



AIRCRAFT ACCIDENT REPORT

OCCURRENCE NUMBER 99/2856

BELL 206B

ZK-HYF

HUIROA, TARANAKI

7 OCTOBER 1999

Glossary of abbreviations used in this report:

CAA	Civil Aviation Authority
C of G	centre of gravity
kV	kilovolt(s)
lb	pound(s)
m	metre(s)
UTC	Coordinated Universal Time

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Aircraft type, serial number and registration:	Bell 206B, 422, ZK-HYF
Number and type of engines:	1 Allison 250-C20
Year of manufacture :	1969
Date and time:	7 October 1999, 0845 hours*
Location:	Huiroa, Taranaki Latitude: S 39° 15.4' Longitude: E 174° 29.7'
Type of flight:	Agricultural
Persons on board:	Crew: 1
Injuries:	Crew: 1 fatal
Nature of damage:	Helicopter destroyed
Pilot-in-Command's licence	Commercial Pilot Licence (Helicopter)
Pilot-in-Command's age	39
Pilot-in-Command's total flying experience:	625.5 hours 209.1 on type
Information sources:	CAA field investigation
Investigator in Charge:	Mr O J Stewart

* Times are NZDT (UTC + 13 hours)

Synopsis

The Civil Aviation Authority was notified of the accident at 1330 hours on 7 October 1999. The Transport Accident Investigation Commission was also notified but declined to investigate. A CAA investigation was commenced the same day.

During the course of agricultural spray operations, the helicopter collided with 11 kV power lines.

1. Factual information

1.1 History of the flight

- 1.1.1 The pilot arrived at the site of operations at about 0815, after a short ferry flight in the helicopter. The loader driver had arrived earlier and had set up his equipment for the task, the application of liquid fertiliser.
- 1.1.2 The owner of the property arrived at about 0835 and discussed the operational requirements with the pilot. The owner asked the pilot if he required an aerial map. The pilot indicated that his preference would be for the owner to accompany him on an aerial reconnaissance of the property.
- 1.1.3 The pilot gave the property owner a safety briefing in which the hazards and safety zones of the helicopter were pointed out, together with door and seat belt operation.
- 1.1.4 During the flight, the pilot and property owner discussed the paddocks to be sprayed, the location of stock and their proximity to the area of operation and the presence of hazards. The latter included 11 kV power lines, which crossed one end of one of the paddocks to be sprayed.
- 1.1.5 With the aerial reconnaissance completed, the first load of fertiliser was uplifted and spraying in the first paddock commenced. Having applied the first load, the pilot returned to the loading area for a second load of fertiliser. Five spray runs were made in the first paddock.
- 1.1.6 Once the first paddock was completed, the pilot began spraying in the second paddock, completing one spray run, following the curve of the boundary fence. Prior to reaching the power lines, the helicopter was seen to climb above the height of the lines, complete a normal spray turn, descend and carry out a further spray run in the opposite direction.
- 1.1.7 On the return spray run, the loader driver noticed that the left outboard spray nozzle (on the left spray boom) was blocked. As the helicopter would be returning for another load shortly, the loader driver walked to the support truck to retrieve another nozzle, which would be fitted as a replacement during the next loading sequence.

- 1.1.8 On retrieving the replacement nozzle, the loader driver looked up at the helicopter, which by now was about halfway between the truck and the power lines, approximately 375m away . The loader driver noticed that the helicopter was flying slightly lower than the previous spray runs and heading towards the power lines.
- 1.1.9 The helicopter suddenly pitched up to about 20 to 30 degrees. It appeared to the loader driver that the fuselage was clear of the lines, but then he observed a bright blue flash and the helicopter began to break up. The loader driver thought that it “tumbled” end for end two to three times, before impacting with the ground some distance further on. He was unable to see the final impact from his vantage point.
- 1.1.10 The loader driver immediately turned the loading plant off and went to the aid of the pilot. Upon shutting the plant down and removing his earmuffs, he could hear a noise like an engine running, coming from the direction of the helicopter.
- 1.1.11 The loader driver arrived at the helicopter, which was lying on its right side on the ground with debris scattered around it, approximately 100 m from the power line impact point. He found that the engine was still running at what he thought to be a high power setting. He reached into the cockpit and shut the engine down by closing the twist grip throttle. He also turned off the master switch and generator, then went to assist the unconscious pilot who was lying on the ground in front of the helicopter. Emergency services were notified.
- 1.1.12 A second witness was watching the spraying operation from a distance of approximately one kilometre. He saw the helicopter flying parallel with the paddock boundary, then commence a sweeping left hand turn to follow the boundary line. He saw the tail boom deflected upwards at a very high rate, then the helicopter disappeared from view behind a hill.
- 1.1.13 He saw the spray pattern from the helicopter as being intermittent.
- 1.1.14 The accident occurred in daylight near Huiroa, Taranaki at an elevation of 610 feet. Grid reference 260-Q20-392156.

