CIVIL AVIATION AUTHORITY
OF NEW ZEALAND

CAA Safety Investigation Report
Wire strike involving MD500E, ZK-ITJ
7 NM north of Wanganui 28 October 2014

Photo: CAANZ file

CAA Occurrence Number 14/5002

Foreword

The focus of the Civil Aviation Authority (CAA) safety investigation is to establish the causes of the accident on the balance of probability. Safety 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.

*The sole objective of the investigation of an accident or incident shall be the **prevention** of accidents and incidents. It is **not** the purpose of this activity to **apportion blame or liability.***

Wire strike involving MD500E, ZK- ITJ

What happened

On 28 October 2014, a McDonald Douglas Helicopter Company 369E (commonly known as a Hughes 500E) registered as ZK-ITJ, was conducting an aerial spraying operation on a farm property located near Brunswick, approximately seven nautical miles north of Wanganui. The pilot was the only person on board.

At approximately 0930 hours (all times are New Zealand Daylight Time) during the first spray run, the helicopter struck two disused suspended 12 and 15 gauge electric fence feeder wires. Contact with the wires resulted in the separation of the vertical and horizontal stabiliser assembly and tail rotor from the helicopter.

The helicopter was observed by witnesses moments after striking the wires. It momentarily gained altitude and then rotated a number of times before descending and landing heavily on its side on an adjacent sealed roadway. The helicopter was substantially damaged and the pilot received fatal injuries.

The facts

The purpose of the flight was for the pilot to spray the farm pasture for thistles.

The pilot and loader driver initially departed in ZK-ITJ from the operator's base at Wanganui Aerodrome at 0622 hours to commence the job. During flight, the pilot received a telephone call from the farm manager indicating that there was significant fog in the area of the farm property. Based on this information, the pilot opted to return to Wanganui Aerodrome and wait for the fog to clear.

A short time later, the pilot received another telephone call from the farm manager indicating that the fog was clearing. The pilot and loader driver again departed the aerodrome. On arrival at the farm, the pilot found that the area was still fog bound which prevented him from immediately commencing the job. The pilot chose to land on a nearby farm airstrip and wait for the conditions to improve. At 0912 hours the pilot received a further telephone call from the farm manager indicating that the fog had cleared sufficiently. The pilot and loader driver then departed the farm airstrip in the helicopter and landed at the designated loading area for the job.

At the loading area, the loader driver disembarked and the farm manager then boarded the helicopter. A reconnaissance flight was conducted for the purpose of indicating the areas to be sprayed and also the location of known hazards in the area including overhead wires. This flight was approximately five minutes in duration.

On landing back at the loading area, the farm manager disembarked the helicopter while the loader driver filled the helicopter spray tanks with chemical product.

The farm manager and loader driver observed the helicopter depart the loading area and fly a wide circuit to the north of the paddock to be sprayed. They both went about their associated tasks at the loading area and were then alerted by a loud bang as the helicopter approached on the first spray run.

The farm manager and loader driver looked towards the helicopter and observed it climbing and noted the tail assembly falling from the helicopter. They continued to observe the helicopter which then began to rotate with spray product coming from the spray booms. The helicopter was then seen to descend rapidly and impact the road, finally coming to rest on its left side.

The farm manager and loader driver immediately went to the pilot's aid. The pilot was removed from the helicopter and with the assistance of a neighbour who arrived at the scene, first aid was carried out. Despite this first aid, the injuries were not survivable.

Pilot information

The pilot held a Commercial Pilot Licence (Helicopter) with the appropriate agricultural, chemical and helicopter type ratings. He held a current Class I Medical Certificate at the time of the accident. The pilot had accrued approximately 18,000 hours flying experience and had completed approximately 96 hours flight time in the last 90 days as recorded in his Pilot Logbook. According to his immediate family, the pilot was well rested prior to commencing the spraying job having spent the previous day at home. Fatigue was not considered to be a factor in this accident.

Weather conditions

Early morning fog in the area had delayed the start of spraying operations at the farm. By approximately 0910 hours the weather conditions had improved sufficiently for the spraying job to commence. The farm manager indicated during the CAA safety investigation that there were still some patches of fog in low lying areas, however the paddock that the pilot had started to spray was free of fog. It was noted from a photo taken by a local resident as they approached the accident site, approximately 10 minutes after the accident, that the fog had not cleared completely. There appeared to be no distinct clear horizon and horizontal visibility was reduced (Refer Figure 1).

