

AIRCRAFT ACCIDENT REPORT
OCCURRENCE NUMBER 06/1135
NZ AEROSPACE FU24-950
ZK-EGP
9 KM SOUTH-WEST OF KAITAIA
31 MARCH 2006



Glossary of abbreviations used in this report:

AMSL	Above Mean Sea Level
C	Celsius
CAA	Civil Aviation Authority
E	east
ELT	Emergency Locator Transmitter
ft	foot or feet
GPS	Global Positioning System
kg	kilogram(s)
km	kilometre(s)
m	metre(s)
M	magnetic
MHz	megahertz
NZDT	New Zealand Daylight Time
S	south
T	true
UTC	Coordinated Universal Time
WGS 84	World Geodetic System 1984

AIRCRAFT ACCIDENT REPORT

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Aircraft type, serial number and registration:	NZ Aerospace FU24-950, 238, ZK-EGP
Number and type of engines:	1 Lycoming IO-720-A1B
Year of manufacture:	1977
Date and time:	31 March 2006, 1345 hours ¹ (approx)
Location:	9 km south-west of Kaitaia Latitude ² : S 35° 10' 26.1" Longitude: E 173° 11' 29.4"
Type of flight:	Agricultural - topdressing
Persons on board:	Crew: 1
Injuries:	Crew: 1 fatal
Nature of damage:	Aircraft destroyed
Pilot's licence:	Commercial Pilot Licence (Aeroplane)
Pilot's age:	44 years
Pilot's total flying experience:	1,347 hours, 864 hours on type
Information sources:	Civil Aviation Authority field investigation
Investigator in Charge:	Mr P J Kirker

¹ Times are NZDT (UTC + 13 hours).

² WGS 84 co-ordinates.

Synopsis

The Civil Aviation Authority (CAA) was notified of the accident by a New Zealand Police Communication Centre alert at 1350 hours on Friday 31 March 2006. The Transport Accident Investigation Commission was notified shortly thereafter, but declined to investigate. A CAA site investigation was commenced the next day.

The aircraft had just carried out the first top-dressing run of the afternoon when it was seen to enter a right hand turn followed by a steep descent towards the ground. The aircraft disappeared into tall bush on a hillside. Witnesses heard the ground impact and saw a column of smoke rising up from the bush. The first person on the scene found the pilot deceased.

1. Factual information

1.1 History of the flight

- 1.1.1 On Friday 31 March 2006 the pilot intended to carry out topdressing on properties near a steep hill range nine kilometres to the south-west of Kaitaia. The day's activities commenced at approximately 0600 hours when the pilot and loader-driver met at Kaitaia aerodrome. The pilot and loader-driver flew in the aircraft from the aerodrome to a farm airstrip located on the back of a hill range near the Pukepoto Quarry where the fertiliser-loading truck had been parked overnight.
- 1.1.2 The topdressing operation began in the morning with spreading approximately 25 tonnes of superphosphate on nearby farmland which was stored in the fertiliser bins next to the airstrip. As the last of the superphosphate was being spread, a consignment of fresh lime was delivered by a trucking contractor. The topdressing operation continued with the spreading of the lime on another property near the base of the hill range, about three kilometres from the airstrip.
- 1.1.3 At around 1000 hours, while waiting on another delivery of lime by the trucking contractor, the pilot and loader-driver flew in the aircraft to another airstrip about 20 km to the south-east near Broadwood. They repositioned a fertiliser-loading truck located at this airstrip to another airstrip near Pawarenga, in anticipation of the next day's topdressing. The pilot and loader-driver then flew back to the original farm airstrip near the Pukepoto Quarry, arriving at approximately 1100 hours.
- 1.1.4 At about this time the pilot received a cell phone call from his supervising Chief Pilot. During the conversation he asked the Chief Pilot for his advice about the best direction for spreading lime on the land that he was currently working on. The pilot also commented about how the lime was 'hanging up' and not flowing easily from the aircraft's hopper. The Chief Pilot cautioned the pilot about the poor flow properties of new lime and advised him to spread the lime in line with the hill range, not up the slope. The topdressing operation then resumed until all the lime in the fertiliser bin had been used.
- 1.1.5 The pilot and loader-driver then stopped for lunch during which time the aircraft was refuelled and another truckload of lime was delivered. The pilot had

commented to the loader-driver during lunch that the lime was still hanging up in the aircraft's hopper. He was finding that he needed to complete about two passes to clear the entire load from the hopper.

