Australian Government
Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT

Aviation Occurrence Report – 200600523

Final

Wirestrike
15 km east of Parkes Aerodrome, NSW
2 February 2006
VH-MFI
Bell Helicopter Co 206B (III)

Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT

Aviation Occurrence Report
200600523
Final

Wirestrike
15 km east of Parkes Aerodrome, NSW
2 February 2006
VH-MFI
Bell Helicopter Co 206B (III)

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office location: 15 Mort Street, Canberra City, Australian Capital Territory
Telephone: 1800 621 372; from overseas + 61 2 6274 6440
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117; from overseas + 61 2 6247 3117
E-mail: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

ISBN and formal report title: see 'Document retrieval information' on page iii.

DOCUMENT RETRIEVAL INFORMATION

Report No.	Publication date	No. of pages	ISBN
200600523	3 August 2007	53	978-1-921165-14-6

Publication title

Wirestrike - 15 km east of Parkes Aerodrome, NSW – 2 February 2006 – VH-MFI, Bell Helicopter Co 206B (III)

Prepared by

Australian Transport Safety Bureau
PO Box 967, Civic Square ACT 2608 Australia
www.atsb.gov.au

Reference No.

Aug2007/DOTARS 50327

Acknowledgements

Figure 3: courtesy of the New South Wales Police Force.

Figure 9: reproduced with the permission of Country Energy.

Abstract

On 2 February 2006, a Bell Helicopter Co 206B (III), registered VH-MFI arrived at Parkes Aerodrome from Dubbo, NSW in preparation for an aerial noxious weeds survey, including the requirement for a closer inspection of the eastern border area of the Parkes Shire Council. At an estimated 0923 Eastern Daylight-saving time, the pilot took off for the estimated 7 to 8 minutes flight to the survey area. Also onboard the helicopter were two council weeds control officers.

Witness reports indicated that, at about 0930, the helicopter struck a powerline that crossed the Parkes to Orange road.

The occupants of the helicopter were fatally injured and the helicopter was destroyed by impact forces and a post-impact, fuel-fed fire. There was no damage to the powerline or associated facilities and structures.

As a result of this investigation, the Civil Aviation Safety Authority (CASA) indicated that it was considering the development of a Civil Aviation Order (CAO) with the effect that anyone carrying out low-level operations would have to satisfy relevant low-level flying standards.

The Australian Transport Safety Bureau (ATSB) issued two recommendations as a result of this investigation, including: the possible enhancement of the content of CASA's *Approval to conduct Low-flying Instruments* and the possible development of a Civil Aviation Advisory Publication or Advisory Circular for application in the conduct of low-level operations. In addition, the ATSB has commenced initial discussions with a number of agencies and associations in order to examine the feasibility of the establishment of a national database of information on the location of known powerlines and tall structures for access by pilots, operators and managers of aerial campaigns.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Transport and Regional Services. ATSB investigations are independent of regulatory, operator or other external bodies.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the Transport Safety Investigation Act 2003 and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to enhance safety. To reduce safety-related risk, ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not the object of an investigation to determine blame or liability. However, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to proactively initiate safety action rather than release formal recommendations. However, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation, a recommendation may be issued either during or at the end of an investigation.

The ATSB has decided that when safety recommendations are issued, they will focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on the method of corrective action. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations. It is a matter for the body to which an ATSB recommendation is directed (for example the relevant regulator in consultation with industry) to assess the costs and benefits of any particular means of addressing a safety issue.

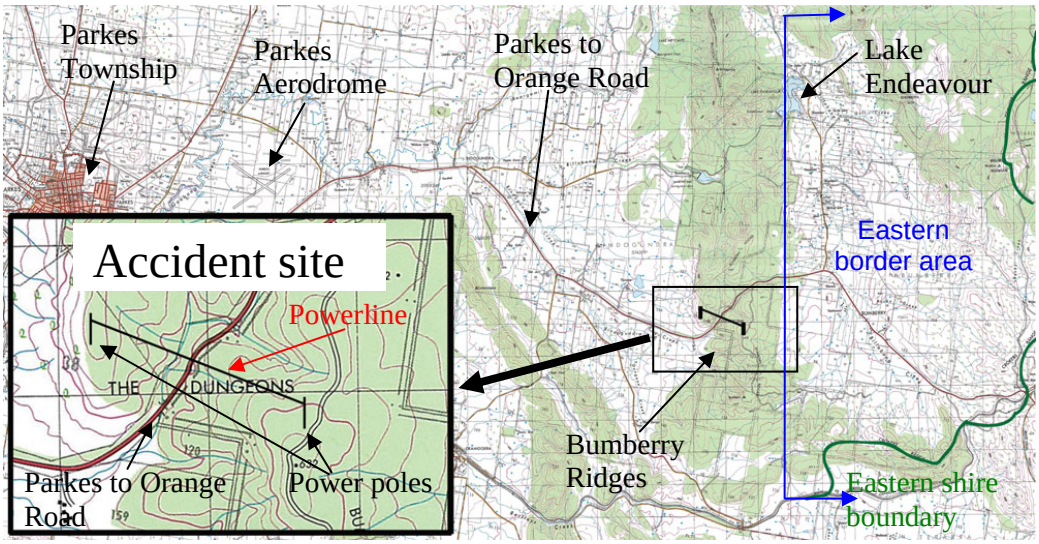
About ATSB investigation reports: How investigation reports are organised and definitions of terms used in ATSB reports, such as safety factor, contributing safety factor and safety issue, are provided on the ATSB web site www.atsb.gov.au.

FACTUAL INFORMATION

History of the flight

On 2 February 2006, a Bell Helicopter Co. 206B (III), registered VH-MFI, arrived at Parkes Aerodrome from Dubbo, NSW in preparation for an aerial noxious weeds survey, including the requirement for a closer inspection of the eastern border area (Figure 1) of the Parkes Shire Council (the council).[1] Witness reports and refuelling records indicated that the preparation included refuelling the helicopter to 'full' at 0820 Eastern Daylight-saving Time[2], and the conduct by the pilot of a 30 to 45 minute pre-flight inspection of the helicopter and a 30 to 45 minute briefing with the two council weeds control officers who were to take part in the survey.

Figure 1: Eastern border area, including the accident site



The council's management reported that, prior to takeoff, one of the weeds control officers rang his supervisor from the aerodrome and advised that 'everything was right to go and that they were about to takeoff' on the estimated 7 to 8 minute flight to the survey area. An examination of that officer's telephone records found that the telephone call was made at 0900.