Figure 1: Weather conditions 10 minutes post-accident

Wreckage and impact information

The helicopter had struck two disused suspended electric fence feeder wires. The wires were strung from a derilict farm building to the top of a small hill adjacent to the helicopter loading area. Contact with the wires resulted in the separation of the helicopter's aft stabiliser and tail rotor assembly.

Following a brief climb, the helicopter descended and the witnesses observed it strike the ground initially with the right skid. The helicopter then rapidly rolled over to the left landing heavily on its left side. The helicopter was largely intact and all parts were accounted for at the accident site apart from the aft stabiliser assembly and tail rotor. Signatures indicated that the main rotor system was under power at the time of ground contact.

Figure 2: Accident site

The aft stabiliser assembly was located along the helicopter's flight path, approximately 80 metres prior to the main wreckage. The tail rotor gearbox and tail rotor blades were located nearby, the tail rotor blades were found to have separated from the gearbox. One tail rotor blade was missing a 10 cm section which was later found embedded in the ground. Refer to Figure 3 for an overview of the accident site and approximate flight path.

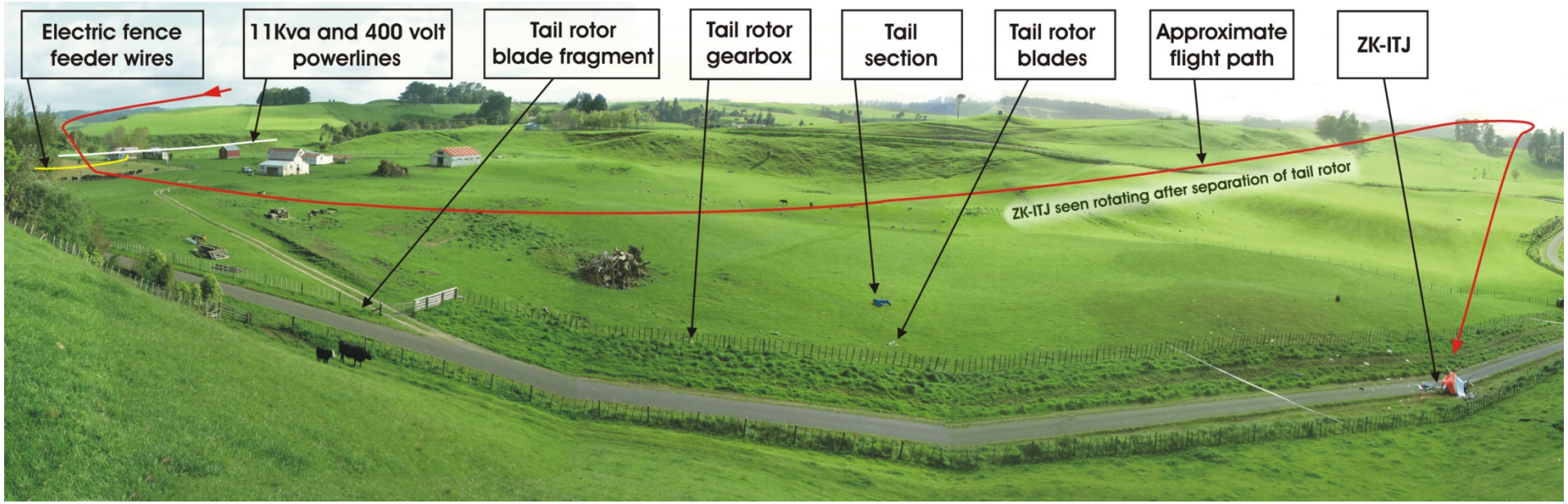

Figure 3: Accident site overview and flight path

The lower vertical stabiliser was found to have a length of wire embedded in the leading edge of the stabiliser (Refer Figure 4).

Figure 4: Electric fence feeder wire embedded in lower vertical stabiliser

Witness marks on the failed tail rotor blade indicated that the blade failed after having contacted the wire. The position of the length of wire embedded in the lower vertical stabiliser coincided with the position of where the tail rotor blade had failed. (Refer Figure 5).

Figure 5: Tail rotor blade failure

Analysis

Spraying operations at the farm were delayed due to the foggy conditions in the area to be sprayed. When the helicopter arrived at the loading area, the farm manager boarded the helicopter and a reconnaissance flight of the farm was carried out. Information provided to the CAA by the farm manager, indicated that although he pointed out the group of wires near the paddock to be sprayed, it would appear that the electric fence feeder wires were not specifically made known to the pilot. No evidence was found during the safety investigation which would indicate that a hazard map had been produced or used to indicate the wire hazards on the farm property. The pilot had not sprayed this particular paddock before and was probably not familiar with the hazards in the area.

