

*(Note – For illustrative purposes only).*

- 1.1.8 Until the end of the recording at 1633 hours, the remaining two plots appeared to indicate that the aircraft entered a spin. At 1634 hours the ELT from ZK-WMT activated and the emergency signal was recorded in the Whenuapai Control Tower. First responders to the accident found the aircraft adjacent to a liquid oxygen storage facility. A post-impact fire was well established and neither occupant had survived the accident.
- 1.1.9 The accident occurred in daylight at 1634 hours NZST at Whenuapai, at an elevation of 100 feet. Grid reference NZ260-R11-554889, latitude S 36° 47.433', longitude E 174° 37.473'.



## 1.2 Injuries to persons

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Other</i>
Fatal	1	1	0
Serious	0	0	0
Minor/None	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 The roof of an RNZAF storage building and several metres of wooden fencing were substantially damaged. In addition, an air-conditioning plant and a liquid oxygen building incurred minor damage.

## 1.5 Personnel information

1.5.1 The pilot, aged 62 years, held a Private Pilot Licence (Aeroplane) and a current Class 2 Medical Certificate.

Conditions on the licence were as follows:

- Bifocal spectacles must be worn.
- Restricted in accordance with medical directions in letter dated 23 June 2005.
- Not valid for IFR flight.

1.5.2 The pilot's medical directions required a six monthly blood test for fasting glucose and HbA1c (Glycated Haemoglobin). The tests were directed by a CAA Senior Medical Officer in response to an elevated blood glucose result during June 2005. When the pilot renewed his Class 2 medical in February 2008 the glucose and HbA1c tests indicated normal levels.

1.5.3 At 19 April 2008, the pilot had flown a total of 745 hours. His total flying time on ZK-WMT amounted to 501 hours. A BFR was completed satisfactorily in January 2008. His Aerobatic Rating was not current.

1.5.4 The pilot had an extensive aviation background, commencing in the RNZAF, initially as an Aircraft Maintenance Engineer, then transferring to flying duties as a Navigator. He gained his PPL during 1997 and an Aerobatic Rating in 2001. In addition, he was Vice President of the Sport Aircraft Association and an active member of the Whenuapai Aviation Sports Club, including a four year period as the Club's Maintenance Controller. The pilot was also approved to carry out

maintenance on his aircraft in accordance with CAR Part 66.155 (b) (2) (ii) *Privileges*.

## 1.6 Aircraft information

- 1.6.1 The Thorp, model S-18 W, was a complete redesign of the Thorp T18 aircraft. The changes provided a fuselage two inches wider and five inches longer, with a newer NASA computer-designed airfoil which lowered the stall speed by three to four knots. The S-18 W was described as having excellent control responses with a gentle stall and adequate pre-stall warning.
- 1.6.2 Of all-metal construction, the high performance aircraft provided seating for two people in a side-by-side arrangement and was equipped with dual control columns connected to conventional flight controls. For transporting and storage the wings could be folded. Re-securing for flight was achieved by main spar pins with built in locking devices.
- 1.6.3 ZK-WMT, serial number WM101, was built from kit plans by the owner/pilot and registered during 2004. By early 2005 the owner/pilot had completed the required test flight program.
- 1.6.4 The following performance data is specific to ZK-WMT:
- |  |          |
|--|----------|
| Max operating weight                             | 1600 lbs |
| Never exceed speed (Vne)                         | 182 kts  |
| Best rate of climb (Vy)                          | 80 kts   |
| Glide ratio                                      | 8:1      |
| Approach speed                                   | 70 kts   |
| Basic stall speed                                | 55 kts   |
| Power on stall speed at 60 degrees angle of bank | 70 kts   |
- 1.6.5 In terms of the basic stall<sup>4</sup>, comments from the test flight report described the pre stall buffet as a rumbling felt through the rear fuselage at approximately five knots before a left wing drop stall occurred.
- 1.6.6 The aircraft was powered by a Lycoming O-360-A1A, serial number L24884-36A engine, driving a Custom two bladed wooden propeller.
- 1.6.7 The main fuel tank was mounted in the aircraft nose section between the engine fire wall and the forward instrument panel. For long range flights, additional fuel tanks had been installed by the owner behind the cockpit seats. The aircraft had a valid Airworthiness Certificate in the Special Category-Experimental Options issued in January 2005. The attached Aircraft Limitations did not permit aerobatics.
- 1.6.8 The pilot regularly maintained the aircraft and up to the time of the accident the total time in service was approximately 501 hours. The last maintenance inspection recorded in the aircraft logbook was a 50 hour inspection. An Annual Review of Airworthiness was performed in March 2008 where all appropriate

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<sup>4</sup> Power off and flaps retracted.

maintenance and defect rectification had been performed satisfactorily. Prior to fitment to ZK-WMT, the engine had been overhauled.

