CIVIL AVIATION AUTHORITY
OF NEW ZEALAND

AIRCRAFT ACCIDENT REPORT

AEROTEK INCORPORATED S-2B

ZK-MAD

LOSS OF CONTROL

STRATFORD, TARANAKI

15 NOVEMBER 2009

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. Civil Aviation Authority (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. CAA investigations are not however done for, or on behalf of, a Coroner.

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Glossary of abbreviations

ARFOR	Area forecast
AMSL	Above Mean Sea level
ATIS	Automatic Terminal Information Service
CAA	Civil Aviation Authority
CAR	Civil Aviation Rules
ELT	Emergency Locator Transmitter
GPS	Global Positioning System
Hpa	hectopascals
IAS	Indicated Airspeed
IFIS	Internet Flight Information Service
KTS	Knots
LEOSAT	low earth orbiting satellite
MHz	megahertz
MPH	Miles per Hour
NZDT	New Zealand Daylight Time
RCCNZ	Rescue Co-ordination Centre New Zealand
RNZAF	Royal New Zealand Air Force
UTC	Coordinated Universal Time
VFR	Visual Flight Rules
WGS	World Geodetic System

CIVIL AVIATION AUTHORITY OF NEW ZEALAND

Data summary

Aircraft type, serial number and registration:	Aerotek S2B Pitts Special, s/n 5087, ZK-MAD
Number and type of engines:	One, Lycoming AEIO-540-D4A5
Year of manufacture:	1985
Date and time of accident:	15 November 2009, 12:07 hours[1] NZDT
Location:	Tuna Road near Stratford, Taranaki Latitude[2]: S 39° 16' 22.19" Longitude: E 174° 18' 08.85"
Type of flight:	Private
Persons on board:	Crew: 1
Injuries:	Crew: 1 fatal
Nature of damage:	Aircraft substantially damaged
Pilot-in-command's licence:	Private Pilot Licence (Aeroplane)
Pilot-in-command's age:	52 years
Pilot-in-command's total flying experience:	843 hours, 187 on type
Information sources:	Civil Aviation Authority Field Investigation
Investigator in Charge:	Mr J P Vincent

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

[2] WGS-84 co-ordinates

Synopsis

The pilot was returning to Ardmore Aerodrome from the Ohakea Military Aerodrome after a weekend of aerobatic flight training. At 1216 hours the Rescue Co-ordination Centre New Zealand (RCCNZ) received an alert from the Emergency Locator Transmitter (ELT) affixed to the aircraft.

The search was hampered by poor weather conditions, and a delay in ELT beacon location with the satellite system. The wreckage was located at 1555 hours, with the first responders finding the pilot deceased.

The Civil Aviation Authority (CAA) was notified of the accident at 1622 hours on Sunday 15 November. The Transport Accident Investigation Commission was in turn notified shortly thereafter, but declined to investigate. A CAA Field Investigation was commenced the following morning.

1. Factual information

1.1 History of the flight

1.1.1 The pilot had been attending the annual Display and Aerobatic Pilot Workshop organised by the Royal New Zealand Air Force (RNZAF) to develop and maintain pilot aerobatic skills. Another syndicate member was to accompany the pilot during the weekend but he withdrew prior to leaving Ardmore. The pilot completed five aerobatic flights over the weekend. His first was on the Friday afternoon, with three more on Saturday and one on Sunday morning.

1.1.2 During Saturday a number of pilots decided to cut short their time at the workshop owing to the forecast deteriorating weather conditions and their need to return home for work commitments.

1.1.3 At 0845 hours on Sunday morning the pilot logged onto the Airways Corporation Internet Flight Information Service (IFIS) and requested a pilot briefing for the flight. This comprised NOTAM[3] and Automatic Terminal Information Service (ATIS)[4] reports for Auckland, Hamilton, New Plymouth, Ohakea, and Palmerston North Aerodromes. These ATIS reports issued between 0757 and 0838 hours indicated that Hamilton and New Plymouth Aerodromes had showers in the vicinity, but the runways were dry. The cloud base for the aerodromes respectively was 3500 feet and 4000 feet, with visibilities of 40 and 30 kilometres.

1.1.4 The pilot discussed weather conditions and reviewed Metservice aviation forecasts with RNZAF personnel and the consensus was that the route via New Plymouth was flyable in the morning but that conditions could deteriorate in the afternoon. The RNZAF personnel also offered hangarage and accommodation if the pilot wished to remain at Ohakea.