A witness who was driving along the Parkes to Orange road, and who indicated that he knew one of the weeds control officers, recalled that, at about 0930, he observed a helicopter flying in a southerly direction about 300 m to his right and at an estimated height of 200 ft above ground level (AGL). The driver understood that

1 The total area of the Parkes Shire Council was 5,958 sq km.

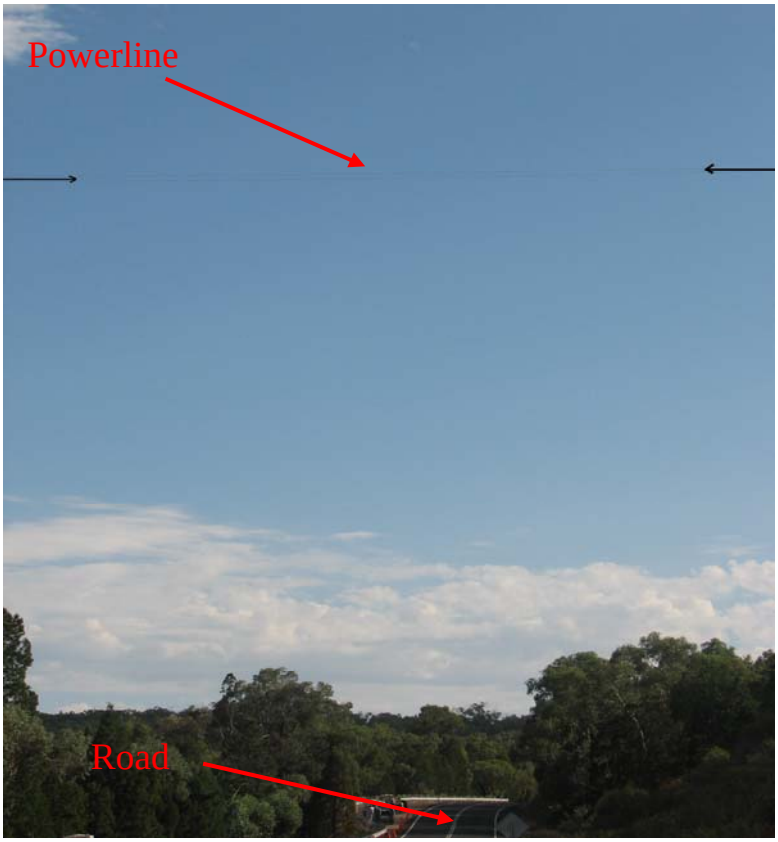
2 The 24-hour clock is used in this report to describe the local time of day, Eastern Daylight-saving Time, as particular events occurred. Eastern Daylight-saving Time was Coordinated Universal Time (UTC) + 11 hours.

this was the pilot's second overflight of the vicinity, as the helicopter had reportedly previously overflown a house to the north-east of the accident site.[3]

The driver advised that the helicopter turned towards his vehicle, before 'it banked around and started to follow the road' towards an area known as 'The Dungeons' (Figure 1). The driver estimated that the helicopter passed overhead his vehicle at about 600 m from the accident site, and at an estimated height of 50 to 60 ft AGL. The driver described that, at that time, the helicopter was 'under full control, nothing wrong with it, and flying level'. In addition, he said that the helicopter sounded 'normal', with the 'usual high-pitch whine', which he presumed was from the helicopter's turbine engine.

The helicopter was observed by the driver to strike the powerline that crossed the road (Figure 2), abruptly changing attitude before rotating as it fell to the left of its original direction of travel, and striking the ground adjacent to the road.

Figure 2: View of powerline overhead the road, looking about 044 degrees true



The three occupants of the helicopter were fatally injured and the helicopter was destroyed by impact forces and a post-impact, fuel-fed fire. There was no damage to the powerline or its associated facilities and structures.

3 That house was later determined to be to the east of the western boundary of the area that was nominated by the council to require 'closer attention'. The owner of that house advised the investigation that his house had not been overflown by a helicopter that morning, and that the first indication to him that there had been a helicopter in the area was when a fire truck arrived to take water from one of the property's dams for use at the accident site.

Personnel information

The pilot

The pilot was appropriately qualified to conduct the aerial work[4] flight. He had about 2,210 hours total flight experience in helicopters, over 1,100 hours in the helicopter type, and had flown about 10 hours in the occurrence helicopter in the previous 24 hours. In addition, the pilot had over 1,100 hours experience in low-level agricultural applications, held a Mustering Approval (helicopters) and an Agricultural Pilot (Helicopter) Rating Grade 1, and had been issued with an Operation Spray Safe Certificate of Approval by the Aerial Agricultural Association of Australia. A Biennial Flight Review was undertaken by the pilot on 4 November 2005, and he held a valid Class 1 Medical Certificate with no restrictions.

The pilot's Daily Flight Records indicated that:

- on 31 January, the pilot took off on the first flight of the day at 0630 and landed after his last flight for the day at 1555
- on 1 February, the pilot took off on the first flight of the day at 0735 and landed after his last flight at 1507.

A manager at the Dubbo Rural Lands Protection Board recalled socialising with the pilot and another friend on the evening of 1 February. The pilot was reported to have had dinner and to have consumed a small amount of alcohol before the manager left the group at about 2120. The manager indicated having later confirmed by telephone that the pilot had retired to his room by about 2140. The pilot was reported by the manager to have stated that he intended going to Dubbo aerodrome at 0700 on 2 February to fly to Parkes.

Family and friends reported that the pilot was fit and healthy. There was no evidence of any physiological condition that may have contributed to the accident.

Weeds control officers

Both of the weeds control officers were reported to have had minimal experience in the conduct of helicopter operations. In each case, that experience was limited to the conduct of a similar noxious weeds survey in mid-May 2005.

A family member advised the investigation that both weeds control officers most likely had an awareness of all noxious weeds outbreaks that were either accessible or observable from the roadside and/or fire trails. Each was reported to be in good health and well-rested on the day of the flight.

Each of the weeds control officers' families believed that the officers were aware of the powerline in the area of 'The Dungeons'. That understanding was later corroborated by council management.

---

4 Aerial spotting and surveying is defined in Civil Aviation Regulation (CAR) 206 as an operation conducted for aerial work purposes.

Helicopter information

Manufacturer	Bell Helicopter Co
Model	206B (III)
Serial number	1060
Registration	VH-MFI
Year of manufacture	1973
Aircraft Total Time in Service (TTIS)	13,615.4[5] hours, 4,866 cycles
Date of last maintenance	15 December 2005, 100-hourly inspection
Maintenance Release	Valid to 13,684.2 hours or 15 December 2006
Flying hours since the last maintenance	About 31 hours

Based on the evidence provided to the investigation, the helicopter was certified, equipped and maintained in accordance with the regulations and approved procedures. A review of the helicopter's maintenance documentation revealed no anomalies or inconsistencies that might have contributed to the accident.

At the time of the accident, the helicopter was not fitted with a wire-strike protection system[6], nor was it required to be by the extant aviation regulations. The utility of such a system has been examined previously in a number of Australian Transport Safety Bureau (ATSB) Aviation Safety Investigation Reports, most recently in report BO/200404590, which examined the accident involving Bell 206B helicopter, registration VH-JIV, at St Albans, NSW on 4 April 2006 (available at www.atsb.gov.au). Due to the large number of variables associated with wirestrike accidents, the effect that the fitment of such equipment may have had in this instance cannot be determined.

The operator indicated that the helicopter's front seats included full harness seat belts and that the rear seats had lap seat belts.

The weight and balance of the helicopter was estimated to be within the manufacturer's prescribed limits.