- 1.6.9 With respect to the aircraft weight and balance, it was estimated that the combined weight of the pilot, passenger and fuel placed the centre of gravity within the specified limits for the aircraft.

## **1.7 Meteorological information**

- 1.7.1 A cold front was forecast to move south-east over the Whenuapai area around midday on 26 April 2008. The actual weather experienced at Whenuapai<sup>5</sup>, one hour either side of the time of the accident was north-easterly winds of approximately 15 knots, with gusts up to 25 knots, and cloudy conditions. Weather was not considered to be a factor in the accident.

## **1.8 Aids to navigation**

- 1.8.1 Not applicable.

## **1.9 Communications**

- 1.9.1 The pilot made the standard line up, takeoff and downwind radio calls on the unattended Whenuapai Tower frequency of 134.5 MHz. He also made contact with Whenuapai Base Operations on 135.1 MHz for clearance to operate in and out of the Whenuapai MOA. There were no other communications heard on any other frequency likely to be used during the flight.

## **1.10 Aerodrome information**

- 1.10.1 Whenuapai Military Aerodrome has a dual runway facility. On the day of the accident the aircraft was using Runway 08. The touch and go was carried out in accordance with the circuit direction for Runway 08, which is stipulated as right-hand. The low level circuit by ZK-WMT passed crosswind over the Whenuapai Golf Club, downwind over runway 03/21, a maintenance hangar, and a number of administration buildings.

## **1.11 Flight recorders**

- 1.11.1 The aircraft was equipped with a Garmin 296 GPS map unit. The data downloaded from the unit provided position, groundspeed, heading, and altitude information from the first scenic flight and the accident flight.

## **1.12 Wreckage and impact information**

- 1.12.1 The accident site was located adjacent to a liquid oxygen compound at Whenuapai. The aircraft, in a right-hand upright spin, initially struck the roof of a small storage shed with the right wing tip and aileron section. The aircraft then continued rotating to the right through a wooden security fence before striking the ground in a steep nose down attitude. An intense fire then developed.

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<sup>5</sup> The Whenuapai auto METAR

1.12.2 Main impact forces were sustained by the nose section. The wooden propeller was severely splintered and had partially separated from the engine. The cockpit area was found severely crushed and the majority of equipment and fittings contained within had been destroyed by fire. Whilst the majority of instruments were destroyed, the following observations of control positions and selections were established:

- Throttle fully forward
- Mixture rich
- Carburettor heat closed
- Fuel selector forward main tank
- Flaps and flap control lever flap up configuration
- Left rudder pedal (pilot) severely buckled
- Right rudder (pilot) minor deformation.
- Left and right rudder pedals (passenger) unremarkable

1.12.3 There was no evidence that the aircraft had incurred a bird strike and except for the right aileron counterweight, all parts of the aircraft were accounted for at the site. The counterweight assembly was located 118 metres away from the main accident site. The counterweight was found to have separated at the attachment point on the arm and was sent to a laboratory for further testing.

1.12.4 Flight control integrity was established as far as possible. The folding wings were found securely locked and the aileron mechanisms intact. The stabilator torque tube was found to have failed in high energy overload but this was attributed to impact forces. The rudder cable and mechanisms were found intact and free to move.

1.12.5 Inspection of the fuel tank system revealed considerable disruption had occurred to the forward main tank allowing the fuel contents to be consumed by the ensuing fire. The long range fuel tanks were undamaged and empty of fuel. They had not been required or used for the scenic flights.

1.12.6 The engine was removed from the site and sent to an engine overhaul facility for inspection. Dismantling and testing concluded that there were no mechanical malfunctions preventing the engine from developing power. The ignition and carburettor system, although damaged in the impact, indicated no pre-existing defects. The carburettor throttle mechanism was found to be in the closed position, but it could not be determined whether it was in the closed position prior to impact or had been positioned there by impact forces.