The group of wires consisted of 11 Kva and 400 volt powerlines supported above each other on the same set of power poles as well as the suspended electric fence feeder wires which passed underneath at an approximate 45 degree angle.

The suspended electric fence feeder wires ran from an old farm building with a span of approximately 265 metres and in close proximity to the powerlines. The wires passed through a stand of poplar trees and bush to terminate on a short pole near the ridgeline adjacent to the helicopter loading area. The wires were supported mid-span by an old telegraph pole. Due to the droop in the wires, it is estimated the wires were approximately four metres above ground level in the vicinity of where the helicopter came into contact with them.

The paddock to be sprayed had a patch of thistles approximately 50 metres from where the electric fence feeder wires ran perpendicular to the flight path. For the pilot to spray the thistles, he would first have to fly over the powerlines, then the electric fence feeder wires before descending to spraying height.

During the approach to the first spray run, the pilot descended the helicopter after crossing the powerlines. The helicopter then struck the electric fence feeder wires which were approximately 70 metres further on from the powerlines.

As shown in figure 2, there was some fog present in the vicinity of the paddock being sprayed which gave a reduced forward visibility and a poor reference to the horizon. The reduction in visibility and the grey/white background of the horizon would have made the visual detection of the electric fence feeder wires more challenging for the pilot.

The helicopter was able to be fitted with a TracMap[1] spraying guidance system, however, the helicopter was not fitted with the equipment at the time of the accident. The pilot preferred to use visual cues rather than electronic guidance equipment such as TracMap. Guidance systems such as TracMap can be used by pilots to mark the position of known hazards, thereby aiding the pilot's memory to the location of the hazard.

[1] TracMap is a GPS based precision guidance system for ground applications in the agriculture, horticulture, viticulture and aviation industries.

Conclusions

The pilot had received a verbal briefing from the farm manager with regards to the areas to be sprayed and hazards on the property. However, it could not be positively established that the briefing specifically included the location of the electric fence feeder wires.

The verbal briefing provided to the pilot was not backed up with supporting information such as a hazard map for the farm property.

During the first spraying run, the helicopter struck a pair of suspended electric fence feeder wires which resulted in the separation of the fin and tail rotor assembly. This led to a loss of control of the helicopter by the pilot.

Following the loss of control, the helicopter struck the ground heavily on its left-hand side fatally injuring the pilot.

The remnants of the early morning fog may have hindered the pilot's visual recognition of the electric fence feeder wires.

The pilot preferred not to use the TracMap system which could be fitted to the helicopter. Use of the TracMap system would allow known hazards to be marked thereby aiding hazard memory recollection for the pilot.

The suspended electric fence feeder wires had been disused for a long period of time. Removal of the wires by the property owners would have eliminated this wire hazard to aerial operations on the property.

The risk of wire strikes is a known hazard during the aerial application of products. Various safety initiatives are currently underway in an effort to reduce the number of wire strike occurrences.

Wire Strike Prevention Initiatives

An article titled '*Wires-Working to get them down'* was published in the November/December 2015 edition of the CAA Vector magazine. The article highlights that since 1979 there have been 116 wire strike occurrences resulting in 28 deaths involving helicopter pilots. In an attempt to reduce the number of wire strike occurrences, the CAA is supporting two wire strike campaigns developed by industry; 'Down To The Wire' and 'Lets Get Em Down'. Refer to Annex 1 for a copy of the article.

The aim of both campaigns is to educate pilots and farmers to the hazards aerial wires pose and how to minimise the risk of having a wire strike. The campaigns also target getting wires down, thereby eliminating the hazard all together.

The CAA has established a wire strike website to aid in the awareness of the risk aerial wires pose to pilots and how to mitigate and eliminate the risk. This can be accessed by using the following link: www.caa.govt.nz/wires In addition, the CAA also previously published an article titled '*Managing Wire Hazards'* in the May/June 2014 edition of the Vector magazine. Refer to Annex 2 for a copy of the article.

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Annex 1: *Wires-Working to get them down*

Wires – Working to Get Them Down

Since 1979, New Zealand helicopter pilots have had 116 wire strikes, with 28 deaths. Many of them were with power or phone cables, but 62 of them were from other wires, including fences and elevated gully wiring. To help reduce this, the CAA is getting behind campaigns to combat wire strike accidents.

