AIRCRAFT ACCIDENT REPORT

No. 90-011T

Fletcher FU24-950M

ZK-BIX

2km west of Waimangu

11 December 1990

Transport Accident Investigation Commission
Wellington · New Zealand

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Transport Accident Investigation Commission
Wellington

Chief Commissioner
Transport Accident Investigation Commission

The attached report summarises the circumstances surrounding the accident involving Fletcher FU24-950M aircraft ZK-BIX at 2 km west of Waimangu on 11 December 1990 and includes suggested findings and safety recommendations.

This report is submitted pursuant to Section 8(2) of the Transport Accident Investigation Commission Act 1990 for the Commission to review the facts and endorse or amend the findings and recommendations as to the contributing factors and causes of the accident.

8 January 1992

R CHIPPINDALE
Acting Chief Executive

APPROVED FOR RELEASE AS A PUBLIC DOCUMENT

12 March 1992

M F DUNPHY
Chief Commissioner

TRANSPORT ACCIDENT INVESTIGATION COMMISSION

AIRCRAFT ACCIDENT REPORT NO. 90-011T

Aircraft Type, Serial Number and Registration:	Fletcher FU24-950M, 50, ZK-BIX
Number and Type of Engines:	One Lycoming IO-720-A1B
Year of Manufacture:	1975
Date and Time:	11 December 1990, 0835 NZDT
Location:	Rotomahana Block Airstrip, 2 km west of Waimangu Latitude: 38° 17.7'S Longitude: 176° 21.6'E
Type of Flight:	Topdressing
Persons on Board:	Crew: 1
Injuries:	Crew: 1 Fatal
Nature of Damage:	Destroyed
Pilot in Command's Licence:	Commercial Pilot Licence, Agricultural Rating
Pilot in Command's Age:	47
Pilot in Command's Total Flying Experience:	12173 hours of which 1171 were on type
Information Sources:	Transport Accident Investigation Commission Field Investigation
Investigator in Charge:	Mr D.V. Zotov

1. NARRATIVE

1.1 The aircraft was taking off for the first topdressing flight of the day. The take-off run was downhill, with a steady tailwind of two or three knots. The indicated load was 20 hundredweight (1016 kg) of granular superphosphate: the pilot intended to increase the load to 22 hundredweight on subsequent sorties, as that was the load he usually took from this airstrip. With 20 hundredweight the mass was about 130 kg greater than the maximum permitted and with 22 hundredweight it would have been some 10% greater than the maximum permitted.

1.2 The take-off path was diagonally across the strip, from top left to bottom right, as this gave the best take-off path to clear terrain ahead.

1.3 Ground marks showed that the aircraft had got airborne about two thirds of the way down the strip. Along the right edge of the strip, for the lowest third of its length, was a hedge of dense thistles some 6 feet high. These thistles had not been present when the pilot operated from this airstrip previously. The tops of these thistles had been shaved off by the right wing, and there was a groove in the thistles which got progressively deeper, where the wingtip had passed. Right at the end of the strip, just before the ground fell away steeply, the aircraft touched on the nosewheel and right mainwheel; the left mainwheel was six inches off the ground.

1.4 Beyond the airstrip was a ravine some 250 feet deep. Initially the slope of the ground was 20°, but about half-way down it steepened to 45°. Along the ridge where the slope changed was a fence and just beyond the fence was an isolated manuka tree.

1.5 A scrapemark showed where the wingtip had touched the ground before the fence; a 20 m length of fence was broken. The manuka appeared as though the right side (looking downhill) had been chopped back by a vertical knife blade. Beyond the fence were the fibreglass right wingtip and aileron aerodynamic balance horn, showing witness marks from vegetation which had been trapped between them. A little further down was a bunch of thistle stems, bent in the middle where they had been trapped.

1.6 The wreckage was at the bottom of the ravine. The aircraft had struck the ground almost vertically, facing back towards the airstrip, before rolling backwards. The cockpit area was completely destroyed. The load was still present in the wreckage, and there was no sign of an attempt to jettison it in flight.

