



Report 99-002

Fletcher FU24-954

ZK-EMV

near Riversdale, Wairarapa

27 March 1999

Abstract

On Saturday 27 March 1999 at about 1435 hours ZK-EMV, a Fletcher FU24-954, had taken off from a grass airstrip on a routine sowing run, 5 km south-west of Riversdale in the Wairarapa, when it was observed to sink rapidly before hitting a fence. After hitting the fence the aircraft ballooned up and rolled, striking the ground inverted. The aircraft was destroyed and the pilot died as a result of the second impact.

No new safety issues were identified during the investigation.

The Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

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ZK-EMV



Accident site

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List of abbreviations

C	Celsius
E	east
kg	kilograms
km	kilometres
lb	pounds
M	magnetic
NZST	New Zealand Standard Time (UTC + 12 hours)
S	south
UTC	Co-ordinated Universal Time

Transport Accident Investigation Commission

Aviation Accident Report 99-002

Aircraft type, serial number and registration:	Fletcher FU24-954, 276, ZK-EMV
Number and type of engine:	One Lycoming IO-720-A1B
Date and time:	27 March 1999, 1435 hours ¹
Location:	5 km south-west of Riversdale, Wairarapa Latitude: 41° 07.6' S Longitude: 176° 02.5' E
Type of flight:	Aerial work, agricultural
Persons on board:	Crew: 1
Injuries:	Crew: fatal
Nature of damage:	Aircraft destroyed
Pilot's licence:	Commercial Pilot Licence (Aeroplane)
Pilot's age:	36
Pilot's total flying experience:	8175 hours Approximately 4500 hours on type
Investigator-in-Charge:	K A Mathews

¹ All times in this report are NZST (UTC + 12 hours)

1. Factual Information

1.1 History of the flight

- 1.1.1 On Saturday 27 March 1999 at about 0645 hours ZK-EMV, a Fletcher FU24-954, departed from Hood Aerodrome at Masterton to conduct sowing operations from an airstrip about 5 km south-west of Riversdale. On board were the pilot and loader driver.
- 1.1.2 The pilot had telephoned the loader driver at about 0530 hours that morning to co-ordinate the activities for the day. Arrangements had been made to sow 180 tonnes of superphosphate on the farm where the airstrip was located. Conditions were forecast as suitable for sowing, with a warm calm day expected.
- 1.1.3 The pilot and loader driver arrived at the aerodrome at about the same time and together prepared the aircraft. Water checks on the fuel were completed and one pint of oil was added to the engine. The engine was run for 10 minutes before departing for the airstrip. The aircraft had been fuelled the previous night.
- 1.1.4 During the preparations, the loader driver recalled the pilot saying that he had gone to bed early the previous night as he had been a bit tired. Nevertheless, the loader driver observed the pilot to be relaxed and in good spirits.
- 1.1.5 The flight to the airstrip took about 10 minutes and was uneventful. After disembarking the loader driver the pilot started sowing operations. Flying continued uneventfully with a short break at about mid-morning for a refuel.
- 1.1.6 Located on a low plateau, the airstrip was a one-way strip with a take-off heading of 260° magnetic (M). The airstrip was about 500 m in length and 250 feet above mean sea level. There was a slight slope up for the first third of the take-off path and then an equally gentle slope down for the remainder. After take-off the ground quickly fell away by about 80 feet, to a large flat open area. A road crossed the take-off path at right angles about 300 m past the threshold. A set of power lines lay beyond the road, angling into the take-off path from the north and meeting the road about 200 m left of the airstrip's extended centre line. The surface of the airstrip was grassed and hard.
- 1.1.7 At about 1150 hours a second company pilot and loader driver arrived by aircraft to assist in the operation. This aircraft was of the same make and model as ZK-EMV. After completing a further two sowing runs the pilot of ZK-EMV took the second pilot for a familiarisation flight for him to observe the areas yet to be sown. No superphosphate was carried during this flight.
- 1.1.8 After refuelling the aircraft from the bowser on the loader truck, the group had lunch. During lunch the pilots co-ordinated their activities for the afternoon and the two loader drivers agreed to do about an hour about on the loader truck. Both loader drivers agreed that the job could be finished by mid to late afternoon. A refuel would be needed after about 2 hours of flying. Airstrip conditions were discussed by several members of the group, who agreed that operations could quickly become tricky in a good southerly or sea breeze.
- 1.1.9 The weather at the time was described as ideal for sowing with clear skies and a hint of an occasional south-easterly sea breeze, giving a slight downwind component on take-off. The pilot of ZK-EMV co-ordinated with his loader driver to recommence sowing with loads of 23 hundredweight (about 1170 kg), while the pilot of the second aircraft planned to start with 21 hundredweight. However, the second loader driver, as the result of an earlier discussion, believed both pilots were to take loads of 21 hundredweight. An hydraulic actuator on the loader was used to measure the weight of each load. Calibrated in hundredweight increments, the loader driver