Powerline information

On-site information

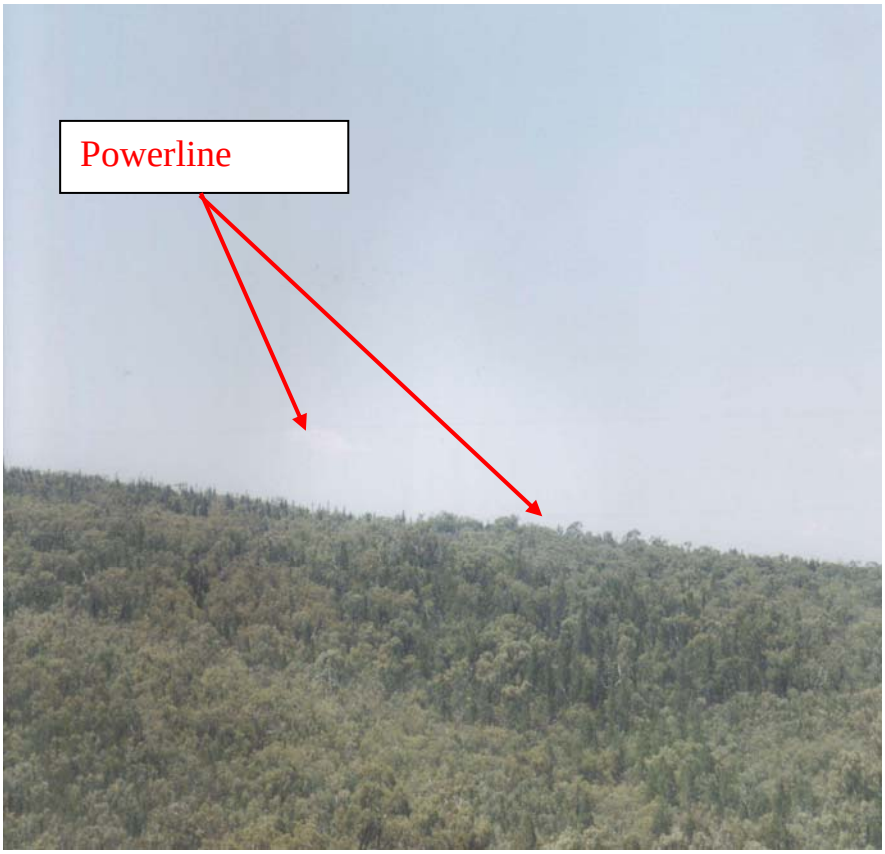
The powerline crossed overhead the road at a position about 33°10'S 148°24' E, on a bearing of about 280 degrees magnetic and included two cables, each consisting of 7-braided strands of 2 mm wire (Figure 3). The power supply company described the cables as being very strong, having a breaking load of 25 kN, and being under

5 The duration of the flight from Dubbo to Parkes on the morning of the accident, and of the accident flight could not be conclusively established.

6 Equipment installed on aircraft to reduce the lethality of an impact with power or other cables.

high tension. The maximum electrical power carried by the powerline was reported to be 22 kVA.

Figure 3: Pilot's view of the powerline from slightly below eye height[7]



There was no spike or surge of electricity recorded by the power supply company on the day of the accident. However, the company stated that that would only occur if the cables had broken and made contact with each other. The company inspected the power poles and cable joins after the accident and found no damage as a result of the wirestrike.

7 Photograph courtesy of New South Wales Police Force.

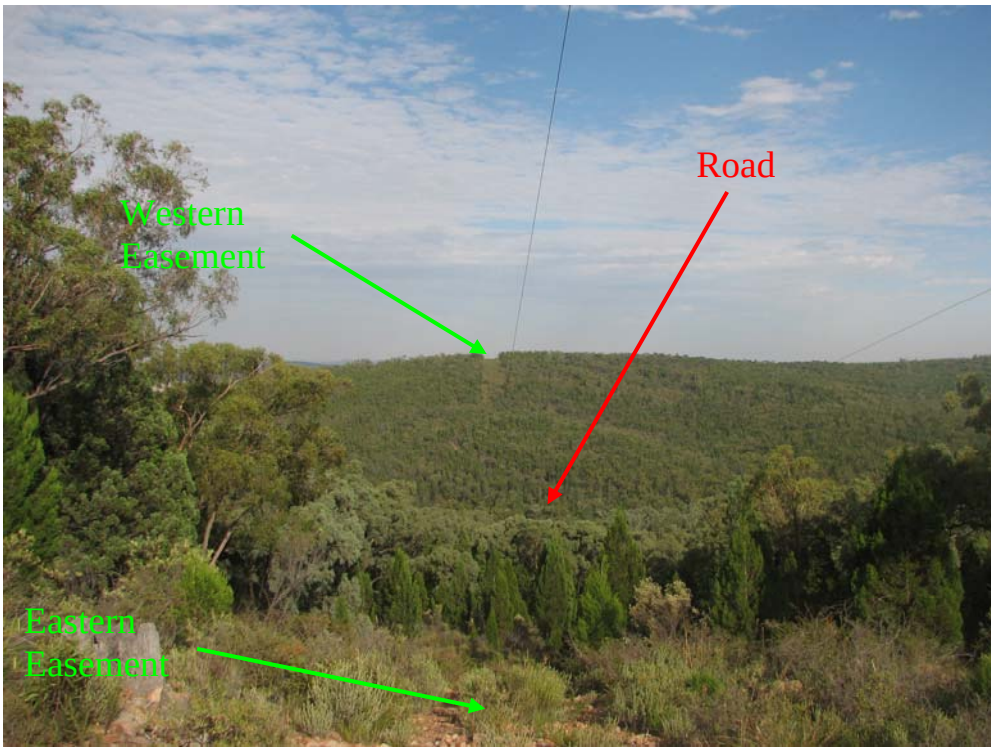
When surveyed after the accident, the pole structures at each end of the 1,260.1 m span were found to be 7.5 m apart (Figure 4). The surveyor determined that, at the then ambient temperature of 39°C:

- the sag of the two cables that constituted the powerline were at differing heights by about 2.5 m (8 ft)
- overhead the road, the cables were:
  - 7.9 m apart laterally
  - about 38.7 and 36.2 m (127 and 119 ft) AGL respectively.

Figure 4: View of the eastern power poles, looking west

The accident site was in a shallow valley that broadly ran at right angles to the powerline. The nature of the terrain was such that the access track (or easement) normally associated with the progress of a powerline through woodland ceased on the eastern and western ridgelines that formed the valley, and on which the powerline support pole structures were located (Figure 5).

Figure 5: East to west view of the power line



Requirement to mark powerlines

The requirements for the mapping and marking of powerlines and their supporting structures are published in Australian Standards AS 3891.1, 1991, Part 1, *Permanent marking of overhead cables and their supporting structures*, and AS 3891.2, 1992, Part 2, *Marking of overhead cables for low level flying*. The requirements of those standards were discussed in ATSB Aviation Safety Investigation Report BO/200404286 (available at www.atsb.gov.au), and include that, in general, there is no requirement for the marking of powerlines with a height above terrain or obstacles of less than 90 m.

The powerline that was struck by the helicopter did not require marking in accordance with either standard.

Meteorological information

The Parkes Terminal Area Forecast valid at the time of the flight indicated a forecast wind of 240 degrees true at 14 kts, visibility of greater than 10 km and few[8] clouds with a base of 4,500 ft above mean sea level (AMSL). The area forecast for the Parkes area indicated a wind at 2,000 ft (about 300 ft above the

8 Few meaning 1 to 2 oktas. An okta is the unit of measurement that is used to report the total sky area that is visible to the celestial horizon. One okta is equal to 1/8th of that visible sky area. The term okta is also used to forecast or report the amount of cloud in an area, along a route or at an airfield. The numbers of oktas of cloud are reported or forecast as follows: Few (FEW), meaning 1 to 2 oktas; Scattered (SCT), meaning 3 to 4 oktas; Broken (BKN), meaning 5 to 7 oktas, and Overcast (OVC), meaning 8 oktas.

height of the accident site) of 340 degrees true at 15 kts and scattered[8] cloud with a base of 5,000 ft on the ranges and western slopes.