Any helicopter flying at low level is at risk of a wire strike. It's serious. Wire strikes happen in New Zealand with unacceptable frequency.

Jim Burtenshaw, CAA's Manager Safety Investigation, says the CAA wants to raise awareness of the risks associated with helicopter agricultural operations. The CAA is also seeking support for that from Federated Farmers.

"If pilots, Federated Farmers, and the CAA work together we can create a strong campaign to prevent more wire strike accidents," says Jim.

Helicopter pilots Alan Beck and Dean Lithgow have been spearheading their own independent wire strike awareness campaigns.

The CAA is supporting both Alan's "Down to the Wire', and Dean's "let's Get 'Em Down" campaigns.

Both campaigns are already receiving a good reception, with posters going up in rural supply stores across New Zealand, such as Farmlands, and advertisements in farming magazines.

Under the Health and Safety in Employment Act 1992, farmers must ensure regulations are complied with on their land. That means they must take all reasonable steps to eliminate hazards to ensure the farm is safe for aerial operations. That includes removing wires. Often farmers don't think of electric feeder wires as hazards because they don't, themselves, fly.

Stringing a wire over a gully or road to save money is not a good idea when you consider the consequences of an accident.

While the aim of both private campaigns is to get wires taken down, they also aim to educate pilots about the risks of wires, and to be aware of where the wires may be.

"We encourage all pilots to have all wires within the area of operation identified to them by the contracting party before they commence operations.

"Simply talking about it, or having it written into a contract, isn't enough. Pilots should sight all wires on the property so they know where they are, and constantly be aware of them," says Jim.

Even then, the risk remains and accidents still occur. The only solution to eliminate the risk altogether is to remove the wires.

The CAA web site has a new section with information on wire strike avoidance, www.caa.govt.nz/wires.

Jim says, "We're looking forward to the campaigns gaining momentum, and are confident they will help reduce wire strike accidents over time." ■

A flyer from the campaign spearheaded by Dean Lithgow.

Managing **Wire Hazards**

Working alongside wire hazards requires careful planning and communication between the parties involved. When the 'get here ASAP' jobs arise, don't cut corners – the consequences can be disastrous.

A recent Health and Safety investigation into a wirestrike incident identified a lack of communication between the pilot and the client as a contributing factor.

During the investigation, a number of wires were discovered that the pilot was not advised about. Fortunately in this instance, the pilot was unharmed and the aircraft sustained only minor damage.

Shared Responsibility

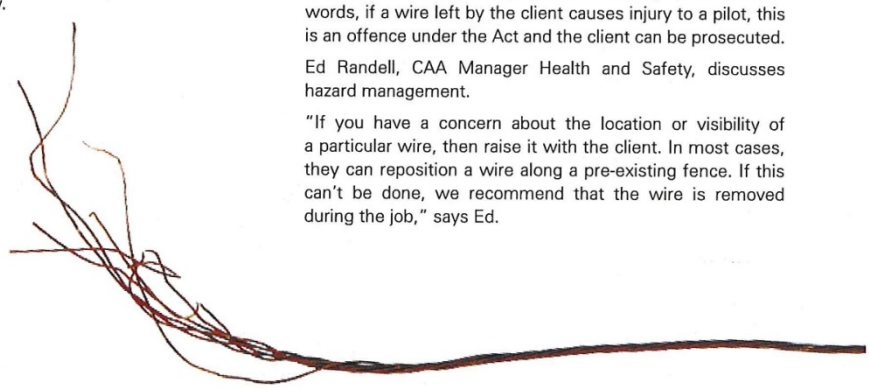
Time constraints, weather limitations, and client demands – there's always pressure to get the job done. Pressure increases the temptation to take shortcuts when planning a job and assessing the risks.

Complacency can be a shortcut to catastrophe. If you take shortcuts, you are accepting avoidable risk and compromising your situational awareness. You need to view every job with a fresh set of eyes. If it's a repeat job, don't rely on old information.

Also realise that you are only one component in the safety equation. A large amount of responsibility rests on the client's shoulders.

Clearly communicate the nature of the job, the risks you face, and let the client know they bear some of the responsibility.

Alan Beck, President of the New Zealand Agricultural Aviation Association, comments on the risks faced by pilots working in the agricultural industry.



"For reasons of expediency, farmers have traditionally pulled the wire from one side of a gully to the other and then stretched it tight. These 16-gauge wires are hard to see, and there isn't always a pole to alert the pilot that a wire is present.