would release excess fertiliser until the correct weight was achieved. A hundredweight was equal to 112 lb or approximately 50 kg.

- 1.1.10 Sowing operations recommenced at about 1245 hours with the pilot of ZK-EMV initially sowing 20 tonnes between the airstrip and the road to the west. He then moved further west to where the second pilot was operating. The slight rise in the middle of the airstrip prevented the loader drivers from observing the departure of the aircraft. However, the farmer and other observers noted that ZK-EMV would normally turn slightly to the left after getting airborne and then head directly to the area to be sown. The second aircraft, sowing a little more to the north, would depart straight ahead. The turn-around time between loads was about 3½ minutes for each aircraft.
- 1.1.11 At about 1415 hours the second loader driver took over the loading duties and began loading both aircraft with 21 hundredweight. After about 10 minutes the pilot of ZK-EMV requested that his load be increased by one hundredweight. The second pilot increased his load by one hundredweight shortly after. The sea breeze was noted to be increasing a little and, while still light, was enough to start flickering the leaves of the bluegum trees next to the superphosphate bin located near the eastern end of the airstrip. However, conditions further down the airstrip and near the road were considered to be calmer.
- 1.1.12 After completing the first run at the heavier weight, the pilot of ZK-EMV indicated to the loader driver that the load be increased by an additional hundredweight after the next run. The pilot of the second aircraft remained at 22 hundredweight, though he had moved his loading point back a short distance to provide additional take-off distance. The second pilot was still encountering “some sink” after take off, coinciding with the raising of flap.
- 1.1.13 On completion of the second run at 22 hundredweight, the pilot of ZK-EMV positioned the aircraft for loading about 25 m to the east of his previous loading point. ZK-EMV was regarded by some personnel in the company to have had slightly better performance than other similar model aircraft. Consequently the increase to 23 hundredweight, while of interest, did not raise any concerns by the loader driver. Despite being unable to observe the departure of ZK-EMV, the loader driver was still able to hear the aircraft’s engine noise and recalled nothing unusual as the aircraft departed after loading.
- 1.1.14 On returning from his run, the pilot of the second aircraft saw ZK-EMV to his lower right, in a steep climb, estimated to be about 45 to 50°. As it continued to climb the aircraft rolled slowly to the left, peaking at a height equivalent to “3 times power pole height”. Objects were seen falling from the aircraft during this time. Once inverted the aircraft descended rapidly, striking the ground. The aircraft hit the ground approximately 350 m from the strip, near where the power lines crossed a bend in the road and a small intersection.
- 1.1.15 The pilot of the second aircraft landed and informed the two loader drivers. Together the group headed for the accident site in the loader truck. While en route a member of the group alerted emergency services by the use of a cellular telephone.
- 1.1.16 The accident was also observed by the driver of a truck who had recently deposited a load of fertiliser in the bin at the airstrip. The driver had stopped the truck on a narrow gravel road below the airstrip to check the tailgate of the trailer. He then heard an aircraft begin its take-off run and decided to stay and watch the departure as the aircraft would fly over the road close to where the truck was parked.
- 1.1.17 The driver saw ZK-EMV leave the end of the strip and “sag down a long way”, appearing to “drop like a stone”. The aircraft was observed to be in a high nose or climbing attitude as it continued to descend in a slight left turn towards a fence next to the road. The aircraft was then seen to strike the fence and balloon up, dropping fertiliser as it climbed. The aircraft then rolled

left and descended in the direction of the truck driver, who quickly sought cover underneath the trailer. The aircraft struck the ground in a paddock next to the road, stopping about 5 m from the truck.