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	0

1.3 Damage to aircraft

- 1.3.1 The helicopter was destroyed by the impact.

1.4 Other damage

1.4.1 Two of the 11 kV conductors were severed by the impact of the helicopter.

1.5 Personnel information

1.5.1 The pilot held a Commercial Pilots Licence (Helicopter), a Grade 2 Agricultural and a Chemical Rating. He held type ratings on Bell 206, Bell 47, Robinson R22 and Hughes 369 helicopters. He had completed a Regulation 76 proficiency check on 25 June 1999.

1.5.2 He had a total flight time of 625.5 hours, which included 209.1 hours on type.

1.6 Aircraft information

1.6.1 ZK-HYF, a Bell 206 Jet Ranger II manufactured in 1969, had completed 12556.6 hours total time in service at the time of the accident.

1.6.2 A review of the helicopter documentation and logbooks, together with enquiries made as to its general condition, indicates that at the time of the accident, it had been maintained as required.

1.6.3 At the time of the accident, the helicopter had flown approximately 79 hours since its last inspection.

1.6.4 The helicopter all up weight and centre of gravity were calculated and found to be within limits at the time of the accident.

1.7 Meteorological information

1.7.1 At the site, the weather conditions were: overcast cloud, excellent visibility and no wind.

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 Not applicable

1.11 Flight recorders

1.11.1 Not applicable

1.12 Wreckage and impact information

- 1.12.1 The helicopter struck the power lines in a 20 to 30 degree nose-up attitude.
- 1.12.2 Two of the conductors appear to have passed through the gap between the tip of the wire cutter (fitted to the lower forward fuselage) and the forward tips of the helicopter skids. There are two witness marks on the forward left hand skid cross tube, indicating that the wires have contacted the helicopter at these points.
- 1.12.3 Reconstruction of the tail boom and horizontal stabiliser indicates several main rotor blade impacts, at least one blade strike cutting through the horizontal stabiliser and tail boom. Pieces from the tail boom were spread over an area of approximately 25m by 35m and within a distance of approximately 40m of the power lines.
- 1.12.4 The tail rotor gearbox with one tail rotor blade still attached, broke away from its attach point on the tail boom, after the helicopters impact with the power lines.
- 1.12.5 The helicopter continued in a tumbling, slightly arching curve, impacting on its forward left hand corner some 100m from the power lines, just clearing a road that bounded the paddock being sprayed.
- 1.12.6 The helicopter appears to have rolled once after ground impact and come to rest on its right hand side.
- 1.12.7 One main rotor blade had driven quite deeply into the ground at the first ground impact, with the subsequent roll and twist of the fuselage bending and braking the blade. The other main rotor blade was also broken off at the root by the ground impact and was found approximately 15m away from the fuselage. The main rotor transmission was torn out of the roof of the helicopter during this sequence.

1.13 Medical and pathological information

- 1.13.1 Post mortem examination of the occupant concluded that death was due to head injuries sustained in the accident.

1.14 Fire

- 1.14.1 Fire did not occur during or after the accident.

1.15 Survival aspects

- 1.15.1 Investigation of the wreckage suggests that the pilot was ejected from the helicopter through the front right hand upper screen, at the initial ground impact point.
- 1.15.2 Inspection of the pilot's safety harness showed that the right hand lap attachment to helicopter fuselage had failed due to overload and the lap belt halves were still locked in the centre clasp.