### **1.13 Medical and pathological information**

- 1.13.1 Post-mortem examinations of the pilot and passenger determined death resulted from multiple injuries. The pattern of the injuries was consistent with a high speed impact.
- 1.13.2 The autopsy also found that the pilot had significant heart disease, to the extent that an incapacitating event or distraction could not be ruled out. The Pathologist stated in his report:

*“It is possible that this man may have had heart disease related symptoms such as chest pain, shortness of breath, or dizziness which led to either distraction or temporary incapacitation. It is not possible to be definitive of this from the autopsy alone and correlation must be made with the examination of the aircraft flight path.*

*Microscopic examination of the heart muscle has shown a single focus of inflammation associated with death of a few muscle fibres. Microscopically this is consistent with myocarditis. The difficulty is knowing the significance of this, as these same changes can be seen in persons who die of unrelated causes or it can cause death in its own right. In this case I cannot exclude the possibility of an abnormal heart rhythm which may have led to an episode of pilot incapacitation or distraction. Once again it is not possible to be certain of this from the autopsy alone and correlation with the other evidence is recommended”.*

- 1.13.3 Toxicological tests for the pilot disclosed no evidence of alcohol, medicinal or recreational drugs.

### **1.14 Fire**

- 1.14.1 An intense fire consumed the nose section and cockpit area. The likely ignition source was from impact-related damage to the aircraft electrical components. The fire was then fed by fuel from the disrupted main fuel tank.

### **1.15 Survival aspects**

- 1.15.1 Although the pilot and passenger were restrained by combined lap and shoulder harnesses, the impact forces were not survivable.
- 1.15.2 The aircraft was fitted with an ACK Technologies model E01 ELT, operating on 121.5 and 243.0 MHz. The device activated immediately on impact and continued until deactivated by rescue services.

### **1.16 Tests and research**

- 1.16.1 A five litre Avgas 100 fuel sample was taken from the Bowser used to refuel ZK-WMT and tested in a laboratory, where the sample was found to be clear and bright and meeting the specified standards.

- 1.16.2 The right aileron counterweight, arm, and the right aileron were examined by the Defence Technology Agency. Optical microscopy indicated the form of fracture to the arm was consistent with the imposition of an overload event. The evidence indicated that the failure was most likely to have been induced by high inertial loads when the aircraft struck the storage shed roof. The spring effect of the light aileron structure and the outward bending loads would have assisted in flinging the counterweight as far as it did.

### **1.17 Organisational and management information**

- 1.17.1 Not applicable.

### **1.18 Additional information**

- 1.18.1 Not applicable.

### **1.19 Useful or effective investigation techniques**

- 1.19.1 Not applicable.

## **2. Analysis**

- 2.1 Evidence gathered by the investigation indicated that the accident occurred as a result of the aircraft being unable to be recovered in the height available after departure from controlled flight.
- 2.2 The departure from controlled flight could have been initiated by:
- a. a mishandled manoeuvre, or
  - b. a distraction sufficiently significant enough to cause a departure.
- 2.3 There was evidence to indicate that the pilot communicated his intentions to carry out a normal landing on Runway 08. Yet GPS data and witness observations clearly indicate that after 16 seconds of straight and level flight, the aircraft deviated from its altitude and heading to such a degree that soon after the aircraft departed from controlled flight.
- 2.4 There was no evidence to indicate an engine failure occurred. A simulated engine failure was also considered unlikely, based on a lack of communicated intentions and the location of the aircraft making a glide approach marginal.
- 2.5 There were no environmental factors likely to have caused a distraction significant enough to lose control of the aircraft, and from the evidence it is considered unlikely that there was a flight control or systems problem. Whilst there was no evidence to confirm whether the pilot in command was wearing his bifocal spectacles, their possible absence or sudden loss was also dismissed as a contributing cause.
- 2.6 The Pathologist's findings, accident details, and the accident report were referred to the CAA Principal Medical Officer for review and comment. Whilst a medical condition leading to an episode of pilot incapacitation or distraction could not be

fully ruled out, CAA medical opinion held that such an event was unlikely to have directly contributed to the cause of the accident.

### **3. Conclusions**

- 3.1 The pilot was type rated and appropriately licensed for the flight.
- 3.2 The aircraft had a valid Airworthiness Certificate and had been appropriately maintained.
- 3.3 The possibility of a pre-existing airframe or engine defect that could have contributed to the accident was eliminated as far as practicable by the investigation.
- 3.4 The investigation could not establish with any certainty why the aircraft departed from controlled flight.
- 3.5 The aircraft's impact with the ground was not survivable.

### **4. Safety actions**

- 4.1 No safety actions have been proposed as a result of the accident investigation.

Report written by:

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