- 1.1.18 With 15 years of working near agricultural aircraft, the truck driver considered himself to be familiar with their operations. The driver observed no items falling from the aircraft before it struck the fence, or anything hit the aircraft. He considered the engine to be at “full song” or maximum power the whole time and heard no change in pitch or beat.
- 1.1.19 After the accident the truck driver went quickly to the upturned aircraft and attempted unsuccessfully to locate the pilot. The driver then headed for the airstrip in the truck, meeting the loader drivers and second pilot on their way to the aircraft. On reaching ZK-EMV the bucket on the loader was used to lift the aircraft to gain access to the cockpit. However, no assistance could be given to the pilot who had died on impact.

1.2 Wreckage and impact information

- 1.2.1 The aircraft initially struck a fence on a heading of about 240° M. It then ballooned into the air, rolled inverted to the left and landed heavily on the engine and cockpit area, heading about 180° M. The accident was not survivable and the aircraft was destroyed.
- 1.2.2 All aircraft components were accounted for at the scene, with two small pieces of fairing and sheet metal found near the road between the two impact points. Although the flight controls were jammed, it was established that there was full control system integrity at the time of the initial impact.
- 1.2.3 Witness marks on the fence and aircraft indicated that the aircraft had struck the fence in a high nose attitude with about 15° of left bank. Two deep gouges were made on the lower surface of the left wing, with one causing damage to the main spar. The left wing folded upwards along the line where the spar had been damaged. Two deep indents were made in the leading edge of the tailplane, with a strike on the right side near the fuselage. Part of the tailplane was pushed into the fuselage, jamming the elevator in an up position. The elevator trim gauge indicated full down trim was selected before final impact.
- 1.2.4 The aircraft struck the ground a second time about 115 m past the initial impact point, sliding a further 30 m before coming to rest. The cockpit and engine area bore the brunt of the impact forces, with little additional damage to the rest of the aircraft. The pilot was restrained by his harness and was not wearing a helmet. No fire occurred.
- 1.2.5 The handle to jettison the load was in the full up position and the hopper was fully open. Load jettisoning had started 22 m before the fence, but did not take full effect until about the fence line. A little over one hundredweight was estimated to be remaining in the hopper after the accident. The superphosphate onboard the aircraft and in the bin was dry and free-flowing.
- 1.2.6 The engine, complete with propeller, was still attached to the fuselage. The damage to the propeller suggested that it was still rotating at high revolutions per minute at the time of impact. One fuel tank was ruptured along the leading edge, however, both tanks still contained some fuel. The electric fuel pump was set to OFF. Fuel from the bowser on the loader truck was free of contamination and was the correct fuel for the aircraft.
- 1.2.7 The flaps were still connected and set to 20°, corresponding to the lever position and expected setting for take-off. The undercarriage sustained no damage. The Emergency Locator Transmitter had not activated and was set to the OFF position. The pre-impact position of the engine controls could not be determined, however, the magnetos were set to OFF.

- 1.2.8 No evidence was found of any other defect or failure of the control system or structure that may have been a factor in the accident. The trip indicator in the cockpit showed that the pilot had completed 84 loads that day. The accident flight was the 85th load.