1.15.3 The shoulder harnesses were found disconnected from the centre clasp. Later inspection of the clasp showed that both shoulder harness locks had sustained damage in the ground impact, probably due to the load applied as the result of high deceleration g forces.

1.15.4 The pilot was wearing a safety helmet.

1.16 Tests and research

1.16.1 Following initial assessment and investigation on site, a possibility existed that the visibility and location of the power lines bisecting the paddock may have played a part in the cause of the accident.

1.16.2 The flight path was reconstructed at the same time of day under similar conditions of light intensity and visibility. At the same height that the pilot had flown on the day of the accident, the wire span from pole to pole crossing the paddock became undetectable against the background.

1.16.3 Observation from the same position showed that for three different intensities of light (affected by sun through cloud) the wire visibility changed from detectable, through partially detectable to undetectable, in a matter of seconds.

1.16.4 At 60 knots (the calibrated spray speed used by the pilot on the day of the accident) approximately 6 seconds elapsed from the time the pilot crossed the fence at one end of the paddock to the time he crossed the power lines.

1.16.5 A number of agricultural operators and trainers were consulted with respect to accepting, as in this case, a flight obstruction or hazard and operating to and over it. Considerable differences of opinion remained among those questioned as to how the paddock should have been sprayed. Some suggesting that the best method of planning would be to fly a parallel route to the lines (with its inherent dangers of drift in towards the lines and difficulties with depth perception) and others maintained that flight over the lines was preferable as the focus could remain on the knowledge that the lines were there (with inherent dangers of undetectability and distraction).

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 Nil

2. Analysis

- 2.1 The farm owner describes thorough briefings and planning prior to commencement of the aerial reconnaissance and the spray operation.
- 2.3 Both witnesses describe the possibility of some form of blockage difficulty with the spray system. It is possible that the pilot may have had some of his attention drawn away from the flying mission, attempting to identify or troubleshoot the problem.
- 2.4 During the pilot's last spray run, it is entirely possible that the wires became undetectable due to the altitude at which the mission was being flown, (that is, flying at the height of the wires reduces the number of wires visible from three to one). The inability to detect the lines may also have been affected by changes in light intensity as the result of fluctuating intensity of cloud cover.
- 2.5 The main rotor strikes on the tail boom were probably as the result of a combination of factors. The action of the pilot bringing the nose of the helicopter up to clear the power lines would cause the main rotor disc to pitch in a manner where the disc would angle up at the front and down at the rear. This would bring the blades into closer proximity to the tail boom, but still clear it, as this action should be within the normal operational capability of the helicopter.
- 2.6 The second event would be the nose down, tail up reaction as the result of hooking the power lines on the forward left hand cross tube. Due to the forward airspeed of the helicopter, this would result in a very fast rotation of the helicopter about the power lines. Even if the pilot had checked forward on the cyclic control at this time, the speed of the rotation and the lag of the main rotor disc (due to gyroscopic effects) would have caused the tail boom to enter the flight path of the main rotor blades.
- 2.7 No clear best practice of planning or strategy with respect to the management of the power line risk was apparent as the result of enquiries made within industry. Whilst it is clear in this case, flying over the lines contributed to the cause of this accident and there are many similar cases available to review, there are also similar numbers of accidents whose contributory factors include flying parallel with wires.

3. Conclusions

- 3.1 The pilot was appropriately qualified and experienced for the flight.
- 3.2 No pre-accident medical incapacitation was detected in the pilot.
- 3.3 The aircraft had a valid Certificate of Airworthiness and had been maintained in accordance with relevant requirements.
- 3.4 There was no evidence in the wreckage inspected of any pre-accident aircraft defects that would have contributed to the accident.

- 3.5 The pilot, in attempting to climb the helicopter above and over the powerlines, did not have sufficient time nor distance to clear them. The reason for this was not determined though distraction and tricks of light may have played a significant role in the late initiation of a climb to clear the lines.

4. Observation

- 4.1 A conclusion regarding the pilot's awareness of spray nozzle difficulties could not be made. However, operators who find themselves in a similar situation should consider the benefits of suspending operations immediately, so that attention can be directed and focused on the problem at hand in a situation less constrained by hazards.

(Signed)
A Buckingham
for Richard White
Manager Safety Investigation

15 September 2000