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[3] NOTAM: A notice containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard.

[4] ATIS: A continuous broadcast, on a discreet frequency, of operational information including current meteorological conditions for an aerodrome provided by Airways Corporation. Current ATIS broadcasts are available in text form from IFIS.

1.1.5 After completing the Sunday morning aerobatic flight the pilot refuelled the aircraft and departed Ohakea Military Aerodrome at 1108 hours. The Air Traffic Controller on duty advised the pilot he was clear of controlled airspace at 1118 hours. This was the last known recorded transmission from the aircraft.

1.1.6 The aircraft was transmitting a Secondary Surveillance Radar code of 1200 and examination of the radar position plots revealed the aircraft had tracked from Ohakea Military Aerodrome up the coast passing seaward of Wanganui. This track continued along the coast until abeam Waverly Beach where the aircraft turned northwards. The last known position was at Lake Rotorangi at 1150 hours. See figure 1.

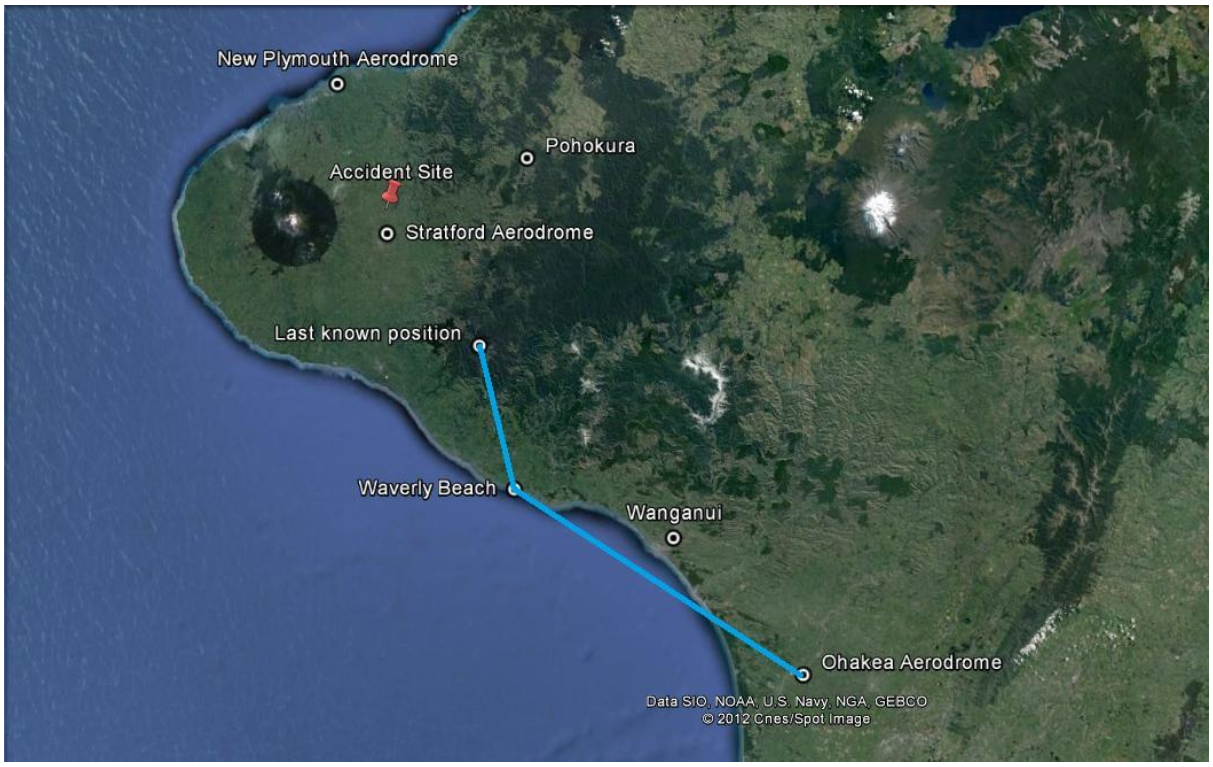

Figure 1: Map of Flight route.

1.1.7 An eyewitness located nine kilometres North of Stratford reported seeing three aircraft including "one with double wings" at intervals between 1130 and 1200 hours. A witness on Tuna Road reported hearing an aircraft flying low level from West to East in the area.