1.3 Aircraft information

- 1.3.1 The aircraft's maintenance records indicated that ZK-EMV had been maintained in accordance with the operator's approved Inspection Schedule and was certified for aerial work and private operations. The aircraft had been flown regularly up to the time of the accident flight and had accumulated a total of 8837 airframe hours. A replacement engine was installed in the aircraft in May 1997 and had accumulated 832 hours since overhaul. The last maintenance inspection was completed on 25 February 1999 and the next 100 hour inspection was due at 8863.00 hours or 26 August 1999, whichever occurred first. The aircraft had a non-terminating Certificate of Airworthiness.
- 1.3.2 With 23 hundredweight (1171 kg) of superphosphate, a pilot weight of 95 kg and an estimated fuel load of 60 kg, it was calculated that the aircraft would have been within its centre of gravity limits at take-off.

1.4 Personnel information

- 1.4.1 The pilot held a valid Commercial Pilot Licence (Aeroplane), Class 1 Medical Certificate and was a B Category instructor (Aeroplane). He was rated on the aircraft type and held an Agricultural Rating.
- 1.4.2 The pilot was in regular flying practice and had flown about 70 hours in ZK-EMV during the 3 weeks leading up to the accident. An experienced agricultural pilot, he had amassed some 4500 hours top dressing in Fletcher aircraft. He was known to be competent, conservative and "not a worrier".
- 1.4.3 There was no evidence of any pilot impairment as a result of medical unfitness, fatigue or environmental factors.
- 1.4.4 On the day of the accident the pilot was not wearing a protective helmet, but the impact forces were such that a helmet would not have prevented his death.

1.5 Meteorological information

- 1.5.1 The weather for Saturday 27 March 1999 was described as fine, with a clear blue sky, an estimated temperature during the afternoon of 18° C and an atmospheric pressure of about 1026 hectoPascals. Wind was light from the south, increasing slightly during the afternoon to about 5 knots. This wind direction would have produced a quartering-tailwind down the airstrip.
- 1.5.2 At the time of the accident the position of the sun relative to the departure path would not have produced any significant shadows or generated any unusual optical illusions. The sun was 38° above the horizon and about 40° to the right of the take-off heading of the aircraft.

1.6 Tests and research

- 1.6.1 The engine and propeller were subjected to strip examination by an approved overhaul facility under the supervision of the Commission. Various engine components were rig tested and checked for serviceability. No evidence was found of any mechanical defect or failure that may have contributed to the accident. The engine was assessed as being capable of producing full power before the aircraft struck the fence. The similarity of damage to each propeller blade and fracture of each pitch change knob was consistent with a "power-on" impact.

1.7 Additional information

- 1.7.1 Tyre marks on the airstrip, corresponding to the take-off track of ZK-EMV, indicated that the aircraft got airborne about 40 m from the end of the strip. The depth of the tracks further indicated that the aircraft had weight on the wheels up until almost lift-off.
- 1.7.2 The topography of the local area comprised of a large flat open expanse, with gently climbing terrain well to the west. There were suitable areas to land the aircraft had an engine malfunction occurred after take-off. There is no evidence to assume that the pilot attempted to position the aircraft for a forced landing.
- 1.7.3 The pilot of ZK-EMV was familiar with carrying loads of 23 hundredweight prior to the accident flight. He had worked quickly up to 23 hundredweight during the early part of the morning, immediately after the mid morning refuel and also after lunch.