- 1.1.6 Just before starting the afternoon's topdressing flights, the pilot had a conversation on his cell phone with a bank manager in Auckland. The conversation concerned the financial position of his topdressing business. The loader-driver reported that the pilot became very agitated during the conversation, but appeared to calm down prior to beginning the afternoon's flying.
- 1.1.7 The farm-owner observed the aircraft on its first flight of the afternoon as it completed the first two passes. He was aware that the aircraft had flown further away after these two passes and assumed the aircraft was returning to the airstrip for a second load of lime. He did not notice anything abnormal about the aircraft.
- 1.1.8 Other witnesses reported that the aircraft flew parallel with a plantation of 30-40 metre high trees towards the rising hill range. The closest eye witness reported seeing what appeared to be fertiliser dropping from the aircraft as it flew along the tree line up the slope. The dropping of the fertiliser then stopped at which point the aircraft was seen entering a steep right hand turn away from the slope whilst descending towards the ground. The aircraft disappeared in to tall bush on the hillside and witnesses heard the aircraft impact the ground. A large smoke-like cloud was then seen rising up through the bush.
- 1.1.9 On hearing the impact, the farm-owner and a local share-milker from a nearby farm searched the hillside for the aircraft. The aircraft was obscured by the tall bush and was initially difficult to locate. The share-milker made his way down the hillside through the bush to the aircraft. He quickly realised that the pilot was deceased. The farmer-owner went to alert the emergency services, however another property owner who had heard the aircraft strike the ground and seen the smoke had already telephoned the New Zealand Police.
- 1.1.10 The accident occurred in daylight, at approximately 1345 hours NZDT, 9 km south-west of Kaitaia at an elevation of 880 feet AMSL. Latitude: S 35° 10' 26.1", longitude: E 173° 11' 29.4"; grid reference: NZMS 260 N05 283698.

1.2 Injuries to persons

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

1.3 Damage to aircraft

1.3.1 The aircraft was destroyed.

1.4 Other damage

1.4.1 Nil.

1.5 Personnel information

1.5.1 The male pilot, aged 44, held a valid Commercial Pilot Licence (Aeroplane) first issued 9 August 2001. He held a Class 1 medical certificate which was valid until 2 June 2007. There were no active conditions or restrictions associated with the medical certificate at the time of the accident.

1.5.2 The pilot had flown a total of 1,347.4 hours. At the time of the accident, he had flown 864.7 hours in the agricultural role. He obtained his Grade 2 Agricultural Rating on 8 June 2002 and a Pilot Chemical Rating on the 25 October 2002. His last annual currency check for single seat agricultural operations was completed on the 23 June 2005. He was still under the supervision of a Chief Pilot, as required by the Civil Aviation Rules.

1.6 Aircraft information

1.6.1 The New Zealand Aerospace Industries Limited FU24-950 (Fletcher), serial number 238, was manufactured in 1977. At the time of the accident, the aircraft records showed the aircraft had accrued a total of 11,230.2 hours in service.

1.6.2 The engine, a Lycoming IO-720-A1B serial number L-1513-54A, had completed 959.3 hours on the airframe since its last overhaul and had a further 540.6 hours to complete before the next scheduled overhaul.

1.6.3 The Hartzell HC-C3YR-1RF propeller, hub serial number DY2724A, had completed 46.5 hours since overhaul.

1.6.4 An annual review of airworthiness had been carried out on the 14 October 2005 and the last 100 hour maintenance inspection on the 22 February 2006 at 11,183.6 hours total time in service.

1.7 Meteorological information

1.7.1 The wind during the morning was an easterly breeze at an estimated five to ten knots, and scattered cloud above 2500 feet. Witnesses in the area described the weather in the morning as being fine, with light winds and higher partial cloud cover.

1.7.2 By midday the wind had backed around to a north-westerly direction and increased to 15 knots and the temperature was around 20°C.