1.1.8 The accident occurred in daylight, at 1207 hours, beside Tuna Road, Stratford at an elevation of 920 feet. Latitude: S 39° 16' 22.19", Longitude E 174° 18' 08.85"

1.2 Injuries to persons

Injuries	*Crew*	*Passengers*	*Other*
Fatal	1	0	0

1.3 Damage to aircraft

1.3.1 The aircraft suffered substantial damage.

1.4 Other damage

1.4.1 Nil.

1.5 Personnel information

1.5.1 The pilot held a New Zealand Private Pilot Licence issued in September 1994. Prior to this he held a United Kingdom Private Pilot Licence. The pilot had completed 843 hours of flight time with 797 hours in aeroplanes and 46 hours in helicopters. The pilot had flown 187 hours in the Pitts Special aircraft.

1.5.2 The pilot completed his most recent Biennial Flight Review on 22 May 2009. This included an aerobatic and a low level authorisation for aerobatics to no lower than 500 feet Above Ground Level (AGL) and 100 feet AGL for wings level fly pasts. The pilot met the recent currency requirements on the aircraft.

1.5.3 The pilot held a current valid Class 2 Medical Certificate. Conditions of the certificate were glasses must be readily available. He was also taking prescription medicine for diabetes control, which was noted on his CAA medical file. This medication was found in his personal effects.

1.6 Aircraft information

1.6.1 The aircraft was constructed by Aerotek Incorporated and initially registered in the United States in 1985. It was imported and registered in New Zealand in October 1990. At the time of the accident it had accrued 2851 hours total time in service. The aircraft had a current Airworthiness Certificate and an Annual Review of Airworthiness was completed on 27 April 2009. Since this check the aircraft had completed 48 hours flight time. No defects were noted on the technical log.

1.6.2 The aircraft was fitted with a Lycoming engine that had accrued 1495 hours since overhaul and had a total engine time of 2851 hours since new.

1.6.3 The Hartzell constant speed propeller was installed new in September 2002 and had been overhauled in June 2009. It had accrued 48 hours since overhaul and 951 hours since new.

1.6.4 The aircraft is a two seat, bi-plane designed for unlimited aerobatics including inverted manoeuvres. It is certified for Day Visual Flight Rule (VFR) operations only. The aircraft is fitted with conventional controls with no wing flaps.

1.6.5 The aircraft was constructed to Federal Aviation Regulations[5] (FAR) Part 23 standards and at the time of aircraft construction required installation of seat belts and shoulder harness capable of surviving a 9 g forward inertia load.

[5] The Federal Aviation Regulations are rules prescribed by the Federal Aviation Administration (FAA) governing all aviation activities in the United States.

1.6.6 The aircraft flight manual advises the stall speed is 53 knots. An aural stall warning system activates 4-8 knots above the stall speed. The manual also states:

"Some Pitts S-2B's will have a "dip" of the nose between 70 -75 MPH IAS (60-65 KTS) when part of the aircraft begins to stall. This is not the stall of the airplane because the "dip" is controllable with elevator until the airplane stalls as listed."

1.6.7 It was calculated that the aircraft was within centre of gravity and weight limits.

1.7 Meteorological information

1.7.1 The investigation procured an extensive report from a Metservice meteorologist. A warm front, part of the frontal system associated with a depression, was moving eastwards across the North Island with forecast deteriorating conditions. See figure 2.