1.7 A fuel sample from the loader was satisfactory. There was black sediment in the fuel sample from the aircraft.

1.8 The engine was stripped and it was found that the number eight injector was completely blocked by a grain of sand. The fine-mesh filter in the fuel control unit was clean (so the filter could not have been bypassed because of filter blockage) but the fuel control unit had been removed for calibration 84 hours before the accident i.e. within the last maintenance cycle. The grit could have entered the system at this time.

1.9 Unlike a partial injector blockage due to carbon, which would cause rough running and a minor power loss, complete blockage of an injector would cause a major power loss. Not only would the engine be deprived of all power

from the affected cylinder ($12^1/_2$% loss) but also there would be pumping losses from that cylinder. The total loss could be of the order of 18%. This could have caused the aircraft to sink back to the airstrip after lifting off.

1.10 In the ordinary course of events a partial power loss would not have been a problem: even if dumping the load was insufficient, the ravine led to fields suitable for landing. However, when the right wingtip brushed the thistles, stems were entrained between the wingtip and aerodynamic balance, forcing the aileron horn down and opening the gap into which more thistles were forced. The pilot, finding the aileron snatched to full deflection, may have used both hands to try to bring it back to neutral but have been unable to do so because of the stems jammed between the balance horn and wingtip. This might account for the lack of any attempt to dump the load, but in any case the accident sequence would have been very rapid. Witness marks on the fencepost confirmed that the aircraft was banked vertically to the right when the wingtip struck the ground; the right outer panel of the wing became partially detached at this point and there was no possibility of regaining control.

1.11 There had been previous incidents of Fletcher ailerons being jammed by vegetation.

1.12 The fuel tanks of topdressing aircraft were prone to contamination by grit from the environment in which they operated.

1.13 When the fuel pump was switched on prior to starting the engine, there was likely to be a flow of fuel, rather than just an increase of system pressure. This was particularly the case if the aircraft had been standing overnight or longer, as the fuel system might have dried out to some extent. It was possible that a surge of fuel might cause the filter in the fuel control unit to lift against its spring, opening the bypass and admitting debris from the fuel tanks.

1.14 A filter unit was modified to have a clear plastic "window", so that the operation of the filter could be seen. To simulate the action of the fuel pump at start-up, the pressure on the test rig was increased to 25 pounds per square inch and the valve controlling the flow was then opened. The filter was seen to lift, but the results were inconclusive and more elaborate tests would be required to establish the extent of the potential problem.

1.15 An engine overhaul facility advised that they had found fuel control units with scored components, which indicated that dirt was able to bypass the filter.

1.16 The size of the particle obstructing the number eight injector on ZK-BIX was such that it should have been trapped by the coarse mesh filter which preceded the fuel pump, but this filter could not be guaranteed to trap all large particles.

2. FINDINGS

2.1 An injector was completely blocked by a grain of sand which caused a significant power loss just after take-off.

2.2 The aircraft sank back until its wheels touched the end of the runway strip and its right wingtip brushed a hedge of tall thistle.

2.3 Thistles were entrained between the wingtip and the aerodynamic balance horn, deflecting and jamming the ailerons and causing the aircraft to roll uncontrollably to the right.

2.4 The grit probably entered the fuel system when the fuel control unit was removed for calibration.

2.5 The possibility that the grit might have bypassed the fuel filters could not be eliminated.

3. SAFETY RECOMMENDATIONS

3.1 As a result of the investigation into this accident, the following safety recommendations were made:

To the General Manager of Landcorp:

> That no further permission be granted for operations from the Rotomahana Block Airstrip, until the thistles have been removed.

3.2 Landcorp responded as follows:

> "Permission will be withheld for further flights until the thistles are destroyed".