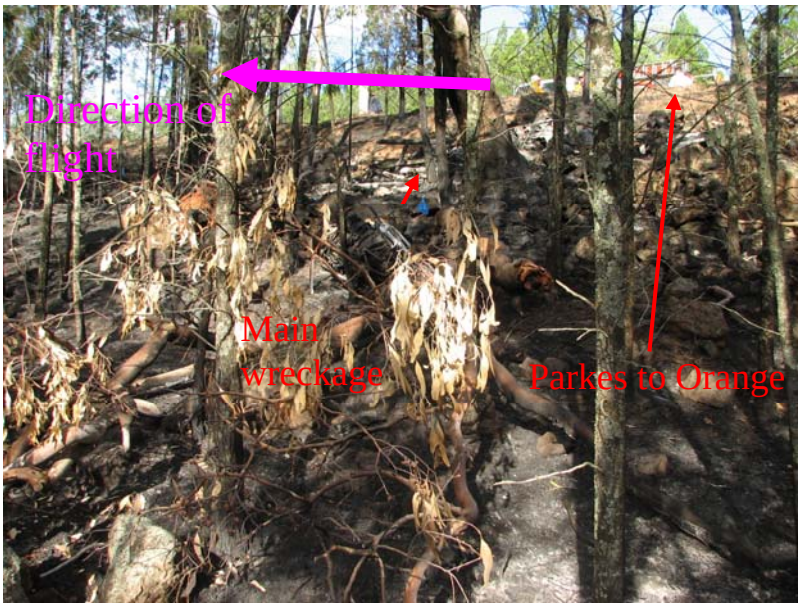
A witness who passed through 'The Dungeons' area immediately prior to the helicopter described the weather as being 'hot, sky clear, wind light north-north-wester'.

The position of the sun at the reported time of the accident was determined from the Geoscience Australia website. The sun's azimuth[9] at that time was 87°21'50" and its altitude[10] 36°07'21". Trigonometry was applied to those parameters, the helicopter's direction of flight as determined from the wreckage distribution (see Figure 8), and the helicopter's estimated height as reported by witnesses, in an effort to determine the potential for the sun to have adversely affected the ability of the occupants to identify the powerline. That examination determined that the sun would have been about 66 degrees to the right of the helicopter's direction of flight as it approached the powerline, and that the helicopter and powerline would most likely have been in full sun.

Wreckage information

The accident site spanned the Parkes to Orange road about 15 km east of Parkes Aerodrome. The terrain at the site broadly sloped from right to left to the direction of flight, at about 20 to 30 degrees down to the horizon. Numerous rocks and large trees surrounded the site (Figure 6).

Figure 6: Terrain and surrounds at the accident site



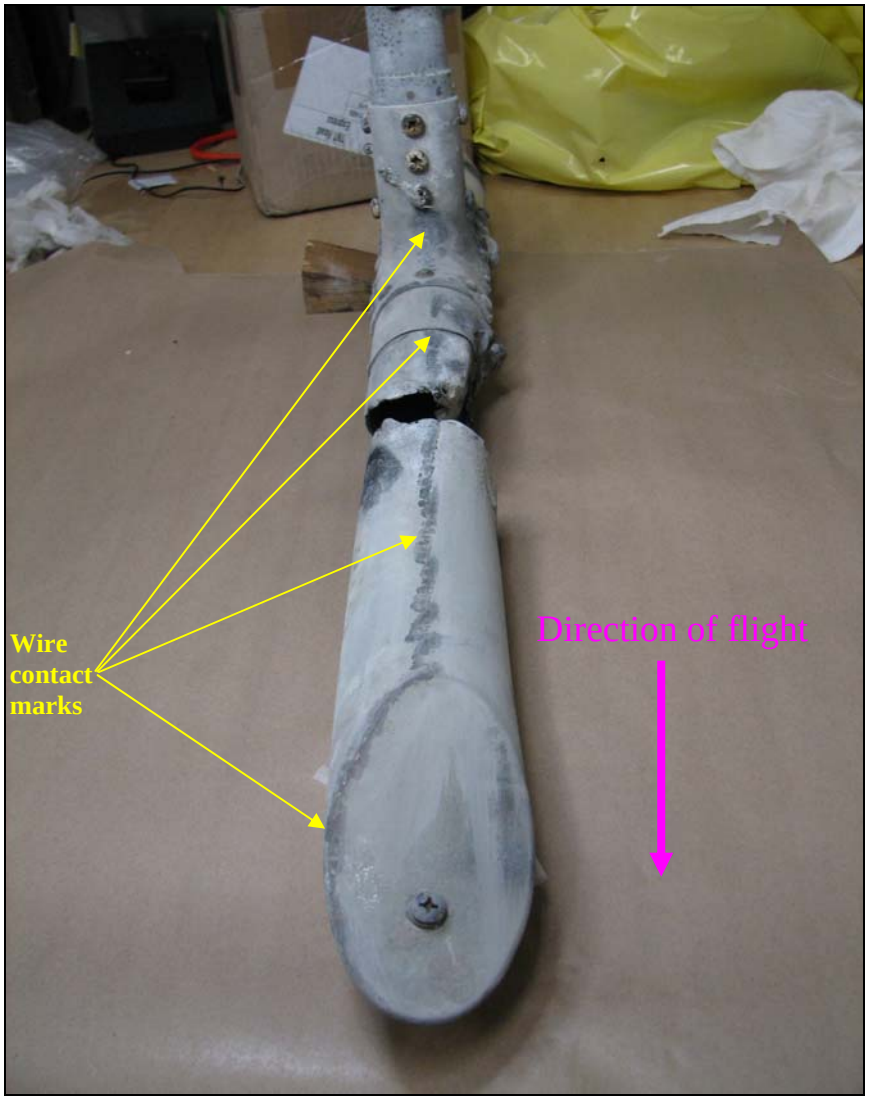
Witness reports and impact markings on the forward upper surface of the helicopter's left landing gear skid and the junction of that skid with the left forward skid landing gear crosstube (Figure 7), were consistent with the helicopter striking

9 The clockwise horizontal angle from the sun to true north, measured in degrees, minutes and seconds.

10 The vertical angle to the sun from an ideal horizon, measured in degrees, minutes and seconds.

the powerline that crossed the direction of flight about 88 m back along the direction of flight. No similar marking was identified on the helicopter's right skid landing gear, or elsewhere on the remaining wreckage.