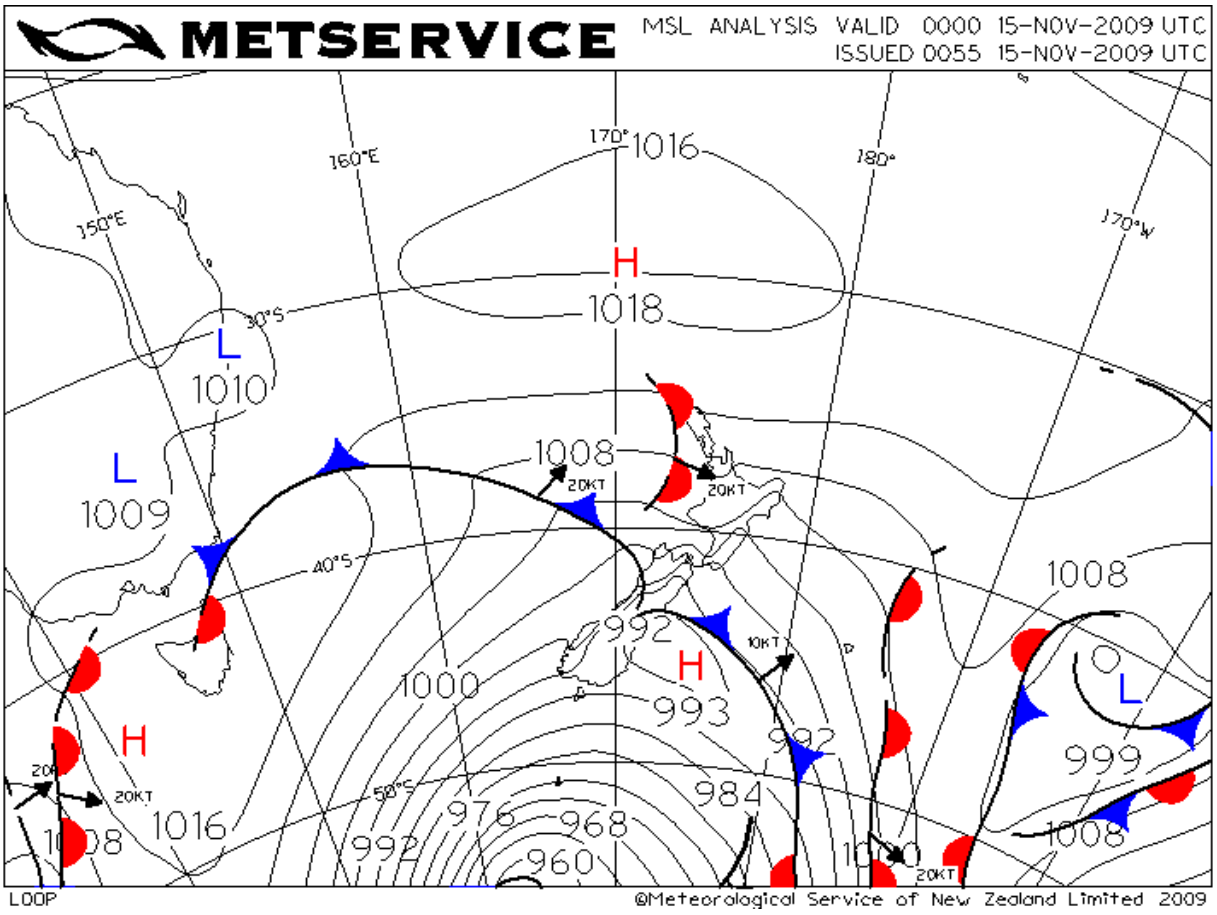

Figure 2: Mean Sea Level Analysis Chart

1.7.2 The Metservice area forecast (ARFOR) issued at 0520 hours for Sanson including Ohakea Military Aerodrome was valid until 1400 hours. Forecast visibility was 15 kilometres reducing to 5000 metres in rain showers. Five to seven oktas[6] of cloud was forecast to develop at 1000 feet Above Mean Sea level (AMSL) during the morning. Widespread showers and rain was forecast by 1300 hours.

[6] Okta: A unit used to express extent of cloud cover, equal to one eighth of the sky.

1.7.3 The Te Kuiti ARFOR which included the accident site was valid for the same period. Forecast visibility was 20 kilometres reducing to 5000 metres in rain and 3000 metres in drizzle. Cloud forecast was five to seven oktas at 1000 feet AMSL lowering to 500 feet AMSL. At 1131 hours a new Te Kuiti ARFOR was issued, valid until 2400 hours. This forecast a further reduction to 2000-6000 metres visibility in rain and showers. The cloud forecast was the same as previously issued.

1.7.4 The Metservice meteorologist stated: *"At midday, in the vicinity of Stratford at the col of the saddle area, the cloud base was probably a similar height above sea level as at New Plymouth (or lower due to the rising ground); 200-250 feet above ground level or lower. Visibility (in areas clear of cloud) was probably 8000 metres at best and lowering to 2000 metres in mist and/or light rain."*

1.7.5 Civil Aviation Rule (CAR) 91.301 stipulates the meteorological minima for Visual Flight Rules in uncontrolled airspace is to remain clear of cloud, in sight of the surface and 5000 metres visibility. CAR 91.311 specifies the minimum height for VFR flights as not less than 500 feet above the surface.