3.3 To the General Manager of the Air Transport Division of the Ministry of Transport:

> That he advise all New Zealand operators of FU24 aircraft, of the potential for light growth to jam the ailerons of these aircraft,
>
> That he alert the civil aviation authorities of other countries where these aircraft are operated, to the potential hazard,
>
> That he consider if a requirement exists for a fence/guard to be developed by the manufacturer, and
>
> That he consider the publication of a warning in the flight Safety magazine or elsewhere, relating to the vulnerability of such control configurations to tall vegetation.

3.4 Air Transport Division of the Ministry of Transport responded as follows:

> "The action taken for the final recommendation (see below) adequately covers this recommendation."
>
> "Accepted. A listing of the known current status of FU24-950 series aircraft, supplied by Pacific Aerospace, indicates that these are flown in seven countries, viz, Australia, Malaysia, Pakistan, Sudan, Thailand, Turkey and Uruguay. Cresco aircraft are operated in Bangladesh. An advisory letter has been sent to the civil aviation authories in these countries plus one to the American FAA.
>
> "The installation of a protective fence/guard is not considered feasible or necessary. The Fletcher aileron utilises a shielded horn balance configuration and the gap between the horn and the wing when the aileron is deflected is integral to this type of design and does not lend itself easily to any form of guard. The Pilatus Porter has an unshielded horn balance, so this problem does not arise to the same extent.

There is a modification to Fletcher FU24-950 ailerons which fits endplates to the aileron horn balance and these provide some protection against the ingress of vegetation by deflecting it away from the area. This modification, AI/FU/0137, is available for retrofit under Service Bulletin 052; it is fitted as standard to all Crescos and since 1980 to all new product FU24-950s.

However, the primary purpose of the modification is to improve the roll rate and decrease stick forces and it is not known what the effect of the increased roll rate would have been if the modification had been fitted to the accident aircraft.

The level of protection is not such that I could justify making the modification mandatory by the issue of an Airworthiness Directive. Nor do I consider that the development of any other protection is justified, as this could involve a significant redesign of the lateral control system.

In response to your recommendation, an article highlighting the potential hazard appeared in the August 1991 issue of the Flight Safety magazine. You will be aware that this is mailed to, among others, all holders of Commercial Pilot Licences.

3.5 To Avco Lycoming Corporation:

That they determine the extent to which the fine-mesh filter in the fuel control unit of the IO-720 engine is susceptible to bypassing fuel under the influence of fuel flow, either at high steady flow rates or when a pulse of fuel occurs, and

That they make any changes necessary to prevent such an occurrence.

4. OBSERVATION

4.1 Checks of other FU24-950 aircraft at random showed that they, too, were limited to about 17 hundredweight (864 kg) load by the maximum permitted mass. This was because repairs and modifications had progressively raised the empty mass, with no revision of the maximum permitted mass. In particular, the substitution of the more powerful IO-720 engine for the original IO-520 (a move intended to improve the performance and thus increase the useful load) had the effect of reducing the permissible load by some 76 kg.

4.2 The manufacturers advised that neither structural strength nor fatigue considerations limited the maximum permitted mass. Since performance considerations in agricultural operations were created by progressively increasing the load to that which could be handled safely from the particular airstrip in the conditions of the day, the limitation had no perceived safety connotation and was ignored widely.

4.3 It was undesirable to have limitations which were seen to be pointless, since they tended to bring all limitations into disrepute. The limitation on maximum permitted mass for the FU24-950 aircraft should be recertificated at some more appropriate value.

5. REGULATORY

5.1 Pursuant to Section 14(5) of the Transport Accident Investigation Commission Act 1990 the legal personal representatives of the operator and the pilot were invited to avail themselves of the opportunities afforded to them thereunder.

5.2 As a result of representations received the report was amended and amplified to clarify some of the points raised.

5.3 The representations made to the undersigned are not to be taken as an admission of liability on the part of the parties concerned and their statements are without prejudice to their right to act in any way they may consider fit in any proceedings or action which may be based on the events to which this report refers.

12 March 1992

M F DUNPHY
Chief Commissioner