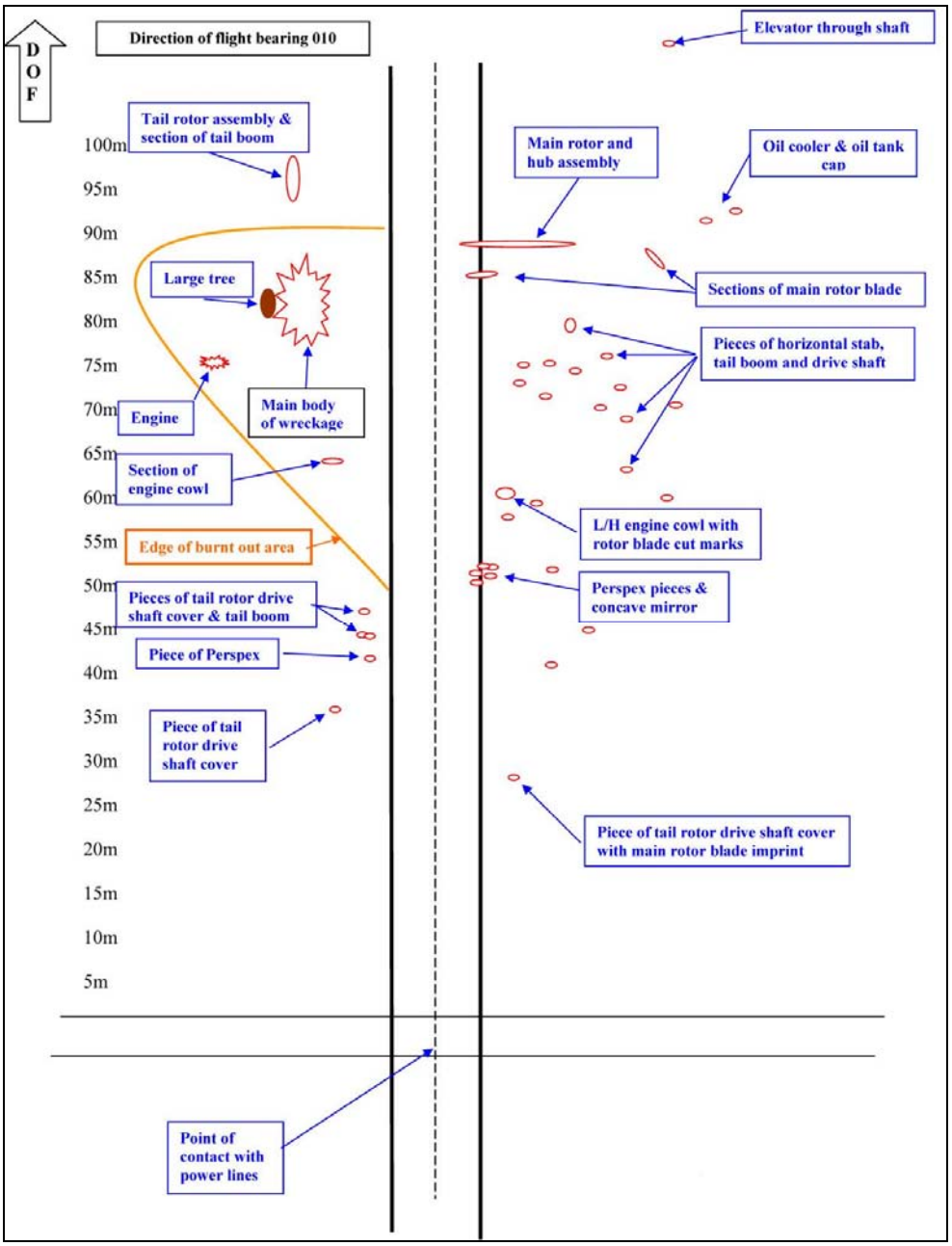
Figure 7: Wire contact markings on the left landing gear skid and crosstube



The wreckage of the helicopter was spread over about 120 m in the direction of flight (Figure 8). The main rotor and hub assembly, and a number of smaller items were located to the east of the Parkes to Orange road, and the remainder of the helicopter was located to the west of the road.

Trajectory analysis that was conducted by the investigation after the accident indicated that, when the helicopter struck the powerline, it was travelling at an estimated 61 kts.

Figure 8: Diagram of the accident site



The main body of the wreckage was found inverted, about 5 m down a steep embankment from the road (Figure 6). The engine assembly had separated from its fuselage mounting points and came to rest a further 5 m down the embankment from the main wreckage. A severe post-impact fire consumed the majority of the helicopter's fuselage.

The main rotor mast fractured in overload at the main rotor mast bump stops, consistent with forces associated with the impact sequence. The main rotor and hub assembly came to rest 15 m from the main body of the wreckage. All parts of the main rotor blades were accounted for within 10 m of the main rotor hub. The tail rotor assembly, a section of the tail boom and the vertical fin came to rest about 15 m beyond the main wreckage, along the direction of flight.

Examination of the engine indicated that it was producing power at the point of impact with the ground.

The digital movie camera that was reported by council management to have been onboard the helicopter for the survey (see page 15) was not identified amongst the wreckage.

Medical and pathological information

A review of the pilot's aviation-related medical records and the results of the pilot's post-mortem examination found no evidence of any pre-existing medical disease, sudden illness or incapacitation that may have affected his ability to control the helicopter.

Organisational information

Regulatory framework

CAR 206 lists aerial spotting and surveying and agricultural operations as operations conducted for aerial work purposes. Agricultural operations are defined as:

> …the broadcasting of chemicals, seeds, fertilizers and other substances from aircraft for agricultural purposes of pest and disease control.

The Civil Aviation Safety Authority (CASA) issued an Air Operator's Certificate to the operator on 6 July 2005 that authorised the conduct of charter and aerial work operations by the company. That certificate specified those authorised operations in relation to the aircraft intended for use, and the type of operation. The certificate was due to expire on 31 July 2008.

In accordance with CAR 157, flight is authorised below 500 ft when clear of any city, town or populous area and the aircraft is conducting aerial work operations that:

> …require low flying, and the owner or operator of the aircraft has received from CASA either a general permit for all flights or a specific permit for the particular flight to be made at a lower height while engaged in such operations;…

Pilot competencies affecting the conduct of low-level operations

The Day (VFR) Syllabus Helicopters[11] supports the various helicopter pilot licences. A limited exposure of all prospective pilots to low-level operations and the associated hazards is achieved via the content of that syllabus.

Agricultural and aerial stock mustering operations are common aerial work activities that are routinely carried out in the low-level environment, below 500 ft AGL. The relevant ratings and approvals affecting the conduct of agricultural

11 Issue 2.0 – Effective 1 June 2004.

operations and aerial stock mustering in helicopters were highlighted in ATSB Aviation Safety Investigation Report BO/200404285. Broadly, the requirements of those ratings and approvals included:

- **Agricultural pilot rating.** Civil Aviation Order (CAO) 40.6 requires that, in order to gain an agricultural rating, a pilot must satisfactorily complete a period of ground training, before carrying out initial and operational flying training. A period of supervised flying follows that training, before an agricultural pilot is authorised to carry out unsupervised agricultural operations. Experience requirements are stipulated as a Grade 2 agricultural pilot, before a pilot can progress to becoming a Grade 1 agricultural pilot.
- **Mustering approval.** Aerial stock mustering is defined in CAO 29.10 as 'the use of aircraft to locate, direct and concentrate livestock whilst flying below 500 feet above ground level'. The aeronautical experience requirements for a pilot to engage in mustering operations include that the pilot must complete 5 hours low flying training[12] and an exam to confirm pilot proficiency, followed by 10 hours operational training.

A more in-depth review of the aeronautical knowledge and experience requirements associated with the Day (VFR) Syllabus Helicopters, and of the additional requirements of CAOs 40.6 and 29.10 with the potential to influence the ability of agricultural and mustering helicopter pilots to identify and avoid wires and other low-level hazards is at Appendix A.

Other than those affecting the conduct of agricultural and mustering operations, or the competencies inherent in the award of the various levels of helicopter pilots' licences, there are presently no aeronautical knowledge, aeronautical experience or supervisory requirements stipulated in the regulations that specifically affect the conduct of aerial work below 500 ft AGL. That includes the conduct of spotting/surveillance operations, such as in this occurrence.

Operator management of the spotting/survey requirement

General

The operator held an Approval to conduct Low Flying Instrument that was issued by CASA and authorised aerial work operations below a height of 500 ft AGL, but not less than 50 ft AGL. The instrument applied to all of the operator's suitably-qualified flight crew members, and stipulated that any low-level operations were to be conducted in accordance with the operator's operations manual. That manual included the potential conduct of aerial spotting and surveillance operations, and the following requirements affecting the conduct of those operations:

> Spotting and survey operations may be conducted down to a minimum height of 50 ft above the surface of the ground.