1.7.6 Prior to the 1 September 2009 pilots could access the General Aviation forecasts and reports available from Metservice through the Airways IFIS site. After 1 September 2009 this facility was removed and a link to the Metservice website[7] was provided by Airways Corporation. The change was published in the September October 2009 issue of the *Vector* magazine. Records showed that the pilot had never logged into the Metservice site.

1.8 Aids to navigation

1.8.1 Two maps, Visual Navigation Chart B3/B4 and C1/C2 were located in a satchel in the aircraft.

1.8.2 The satchel also contained a small plastic ring binder with copies of the Aeronautical Information Publication operational data for the following aerodromes:
Ohakea Military Aerodrome
Wanganui Aerodrome
New Plymouth Aerodrome
Taumarunui Aerodrome

1.8.3 No navigation log was found in the wreckage.

1.9 Communications

1.9.1 The last known communication from the pilot was the reply to the controller as he vacated the Ohakea Control Zone. Checks of other frequencies being monitored by Airways Corporation staff during the search for the aircraft revealed no further contact.

1.9.2 No flight plan had been filed for the flight with Airways Corporation.

[7] Metservice website for general aviation weather briefings www.metflight.metra.co.nz

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 aircraft had come to rest on an easterly heading against a recently formed drain in a farm paddock, having struck the ground at an angle of approximately 30 degrees.

1.12.2 Damage to the aircraft was limited to the nose, engine cowling and lower wing areas. The bi-plane struts were deformed while the upper wing showed no signs of direct frontal impact. The rear of the fuselage remained intact but there was damage and disruption to the underside of the rear cockpit area. This included compression of the pilots' seat pan.

1.12.3 All damage, and the absence of ground scars and debris prior to the drain was consistent with the aircraft having entered an aerodynamic stall from a low altitude prior to impact.

1.12.4 The engine and propeller were partially buried in soil. The two bladed propeller was found with the upper blade undamaged while the lower blade was bent rearwards under the engine.

1.12.5 Pre impact flight control integrity was established at the site and it was observed that the elevator trim had been in the full nose up position prior to ground impact.

1.12.6 Fuel was found in the wing and main fuselage tanks and in the engine fuel manifold during the onsite investigation. A sample taken revealed no contaminants present.

1.12.7 The pilot's shoulder harness cable had failed in overload from impact forces. Inspection found that the connection point for the shoulder harness located at the rear of the fuselage had also sheared prior to the cable failing. As a consequence of these failures the pilot's upper body was unrestrained during the final accident sequence and his head struck the right side instrument panel, deforming the panel.

1.13 Medical and pathological information

1.13.1 Post mortem examination of the pilot revealed the cause of death as multiple blunt trauma injuries. There were no pre-existing conditions detected that could have contributed to medical incapacitation. Medical advice was sought on any possible side effects of the prescription medicine on the pilot's decision making and this was considered unlikely.

1.14 Fire

1.14.1 Fire did not occur.

1.15 Survival aspects

1.15.1 The pilot was found outside of the aircraft. It was evident that the pilot had released the lap seat belts and exited the aircraft after the accident. The injuries believed to have been sustained as a result of the shoulder harness cable failure were considered to have made the accident un-survivable.

1.16 Tests and research

1.16.1 The aircraft engine was sent to an overhaul facility where it was inspected in the presence of CAA staff. The engine was mounted on a test rig where it started and ran normally.

1.17 Organisational and management information

1.17.1 The aircraft was owned in a syndicate of which the pilot was a member.

1.18 Additional information

1.8.1 A pilot familiar with the aircraft stated that using a map can be difficult in this aircraft due to cockpit space restrictions. It is often preferable to have additional assistance in the form of a GPS navigation aid or another pilot in the front seat map reading. No GPS unit was found in the wreckage.

1.8.2 A pilot flying from Paraparaumu Aerodrome to Ardmore Aerodrome using a similar route was flying further inland. Abeam Pohokura on State Highway 43 he decided to divert to Stratford due to deteriorating weather. He stated: "*I joined directly for grass runway 17 due to the poor visibility immediately to the North, which I believed to be less than two kilometres and could not differentiate between the cloud and the ground. I landed at approximately 12.08 NZDT".*

1.8.3 A resident of Tuna Road, where the accident occurred, reported the weather as heavy rain, with strong winds and poor visibility.