1.8 Aids to navigation

1.8.1 Not applicable.

1.9 Communications

1.9.1 Not applicable.

1.10 Aerodrome information

1.10.1 The airstrip, orientated 100°/280° M, was located near the top of a western face of a steep low lying hill range. The take-off run available (from the loading point) was approximately 250 metres long down a slope in a westerly direction. The grass surface on the airstrip was undulating in parts and generally firm.

1.10.2 The ground beyond the airstrip continues to rapidly drop away and forms the side of a quarry face. The pilot made left turns after taking off and passed along the quarry face before following the edge of the hill range to the top-dressing areas on the north-western side of the hill range. Occasionally the pilot returned to the airstrip over the hill range via the shortest distance.

1.11 Flight recorders

1.11.1 Not applicable.

1.12 Wreckage and impact information

1.12.1 The aircraft had struck downward sloping ground (approximately 30 degree slope) in thick bush, in a steep nose-down attitude facing directly down the slope. The engine was partly embedded in the ground. From the engine position it was determined that the aircraft had struck the ground at an angle of approximately 17 degrees to the vertical and 2 degrees to the right of the centre line (see figure 1). The cockpit had suffered significant longitudinal deformation leaving no occupiable space.

1.12.2 The fuselage aft of the pilot's seat remained relatively intact. The wings and tail section was still attached to the fuselage. The rear section of the fuselage had twisted in a clockwise direction by about 45 degrees, and in an upwards direction just forward of the tail section. The midsection of the fuselage had split open laterally just behind the right wing. Both the left and right wing outboard sections had almost completely separated, remaining partially attached to the wing by their forward attachment points.

1.12.3 The instrument panel and flight/engine controls had been significantly disrupted offering little useful information about the pre-impact indications or flight control positions.

1.12.4 The fuel tanks located along the leading edges of both wings were crushed evenly indicating that the aircraft had likely struck the ground squarely. The area around the fuel tank inspection panels and fuel filler caps had been deformed outwards as a result of the rapid pressurisation of the fuel tanks caused by their compression in the accident.