"Because of the tensile strength, the wire doesn't break easily. It tends to wrap itself around drive shafts and rotor masts until control rods break, or the helicopter is 'winched' to the ground. This happened to me in my only accident in over 20,000 hours. It resulted in a fractured spine, and damage to the helicopter.

"Many pilots have spent decades trying to get farmers to understand the risks. To their credit, a lot of farmers have taken wires down, or strung them on top of the fence line. However, the vast majority just left them where they are, with the excuse that the pilot has been told about them, or 'he knows they are there'.

"Unfortunately, it is usually a momentary distraction that causes a pilot to forget about the hazard, such as a blocked nozzle, or the phone ringing in his ear, or the loader driver calling during a spray run to verify something," says Alan.

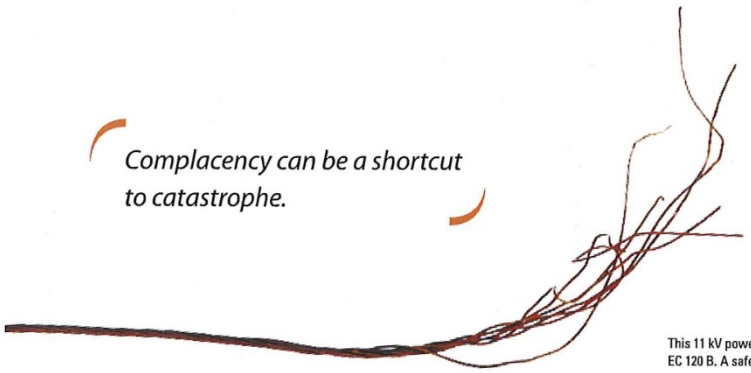
Health and Safety in Employment Act

The client is required by the Health and Safety in Employment Act 1992 to take all practicable steps to ensure the safety of contractors and their employees while they work. In other words, if a wire left by the client causes injury to a pilot, this is an offence under the Act and the client can be prosecuted.

Ed Randell, CAA Manager Health and Safety, discusses hazard management.

"If you have a concern about the location or visibility of a particular wire, then raise it with the client. In most cases, they can reposition a wire along a pre-existing fence. If this can't be done, we recommend that the wire is removed during the job," says Ed.

Complacency can be a shortcut to catastrophe.



This 11 kV powerline, one of three wires, was severed by a Eurocopter EC 120 B. A safety investigation cited complacency as a contributing factor.

Mapping the Hazards

To help safeguard yourself and your company against a potential wirestrike, you should formalise the communication process. Make sure that any exchange of information is well documented.

To assist you with the process, there's a Contract Relationship Management guide on the CAA web site, www.caa.govt.nz, "Health and Safety".

The client needs to provide a detailed map showing wires, high fences, and other hazards. Be positive in how you ask about wires or hazards. Use phrases like, "where are the wires around here?" and, "How do these structures get their power?" Make sure clients survey their property before an operation, rather than giving you a sketchy hazard rundown from memory.

Stress that hazards in the surrounding areas must also be identified. In an emergency, you may need to fly outside the intended operating area.

Your hazard map needs to be comprehensive. For further insight, you can talk to neighbouring landowners, or other operators who have experience working in the area.

Aerial Reconnaissance

Don't rely solely on the information the client provides. Complete a full 360-degree reconnaissance of the area you are about to operate in from the air and from the ground.

When conducting reconnaissance:

- Take note of any structures that use power. Power is often supplied by an underground cable – but not always. Be especially careful of single wires strung across farm buildings. They are particularly hard to see, and can also be attached to hidden structures.
- Look for poles. If there is a pole, it's highly likely there is a wire, even if you can't see it. Also be mindful of earth wires which run between the tops of pylons. They are thinner and much harder to see than the actual conductors.
- Assume that all rivers and streams have wires strung somewhere.
- To aid your situational awareness, try to get an idea of how the wires look from different angles.

For further information see the *Vector* article: "Avoiding Wirestrikes", January/February 2009.

To contact the CAA Health and Safety Unit, email: hsu@caa.govt.nz. ■

Wirestrike Avoidance Course

The "CRM in the Wire and Obstruction Environment" course will be held in New Zealand again this year by Bob Feerst, an internationally renowned safety expert specialising in wirestrike avoidance.

The course aims to give pilots the specialised skills needed to fly in the wire environment and the knowledge to help them forecast the presence of wires before they can actually be seen.

The dates, times and venues were not available at the time *Vector* went to print, but details will be available from: www.totalaviationquality.co.nz.