12 Including: avoidance of obstacles; aerial reconnaissance and operational planning; and the effect of obstacles on operational procedures.

In addition, the operations manual stated that, before acting as pilot in command of an aircraft being operated in accordance with a Low Flying Permit below 500 ft over land, pilots were to have:

- successfully completed a course of low-flying training in accordance with the low flying syllabus included in CAO 29.10 Appendix 1
- complied with the company's pilot experiential requirements that affected the conduct of charter operations under the visual flight rules (VFR).

In order to obtain his mustering approval, the pilot completed the low-flying training requirements of Appendix 1 to CAO 29.10. The pilot complied with the operator's experiential requirements for the conduct of charter operations under the VFR.

Preparation for aerial spotting/surveillance operations

Prior to the commencement of a particular aerial spotting or survey operation, the operations manual required the Chief Pilot to carry out a briefing with the pilot in command for that operation. That briefing was required to include:

- Confirmation of the Survey/Spotting area boundaries.
- Location and description of known hazards/obstacles.

The Chief Pilot indicated that it was not always possible to satisfy that briefing requirement. In that case, the Chief Pilot relied on his prior knowledge of a pilot's background and ability, and that the pilot had conducted similar work previously. The Chief Pilot stated that, as a result of the fluid nature of the company's work, and of the geographic dispersion of its assets and operations, it could be difficult to know the precise boundaries and hazards that might affect an operation.

In regard to the Parkes operation, the Chief Pilot stated that the pilot had organised and accepted that operation as a result of direct liaison with the council while in Dubbo on a similar operation. The Chief Pilot's understanding was that the requirement for the noxious weeds survey in the Parkes area had been an opportunistic development, based largely on the pilot's standing with the various councils' weeds control personnel as a result of his work in the Dubbo area, and the reported high calibre of the pilot's work.

In general, the Chief Pilot reported that he attempted to maintain an overview of each company operation. However, he stressed the importance for a pilot to interact with the customer in preparation for an operation, including that the individual pilot should:

- discuss the fine definition of an operation's boundaries with the customer, including with any observers or other customer's staff that were planned to be involved in a flight
- encourage a two-way exchange of information about the intended area of operation, including of any known hazards or obstacles in the area of operation
- involve any intended observers in the identification and reporting of observed hazards and obstacles once airborne.

The Chief Pilot advised that he did not specifically discuss the Parkes operation with the pilot prior to its commencement. In addition, whereas he had a general

knowledge of the Parkes area, he had no specific understanding of the actual area to be surveyed by the pilot.

Noxious weeds spotting/surveillance profile

The Chief Pilot reported that, unless an individual pilot knew the area to be surveyed well, the survey area was identified and carefully considered with the customer's observers before commencing the actual survey. In addition, the operator advised that survey area boundaries can be ill-defined and are frequently subject to in-flight amendment. That was reported to depend on the growth pattern of the vegetation encountered during the survey flight.

The Chief Pilot related the understanding that the pilot did not know the Parkes eastern border area well.

In an unknown area, the Chief Pilot expected that a pilot would carry out a higher-level pass over the intended survey area, in order to identify any powerlines or other relevant obstacles and areas of habitation to be avoided. Once that higher-level examination was completed, a pilot would descend to low level for a second pass in an effort to identify any obstacles or hazards, or to commence the intended task.

The operator added that, if there was a requirement to commence a survey at a particular height at the boundary of a survey area, then it would be normal to descend to that height shortly before reaching the boundary. In that case, the operator reported that a pilot would 'walk back' the boundary, and examine the expanded area for wires and other obstacles before descending to the survey height.

The height of a survey was reported to depend on a number of factors, including the nature of the terrain, and the amount and type of vegetation.

Although there was insufficient information available for the Chief Pilot to be able to conclusively state the pilot's actual activity when he struck the powerline, the Chief Pilot felt that it may have been after the commencement of the survey. That assessment was based on the Chief Pilot's:

- understanding from other sources that the pilot was reported to have carried out an earlier higher-level pass over the area
- observation that the powerline that was struck by the helicopter was at about the height at which the Chief Pilot himself might have conducted the survey.

The Chief Pilot indicated that the speed flown during a survey was dependent on a number of factors, including the nature of the terrain and of any vegetation, and the requirements of the onboard observers. That was, if the terrain was open and lightly-timbered, the speed flown during a portion of a survey might be increased until encountering more complex or heavily-timbered terrain. Similarly, there could be instances where the onboard observers had an intimate knowledge of an area, and would request a pilot to vary the helicopter's speed commensurate with that prior local knowledge. In general, however, the Chief Pilot reported that, in his experience, the survey speed could vary from 20 to 40, perhaps 45 kts. At times that speed could be increased to 50 kts.

Council management of the noxious weeds spotting/surveillance requirement

Background

The council's prior experience in the management of helicopter operations was restricted to the conduct in mid-May 2005 of a similar noxious weeds survey. That survey was reported to have been conducted in the same area as the February 2006 survey, but with a different helicopter services provider. The aim of the 2006 survey was to:

- determine the effectiveness of the council's noxious weeds control program
- identify any new weed infestations to those identified during the May 2005 survey.

Given the nature of the hilly and, at times, heavily-wooded eastern border area (Figure 1), the council believed that the use of a helicopter in support of the surveys offered the most efficient and effective means to satisfy the council's objectives.

During the May 2005 survey, the helicopter services provider restricted the operation to not below 500 ft AGL. In response, the council purchased a zoom-capable digital movie camera, in order to identify and record any outbreaks of the targeted African Boxthorn and Blackberry bush from that minimum height. Council management reported that the digital movie camera had been found to not be necessary during the May 2005 survey, and that the clumps of African Boxthorn and Blackberry bush had proven easy to identify from the air, and stood out from the general background.

Council management indicated that the digital movie camera was also planned to be carried by the weeds control officers during the 2006 survey.

Preparation for the February 2006 spotting/surveillance requirement

There was no specific tender process applied to the selection of the helicopter services providers for either of the May 2005 or February 2006 surveys. In each case, the provider was broadly selected on the basis of:

- their reported experience in the conduct of such operations
- recommendations from other councils' noxious weeds control staff
- an acceptable price for the hire of the helicopter and pilot.

In the case of the decision to use the operator for the 2006 survey, one of the weeds control officers identified the operator as being experienced and reputable in the conduct of noxious weeds surveys. That assessment was reported to be on the basis of:

- research by that officer regarding the proposed operator
- the officer's knowledge of the pilot, and that he had conducted similar surveys for a number of the other councils in the area
- his discussions with other councils' noxious weeds officers at a noxious weeds conference that was conducted in Orange in 2005.

The council received an acceptable hourly rate for the provision of the helicopter and pilot, and verbally-agreed to the provision of the services by the operator. Council management stated that, during the 0900 telephone call from the aerodrome, the weeds control officer requested his supervisor to complete the relevant order for goods and services that would formalise the verbal arrangement with the operator. The supervisor was unable to complete that order until later that afternoon.

Council management's understanding was that the February 2006 survey would not descend below 330 ft AGL. There was no formal risk assessment carried out by management prior to the survey. However, council indicated that, from a management perspective, the council's risk controls included that:

- the survey was expected to not be flown at lower than 330 ft, which was reported to have been the result of direct discussions with the weeds control officers
- that height was believed to be 'well above the height of any powerlines', effectively eliminating the risk of a wirestrike
- the work would be undertaken by an experienced helicopter company and pilot.