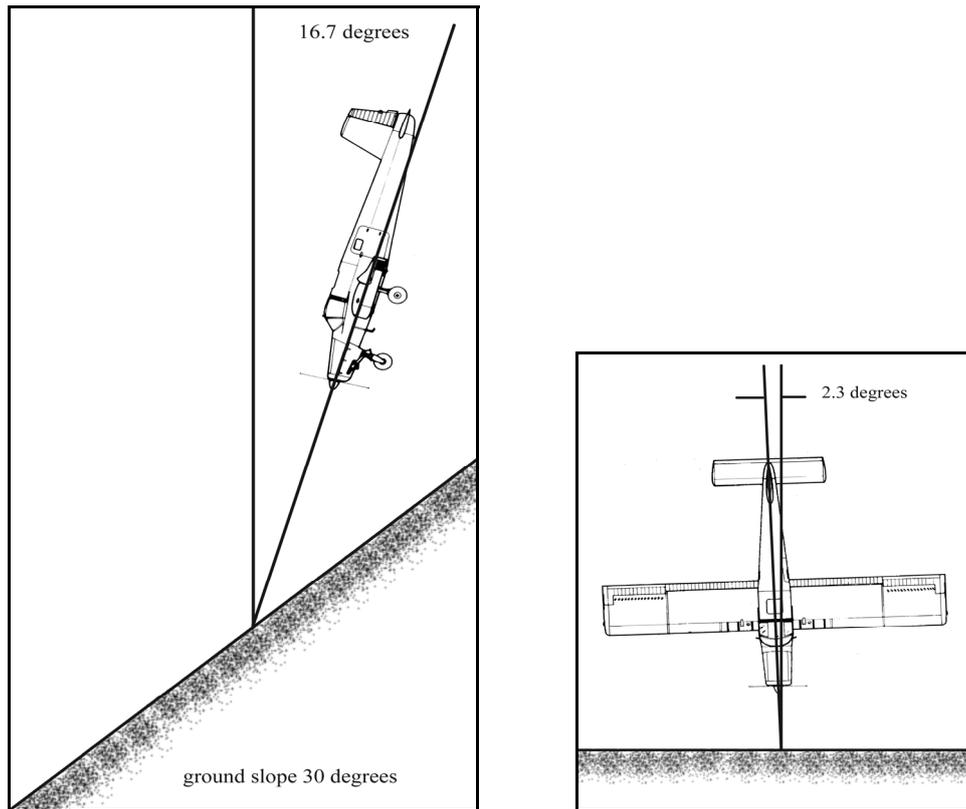


Figure 1. Calculated impact angle

- 1.12.5 After initially striking the ground, the aircraft section aft of the engine firewall appears to have lain down on the main undercarriage and then rolled forward a distance of approximately one metre down the slope.
- 1.12.6 The hopper was estimated to contain about half a load of lime. The hopper had split open during the impact and some of the lime had spilled out under the aircraft wreckage. The hopper 'clam-shell' style doors were found in the closed position. The pre-impact position and integrity of the hopper doors and operating mechanism could not be confirmed owing to the amount of damage sustained during the accident.
- 1.12.7 Pre-impact control system integrity was established as far as possible at the accident site. The flaps were found to be in the retracted position.
- 1.12.8 The propeller was found buried in the ground under the engine. The damage sustained to the propeller blade pitch change mechanism prevented the pre-impact blade angle from being established. Examination of the propeller blades indicated that the engine was most likely at a low power setting at the time of impact.
- 1.12.9 The first person to arrive on the accident scene reported there was a very strong smell of aviation fuel, indicating there was probably a satisfactory amount of fuel in the fuel tanks prior to the accident. A sample of fuel was drained from the aircraft tanks and sent to a laboratory for analysis. Fuel was found in the fuel manifold and fuel filter indicating that it was likely there was a supply of fuel to

the engine at the time of the accident. The destruction of the cockpit prevented the pre-impact position of the fuel selector from being determined.

1.13 Medical and pathological information

- 1.13.1 Post-mortem examination showed that the pilot died of multiple injuries consistent with the aircraft striking the ground with significant force.
- 1.13.2 The pathologist's report indicated that the pilot had a pre-existing heart condition involving the narrowing of a coronary artery, but the autopsy revealed that this was not likely to have been a factor in the accident.
- 1.13.3 Toxicological tests revealed nothing unusual detected in the pilot's bloodstream.

1.14 Fire

- 1.14.1 Fire did not occur.

1.15 Survival aspects

- 1.15.1 The aircraft was fitted with a full harness restraint system. The attachment fittings had failed due to the force of the impact.
- 1.15.2 The force also caused the pilot to lose his helmet, which was found resting relatively undamaged on top of the right wing.
- 1.15.3 The aircraft was equipped with an ACK-E01 121.5/243.0 MHz ELT. The ELT and its associated transmission cable had suffered significant damage in the accident which prevented the ELT from transmitting an emergency signal.
- 1.15.4 The accident was not survivable.

1.16 Tests and research

- 1.16.1 The propeller and hub were stripped at an approved overhaul facility where it was determined that there were probably no pre-existing mechanical defects.
- 1.16.2 The engine and fuel control system were also stripped down at an approved overhaul facility. The damage found in the engine was consistent with damage from a severe frontal impact. The top piston ring on the number seven cylinder was found to be worn. This would account for a report from the maintenance provider that the spark plug in this cylinder had earlier been found slightly oiled up. There were no issues identified during the strip down of the engine or fuel system that may have contributed to the accident.
- 1.16.3 In 2004 the CAA commissioned Lincoln Ventures Ltd of Lincoln University to perform a study into the flow properties of lime for agricultural aircraft (Project No. 02137). The ultimate aim of the project was to develop a reliable field test method which would establish which lime products had good flow properties for aerial topdressing. The study determined that particle size, density distribution and moisture content appeared to have no clear influence on the flow properties of lime, however the report noted that there was a large variability in the properties

of the lime samples taken throughout the country. A sample of lime from the aircraft's hopper was sent for analysis to the New Zealand Centre for Precision Agriculture (NZCPA) at Massey University in Palmerston North. NZCPA found that they were unable to obtain any reliable information about the flow properties of the lime as present testing methods cannot cope with the variable particle size distribution of the lime.

- 1.16.4 An independent authorised petroleum laboratory tested fuel samples taken from the aircraft and the aviation fuel tank on the loader-truck. No abnormalities were detected.