1.8.4 The weather conditions caused delays to the search and rescue effort. The New Plymouth rescue helicopter was contacted at 1258 hours but did not depart until 1350 hours due to weather. The helicopter had to track around the coast prior to commencing its search. At 1458 hours the helicopter was forced to land due to deteriorating weather conditions. At 1545 hours, the helicopter was able to resume the search by air and located the wreckage at 1555 hours.

1.8.5 The ELT beacon installed in the aircraft functioned correctly. Its identification signal was detected by a geostationary satellite at 1207 hours. This was relayed to RCCNZ at 1216 hours who initiated search and rescue action. There was a delay in beacon location by the Low Earth Orbiting Satellites (LEOSAT) due to the first five orbits being out of view of the ELT since its activation.

1.8.6 The first LEOSAT pass that detected and located the beacon was at 1422 hours which downloaded its position as S39° 16' 03" and E 174° 18' 15". A second pass resolved the position as S39° 16' 13" and E174° 18' 16" at 1443 hours.

1.8.7 The international organisation responsible for the satellite constellation (Cospas Sarsat) is aware of the delays possible with the LEOSAT detection system. RCCNZ

also notes this fact on its beacon.org.nz website *"The time between satellite passes varies greatly, ranging between 20 minutes and 4 ½ hours."*

1.8.8 Transiting aircraft listening on 121.5 MHz also detected the ELT beacon and Airways Corporation received 39 hearing reports between 1233 hours and 1526 hours. These were passed to RCCNZ as requested.

1.19 Useful or effective investigation techniques

Nil

2. Analysis

2.1 It was determined from the available evidence that the aircraft was most likely being flown at a low speed and low altitude prior to entering a stalled condition that could not be recovered by the pilot in the height available.

2.2 Given the poor weather at the time, the pilot probably encountered conditions that prevented continued VFR flight and as a consequence the pilot may have been contemplating landing the aircraft in the immediate vicinity when the departure from controlled flight occurred.

2.3 The impact angle of 30 degrees produced forces higher than the design of the shoulder harness cable and attachment point could withstand. Their failure in overload from the deceleration allowed the pilot's upper torso to contact the instrument panel.

2.4 In terms of the pilot's weather briefing, he did not have sufficient information to make an informed decision. His IFIS request for pre-flight information was completed early on the day of the flight and did not contain any aviation forecasts. The pilot's departure without a weather information update and the lack of any inflight requests for weather information from Airways, meant the Te Kuiti ARFOR issued at 1131 hours forecasting conditions to be below VFR minima was also not evident to him. Poor weather conditions also hampered the terrestrial search and rescue operation.

2.5 Finally, the pilot's decision to complete another aerobatic flight on Sunday morning delayed his departure and this aspect put the timing of the flight directly in line with the weather conditions that turned out to be exactly as forecast. In addition, he has appeared to have misinterpreted the advice from RNZAF personnel where weather conditions were deemed to be suitable in the morning but could deteriorate after lunch.

3. Conclusions

3.1 The pilot was appropriately qualified and licenced for the flight.

3.2 The aircraft was airworthy and there were no mechanical defects found that may have contributed to the accident.

3.3 The pilot did not update his weather information prior to or after departure.

3.4 The pilot continued to fly into deteriorating conditions.

3.5 Forecast weather conditions were below that required for VFR operations.

3.6 The ELT and satellite system operated as designed and within known limitations.

3.7 RCCNZ initiated search and rescue action in a timely manner using the available information and resources available to them.

3.8 The accident was un-survivable.

3.9 Weather conditions after the accident had occurred hampered the search and rescue effort.

4. Safety actions

4.1 Information highlighting beacon and satellite operation and the limitations with the current ELT system were published in the November December 2011 issue of Vector magazine. Information was also provided regarding the preference for fitting GPS interfaced or equipped ELTs along with other steps to enhance the probability of being found promptly.

4.2 The CAA has produced a variety of meteorological information and cross country flight guidance for pilots. This report again highlights the importance of obtaining appropriate and current weather briefings with both reports and forecasts that cover the entire route to be flown.

5. Observations

5.1 The ELT functioned correctly and the satellite system operated to its known limits. At the time of the accident New Zealand was affected by a lapse of LEOSAR coverage and this delayed location of the beacon. In 2009, the possible delay in location by the LEOSAR system was understood but not well promulgated.

5.2 The Cospas- Sarsat organisation is currently deploying new detection equipment onto satellites in medium Earth orbits. These Medium Earth Orbit Search and Rescue satellites will provide, when fully operational much improved coverage of the earth surface, with improved detection times.

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