However, council management indicated that the weeds control officer that planned and organised the survey had been the prime advocate for the aerial inspections and, '…in that regard, [the weed control officers] had quite a lot of autonomy to do their inspections'. In a later written statement, the weeds control officers' supervisor and the supervisor's manager noted that:

> Once the helicopter is in the air, the pilot was in control of the helicopter and responsible for adhering to the relevant regulations. [The weeds control officer that planned and organised the survey] would have requested what areas to go to and possibly asked to fly lower as required, in accordance with the flying threshold [of 330 ft]. However, the pilot always had the final element of control.

The ability of the weeds control officers to vary the height of the survey appeared to be corroborated by a statement by a grounds person at the Parkes Aerodrome who had spoken with the weeds control officer who arranged the survey about 1 week prior to the survey. In that statement, the grounds person indicated that, during their conversation, the weeds control officer informed him that:

> …when they went up they would not be going below 300 feet which will be good but if we needed to go down and have a look we will but then would be straight back up again.

No documentation was available to confirm the minimum height applicable to the survey, other than the operator's Approval to conduct Low Flying Instrument.

The council felt assured that the weeds control officer that recommended the operator for the survey would have essentially followed the council's 'Engaging of Contractors' procedure when assessing the operator's capability for the survey. That procedure:

> …specifically applies to Contractors used by Council's Operations Department and involves the process and documents required to be submitted before a Contractor can begin working.

In terms of the consideration of prospective operators' and pilots' approvals, licences, endorsements, low-flying approvals, and so on that might have proven relevant to the conduct of an aerial survey operation, that procedure included no aviation-specific requirements or guidance. The council relied on a verbal assurance from the weeds control officer that recommended the operator, that the company and pilot were appropriate for the survey, and that an induction/risk assessment for the survey would be carried out prior to the initial takeoff. There was no documentary evidence that that had been the case; council indicated that such documentation may have been onboard the helicopter with the observer and been destroyed in the post-impact fire.

Council managers believed from discussions with staff at the Parkes Aerodrome that, prior to the takeoff, the pilot spent 30 to 45 minutes 'checking over the helicopter' before another 35 to 45 minute discussion with the council weeds control officers. The council management assumed that must have included the conduct of an induction/risk assessment briefing. Given that all onboard were fatally injured, that no-one else attended the pre-flight briefing, and the lack of any documentary evidence regarding the conduct of the survey, the investigation could not determine whether or how any briefing might have changed the conduct, minimum height, etc of the flight.

Council management indicated that they had no prior knowledge that the operator's pilots were authorised to fly at 50 ft AGL. There was no attempt recorded by the council to contact the local power supply company in order to identify or chart the known powerlines or other potential low-level hazards in the eastern border area prior to the survey.

Additional information

Council intention for the conduct of the survey

One of the council's managers indicated that the survey was to be conducted in the eastern border area of the council's area of responsibility. That was defined as the area to the east of a north to south line that passed through Lake Endeavour (Figure 1). The survey was planned to be conducted in a general south to north direction, before progressing to the north-west along the Bogan River.

Despite the intended survey area being declared as east of Lake Endeavour, the council's understanding of whether the helicopter was within the intended survey area when it struck the powerline was inconsistent. In one instance, the weeds control officers' supervisor indicated that, although not east of the western boundary of the survey area, the helicopter would have surveyed the Bumberry

Ridges area, as it was 'sort of in their area of operation'. In another instance, council management indicated that:

- council was unaware of any reason for the helicopter to have been so low at the site of the accident
- council had no knowledge of any noxious weeds in the vicinity of the accident site
- the observers could have easily confirmed the lack of any weeds in the area of the accident from a greater height.

Later, council management indicated that the survey area was 'defined by the entire flight', and that the flight would have targeted 'rugged or less accessible area[s] during the trip from the airport'. Management stated that the area to the east of the 'arbitrary' north to south line through Lake Endeavour was intended for 'closer attention' or 'closer survey work', but not below 330 ft AGL. That appeared to contrast with another council statement that 'the survey area was not strictly defined by the arbitrary line described by Council's management'. In either case, council noted that:

> While it [the accident site] was marginally outside the above arbitrary line [through Lake Endeavour] it was not in anyway "wildly" remote from where it [the helicopter] should have been as indicated by management, particularly given the exploratory nature of weed inspections.

The precise locations to be inspected were felt by council management to be 'reliant on the expertise of the weeds control officers and the level and nature of weed infestations identified during the aerial work'.

As discussed previously, the survey operation was an opportunistic operation that was arranged on behalf of the operator by the pilot. The operator's Chief Pilot was unable to confirm the precise boundaries affecting the conduct of that operation.

Pre-flight preparation – identification of powerlines and other low-level hazards

Pre-flight availability of powerline information

The responsibilities of a pilot in command of an aircraft are listed in CAR 224 and include the operation and safety of the aircraft and crew members and/or persons carried during a flight. CAR 233 requires pilots to take action to ensure that, prior to commencing a flight:

> (h) the latest aeronautical maps, charts and other aeronautical information and instructions, published in AIP [Aeronautical Information Publication] or by a person approved in writing that are applicable:
>
> (i) to the route to be flown; and
>
> (ii) to any alternative route that may be flown on that flight;
>
> are carried in the aircraft and are readily accessible to the flight crew.

Discussions with Commonwealth and NSW Government mapping agencies indicated that the decision of whether, and on which scale of map or chart a powerline is marked includes the consideration of the magnitude of the electrical

power carried by that powerline. In general, the electrical power carried by a powerline has the effect that:

- a powerline carrying 110 kVA would be shown on a 1:250,000 scale map
- a powerline carrying 66 kVA would be shown on a 1:50,000 scale map
- a powerline carrying 33 kVA would be shown on a 1:25,000 scale map.

The powerline that was struck by the helicopter was not marked on any aviation or other map or chart that might be expected to be normally accessed by a pilot. The Parkes office of the power supply company retained a schematic representation of its known infrastructure (Figure 9). That representation did not include a scale, or either an indication of the latitude and longitude or of a grid reference system for application when using the schematic.

Figure 9: Power supply schematic[13] (indicating the approximate position of the powerline)

Prior to being used by the pilot, it would have been necessary for the pilot to have transposed the 381 known powerlines in the survey area from the power supply company's schematic chart onto a suitable topographic chart.

Potential additional sources of pre-flight powerline information

A number of recent ATSB Aviation Safety Investigation Reports have determined that there is presently no single source of information available to pilots on the location of known powerlines or tall structures that might represent a hazard to low-level operations.

13 Reproduced with the permission of Country Energy.

However, a number of potential sources of that information have been identified by those investigations as follows (all reports are available for download at www.atsb.gov.au):

- **Investigation BO/200404285, Bell Helicopter Co Jetranger, registration VH-JVW that occurred at Forbes, NSW on 30 October 2004.** In that case, the power supply company indicated that it had digitally-mapped its infrastructure and would, with stipulated provisos, have no in-principle difficulty providing that information for use by pilots. However, the company did caution that national security concerns could impact on the free use of that information.
- **Investigation BO/200601663, Bell Helicopter Co 206B (III), registration VH-JIV that occurred at St Albans, NSW on 4 April 2006.** That accident involved the conduct of a powerline survey when the helicopter struck an unrelated, single-strand telecommunication cable support wire. The following potential sources of information regarding the location of powerlines, cables and other potential low-level hazards were identified during that investigation:
  - **Power supply company.** The power supply company affected by the wirestrike at St Albans was unrelated to that involved at Forbes. However, as in the case of the Forbes power supply company, that company also indicated that it had digitally-mapped its infrastructure and, given the relevant legal and other protections, felt that there would be no problem releasing that data for use by pilots during their planning for low-level operations.
  - **Telephone company.** The telephone company that owned the single-strand telecommunication support wire indicated that the capability existed for parties to contact its 'Dial Before You Dig' service in order to obtain information on the location of its known overhead wires. The company cautioned however that information on its overhead infrastructure was not always available, or might be incomplete, or that, because of the relative visibility of its overhead structures compared to its underground structures, the same level of detail might not be available.