1.17 Organisational and management information

- 1.17.1 The pilot had purchased the aerial topdressing company in June 2004 from its previous owner who was acting as his Chief Pilot. On the morning of the accident the Chief Pilot had observed the pilot from the road side near the Pukepoto Quarry as part of his required supervision responsibilities. He also spoke to the pilot by cell phone later in the morning to discuss operational issues.
- 1.17.2 The company initially commenced operations with two Fletcher FU24-950 aircraft and had employed a second topdressing pilot. In November 2005 the company took delivery of a Cresco 08-600 aircraft which involved a significant financial outlay.
- 1.17.3 Over the Christmas and New Year (2005/2006) period there had been limited opportunities for the company to earn revenue from topdressing, primarily due to the marginal weather conditions. Financial pressure had been building as the business started to have cash flow issues. Revenue earning flights had subsequently increased during the month of February, and on the day prior to the accident the pilot had completed over eight hours of operational flying.

1.18 Additional information

- 1.18.1 Civil Aviation Rule Part 137 *Agricultural Aircraft Operations* (Appendix D.4) requires that agricultural aircraft are configured to allow the pilot to determine the 'upper level' of the hopper contents, either by indication or observation. This aircraft had a sight (observation) window on the rear cockpit bulkhead (a standard Fletcher aircraft design) to enable inspection of the hopper contents from the cockpit. During flight, the pilot is not inclined to look through this window as it is positioned behind him. The position of the window also does not allow the pilot to view the last portion of the hopper load. The window is therefore not a practical way for the pilot to check if there is a hung load in the hopper. In the case of lime, which has a higher density than other fertiliser products³, the upper level of a full hopper load can be around 300 mm lower in the hopper compared to superphosphate, and therefore far more difficult for the pilot to observe.

³ Lime has a bulk density approximately 50% greater than superphosphate.

- 1.18.2 A rule change issue brief (No.7/ISS/10) was raised by the CAA on the 2 May 2006. This brief acknowledges that the current Civil Aviation Rules do not adequately ensure that the agricultural pilot knows the actual weight of the hopper load during all stages of flight. Some agricultural aircraft are fitted with load cells that provide the pilot with a digital readout of the hopper weight. In the past the load cells have proven to be unreliable. This system has therefore not gained much favour in the industry, particularly when the cost of modifying the aircraft is taken into account. Due to technology improvements, more reliable load cells are now available, but it is still unlikely the majority of the agricultural aviation industry will voluntarily introduce this system unless required to by Civil Aviation Rule compliance.
- 1.18.3 The CAA hosted an Issues Assessment Group (IAG) meeting on the 23 January 2007 to discuss various agricultural aircraft operational safety issues conducted under Civil Aviation Rule Part 137 *Agricultural Aircraft Operations*. One of the safety issues discussed was the rule change issue brief (No.7/ISS/10). It was commented at the meeting that the current rule requirement for the pilot to detect the upper level of the hopper contents by indication or observation is inadequate. It was agreed that a pilot should know how heavy the aircraft load is during all stages of flight and a rule amendment will be required to achieve this outcome. The issue will now proceed to the next level for consideration by a specific working group.
- 1.18.4 The same IAG meeting discussed the issue of pilot fatigue in the agricultural aviation industry. The IAG attendees had mixed feelings with regard to the need to introduce fatigue management systems for the industry. Other countries such as Australia have rest regulations specifically for topdressing operations. A Proposed Rule Issue was raised on the 26 January 2007 requiring the CAA to consider establishing a new rule for the agricultural aviation industry requiring flight, duty and rest periods to be introduced for the purpose of managing pilot fatigue.
- 1.18.5 In December 2006 several groups involved with the agricultural top-dressing industry, including the CAA and Department of Labour, published a Safety Guideline document titled 'Farm Airstrips and Fertiliser Cartage, Storage and Application'. This guideline was triggered by a recommendation from an Inquest into a top-dressing accident that occurred as a result of a hung load in an agricultural aircraft. The guideline covers, amongst other things, methods for determining the suitability of the fertiliser for use in top-dressing aircraft in terms of desirable flow properties.

1.19 Useful or effective investigation techniques

- 1.19.1 Nil.