2. Analysis

- 2.1 The pilot had completed numerous routine sowing runs without difficulty after the lunch break. Having probably detected the reduction in load, 23 hundredweight down to 21 hundredweight, coinciding with the change in loader driver, the pilot requested an increase of one hundredweight. After returning from the sowing run and before departing on a second run at 22 hundredweight, the pilot requested a further increase of one hundredweight for the next run. In preparation to receive the 23 hundredweight load, the pilot positioned the aircraft about 25 m further back up the airstrip. The aircraft departed normally.
- 2.2 During the take-off roll the pilot initiated a positive rotation of the aircraft shortly before the end of the airstrip. After clearing the airstrip the aircraft descended in a gentle left turn while maintaining a high nose or climbing attitude. The pilot probably realised that the aircraft would not clear the fence and so pulled the jettison handle to jettison the load of superphosphate. This action was too late to prevent the aircraft from striking the fence.
- 2.3 As a result of striking the fence the aircraft sustained major damage to the left wing and tailplane, jamming the elevator. The angle at which the elevator jammed would have produced a significant upwards pitching moment at moderate aircraft weights and speed.
- 2.4 After striking the fence, the aircraft ballooned up as the load was being dumped, with the pilot applying full forward elevator trim in an attempt to stabilise the pitch attitude of the aircraft. At about this time the left wing folded upwards along the line where it had struck a concrete fence post. The aircraft then rolled to the left, inverted and descended rapidly. The pilot probably turned off the magnetos when he became aware that the aircraft was about to strike the ground. The aircraft struck the ground inverted and slid a short distance.
- 2.5 The pilot was experienced in top dressing and familiar with the area being sown. He had operated from the strip that morning and completed 84 sowing runs. The final flight path of the aircraft suggested that the pilot was following his normal track to the area to be sown.
- 2.6 Witness observations, post-impact inspection and component testing indicated that the aircraft was performing normally up until the time it struck the fence. There was no evidence of any power loss or loss of control. The terrain in the local area should have presented no problems to the pilot during his sowing operations

- 2.7 In leaving the decision to jettison the load as late as he did, the pilot may have been under the impression that he could have flown away from the approaching road and fence. The jettisoning of the load was left too late to prevent the aircraft striking the fence. After the aircraft struck the fence, it became uncontrollable and the second impact was inevitable.
- 2.8 The weather conditions were suitable for sowing. The light sea breeze, estimated to be about 5 knots, generated a quartering tailwind for take-off. The quick fall away at the end of the airstrip would have meant that any ground effect the aircraft had during the take-off roll would have been lost immediately after getting airborne.
- 2.9 The wind was observed to increase slightly during the early afternoon, increasing the downwind component on take-off and possibly creating an area of slight downdraught or sink off the end of the airstrip. The increase in temperature during the day would also have degraded the aircraft's take-off performance.
- 2.10 In shifting the loading point for the final load back 25 m, the pilot may have been concerned about the take-off performance of the aircraft. After the initial upslope, the gentle downslope of the airstrip would have provided little or no benefit to the aircraft's take-off performance.
- 2.11 Although the second loader driver had not worked on the loader truck used on the day of the accident he was, nevertheless, an experienced loader driver and familiar with its operation. He encountered no difficulties in loading the 2 aircraft. The hydraulic gauge measuring the load has not been calibrated for some time but was regarded by the regular driver as "pretty accurate". The second pilot said that the loads received from the loader were consistent and gave him the weights he expected.
- 2.12 A combination of factors probably contributed to the accident, these included:
- increasing tailwind on take-off
 - sudden loss of ground effect after take-off
 - encountering an area of possible sink after take-off
 - taking off at a heavier weight than previously
 - a gradual increase in temperature, affecting take-off performance
 - delayed jettisoning of the load.

3. Findings

Findings are listed in order of development and not in order of priority.

- 3.1 The pilot was appropriately licensed, rated and experienced for the agricultural operation.
- 3.2 The aircraft had a valid Certificate of Airworthiness and its records indicated that it had been maintained correctly.
- 3.3 There was no evidence of any malfunction with the aircraft.
- 3.4 The topography of the area should have presented no unusual problems for the pilot.
- 3.5 The weather conditions at the time were suitable for sowing.
- 3.6 A light tailwind component degraded the take-off and departure performance of the aircraft.

- 3.7 Any ground effect benefits would have been lost immediately after take-off.
- 3.8 The pilot was unable to establish a positive climb gradient after take-off.
- 3.9 The aircraft was probably overweight for the prevailing variable weather conditions at the time of the last take-off.
- 3.10 The pilot's jettisoning of the load was too late to prevent the aircraft from striking the fence.
- 3.11 As a result of striking the fence, the aircraft became uncontrollable.

Approved for publication 11 August 1999

Hon. W P Jeffries
Chief Commissioner