2. Analysis

- 2.1 There was no evidence that the aircraft had suffered any mechanical problem which may have contributed to the accident.
- 2.2 The evidence does indicate that as the new owner and operator of the business, the pilot had a lot of activities to control and manage. Being a relatively new pilot to agricultural flying, it appears he was trying to become fully proficient in agricultural flying techniques as quickly as possible while at the same time trying to run the business. He therefore had a high work load in the aviation operational sense, and was facing many pressures from other events in his life which would have contributed significantly to his stress.
- 2.3 As there is no evidence to support a conclusion that any other mechanical failure occurred, the possibility of contributing human and environmental factors remains. In this respect, it is possible the pilot's concentration and attention may have been diverted from the immediate flying task by the recent distraction of the cell phone call with the bank manager. He may have also been feeling the effects of fatigue after the early morning start and the long hours of flying completed the previous day.
- 2.4 The pilot had repeatedly reported during the morning the problem with the lime not flowing freely from the aircraft hopper. Lime is known to have a propensity to bind rather than to flow freely. It is likely that the lime in the hopper had 'hung up' during the topdressing run just prior to the accident. This would have first become apparent to the pilot as he tried to climb the aircraft up the steep sloping ground which was along the direct track back to the airstrip.
- 2.5 The pilot most likely suddenly found himself in a precarious situation. Due to the weight of lime onboard, the aircraft's climb performance would have been less than he expected as he approached the steep terrain ahead. The rising tree line on the left of the aircraft would have deterred the pilot from turning the laden aircraft in the shorter (and shallower) direction down the slope.
- 2.6 It is possible the pilot tried to release the lime in the hopper by pulling the dump handle. This could explain the eye witness account of seeing fertiliser dropping from the aircraft as it flew up the tree line. Possibly the lime continued to hang up in the hopper, and did not clear sufficiently in time to assist the pilot in manoeuvring the aircraft.
- 2.7 The airspeed of the aircraft would have been reducing at this point as the pilot tried to climb the aircraft. Faced with the sharp rising terrain ahead, a tree line on his left and an aircraft with reduced climb performance, the pilot would have been forced to turn the aircraft in a tight right-hand turn. This means the aircraft most likely entered a stall in the turn from which there was insufficient height for the pilot to recover before it struck the ground.

3. Conclusions

- 3.1 The pilot was appropriately licensed and was being supervised as required by Civil Aviation Rules.
- 3.2 The aircraft had been maintained in accordance with the requirements of Civil Aviation Rules, and had a valid airworthiness certificate.
- 3.3 There was no evidence that the aircraft had suffered any mechanical problem which may have contributed to the accident.
- 3.4 The probable initiator of the accident was a hung load of lime which would have limited the climb performance of the aircraft. Factors contributing to the accident were the steep rising terrain and a high tree line which restricted the turning options for the pilot.
- 3.5 The pilot flew the aircraft into a situation where he had limited recovery options. Due to his limited agricultural flying experience, he may not have appreciated his predicament until it was too late or taken recovery action early enough. The aircraft appears to have aerodynamically stalled during a right hand turn from which there was insufficient height to recover.
- 3.6 In addition, the pilot's decision making ability and concentration may have been impaired to some degree by various distractions and fatigue.
- 3.7 The accident was not survivable.
- 3.8 The standard sight (observation) window installed on Fletcher aircraft is an impractical method for pilots to monitor the upper level of the hopper contents during flight, particularly with a product like lime which has a higher relative density compared to other fertiliser products.

4. Safety actions

- 4.1 A Safety Related Concern Finding (No. 7F944) was raised on the 13 December 2006 for the CAA to further investigate ways of eliminating, isolating or minimising the risk of agricultural lime hanging up in aircraft hoppers.
- 4.2 A Proposed Rule Issue was raised on the 26 January 2007 for the CAA to consider establishing a new rule for the agricultural aviation industry requiring flight, duty and rest periods to be introduced for the purpose of managing pilot fatigue.
- 4.3 A rule change issue brief (No.7/ISS/10) was raised by the CAA on the 2 May 2006 requiring Civil Aviation Rule Part 137 Appendix D.4 to be reviewed in consultation with the agricultural aviation industry, so that the pilot can accurately determine the weight of the hopper load during all stages of flight.

Authorised by:

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