It was identified during this investigation that information on certain 'tall structures' is also required to be reported to the Royal Australian Air Force (RAAF) Aeronautical Information Service (AIS).

Reporting of tall structures

The requirements for the reporting of tall structures are outlined in CASA Advisory Circular (AC) AC 139-08(0)[14]. ACs provide advice and guidance to interested parties regarding a means by which those parties might comply with the relevant regulations, or explain or simplify certain regulatory requirements. They do not necessarily provide interested parties with the only means for compliance.

Information on known tall structures is maintained in a central database by the RAAF AIS. That information can be provided to a number of aviation organisations to facilitate the structures' identification on aeronautical charts.

---

14 AC 139-08(0) was the first AC to be issued on that subject, but its content updated that previously published in Civil Aviation Advisory Publication CAAP 89W-2(0).

The AC suggests that the following tall structures should be reported to the RAAF AIS for inclusion in that unit's database:

- within 30 km of an aerodrome, all structures with a height of 30 m or more AGL
- elsewhere, all structures with a height of 45 m or more AGL.

A number of regulations affect the requirement to report tall structures. Civil Aviation Safety Regulation (CASR) 139.360 requires any development or construction proposal in the vicinity of an aerodrome with the potential to be a hazard to air navigation to be reported. The *Airports (Protection of Airspace) Regulations 1996* apply in the vicinity of major capital city airports, and require the airport operator to report any potential infringement of that aerodrome's prescribed airspace to the Department of Transport and Regional Services. Finally, in areas remote from an aerodrome, CASR 139.365 requires the reporting of structures, or proposed structures that are, or will be 110 m or greater AGL.

The AC recognises the utility of the collected information to pilots, including during the conduct of specialist low-level operations such as agricultural, pipeline inspection, fire-fighting and search and rescue operations. However, aside from the possible inclusion of the reported structures on maps and charts, there is no general access to the information available for use by pilots.

Risk management and low-level operations

Supporting definitions

Australian/New Zealand Standard AS/NZS 4360:2004 *Risk Management* (the Standard) defines a hazard as 'a source of potential harm'. Risk is defined as:

> The chance of something happening that will have an impact on objectives
>
> NOTE 1: A risk is often specified in terms of an event or circumstance and the consequences that may flow from it
>
> NOTE 2: Risk is measured in terms of a combination of the consequences of an event…and their likelihood…
>
> NOTE 3: Risk may have a positive or negative impact…

The Standard defines risk management as:

> the culture, processes and structures that are directed towards realizing potential opportunities whilst managing adverse effects

and the risk management process as:

> the systematic application of management policies, procedures and practices to the tasks of communicating, establishing the context, identifying, analysing, evaluating, treating, monitoring and reviewing **risk**…

Relevant elements of the risk management process

Communication and consultation are important elements for application throughout any risk management process. An inclusive, consultative[15] approach that involves all stakeholders ensures the proper development of the context of the risk management process. The involvement of all stakeholders ensures the 'ownership of [identified] risks by managers' at appropriate management levels.

The risk management method includes that, initially, the basic parameters or 'context' affecting the assessment of risk should be identified. That can include 'defining the extent of the project activity or function in terms of time and location'. The Standard identifies that 'an important aspect of "establishing the context" is to identify stakeholders and seek and consider their needs'.

The weeds control officers' supervisor reported that there was no specific contact with the operator by council management prior to the accident.

The Standard identifies the following options for modifying or treating identified risks that may present negative outcomes:

- to avoid or eliminate the risk altogether which, although removing a potential source of harm, may also preclude an opportunity
- influencing the likelihood of a risk, in order to reduce the probability of a negative outcome
- changing the consequence(s) of an event to minimise the extent of any losses
- a combination of risk reduction strategies.

Residual risk is that 'risk remaining after implementation of risk treatment'.

Application of risk management to low-level operations

A number of ATSB Aviation Safety Investigation wirestrike reports have examined the application of elements of the risk management process to low-level operations (all reports available for download at www.atsb.gov.au):

- **Investigation BO/200402669, Bell Helicopter Co 47G-3B1, registration VH-RTK that occurred 12 km west of Wodonga, Vic., on 19 June 2004.** That investigation highlighted the importance of confirming the 'context' of any risk management process. The election by the pilot in that case to return to the replenishment point for the operation via a route that had not been previously surveyed for wires meant that the pilot had unwittingly altered the context on which the operation's risk assessment had been based. That action increased the risk that a wirestrike might occur.
- **Investigation BO/200404285, Bell Helicopter Co Jetranger, registration VH-JVW that occurred at Forbes, NSW on 30 October 2004.** Risk management options for application during a low-level airborne operation, including reducing the risk of a wirestrike, were examined as part of that

15 Described in the Standard as 'a process of informed communication between [an] organisation and its stakeholders on an issue prior to making a decision or determining a direction on a particular issue.'

investigation. Those options included reducing the:

- consequence of an adverse event, including by the use of helmets[16] and full-cover clothing by aircraft occupants and, where possible, the installation of wire-strike protection systems
- likelihood of an adverse event.

The report identified that, as the consequence of an aircraft striking a powerline can generally be expected to be catastrophic, a large investment is made by participating parties in order to reduce the likelihood, and therefore risk of a wirestrike.

- **Investigation BO/200601663, Bell Helicopter Co 206B (III), registration VH-JIV that occurred at St Albans, NSW on 4 April 2006.** In terms of reducing the likelihood of a wirestrike, that report discussed the importance of the low-level aircraft pilot and crew identifying, and then avoiding, any powerlines or wires in the area of operation. The factors with the potential to influence the visibility, and therefore subsequent avoidance of powerlines and wires included the:
  - pilot and crew's prior knowledge of the location of any powerlines
  - presence and visibility of any supporting structure(s)
  - diameter and make-up (or alloy) of the wire
  - nature and visible background to the wire; ambient light, in terms of its angle and intensity; and the presence or influence of any illusions.

  The report noted the adverse impact on a crew's ability to locate a powerline or wire of the obscuration of any support structures, and the nature of the environmental backdrop.

Proposed low-level flight crew licensing requirements – CASR Part 61

CASR Part 61 is being developed by CASA for implementation no earlier than the middle of 2008,[17] and will prescribe the:

> requirements and standards for the issue of flight crew licenses, ratings and other authorisations, including those issued to pilots and flight engineers.

CASA intends that Part 61 will affect existing and future license holders, training organisations and their staff and students, and aircraft operators. Included in the key proposals is the creation of a number of Operational Ratings, including a low-level[18] rating. The aim of the proposed low-level rating is to 'provide a pilot with low flying skills to enable safe operations at low level'. It will ensure a qualification

16 The operator that was involved in the Parkes accident advised that all company pilots wore helmets.

17 CASR Part Development: Project Status Report, Regulatory Development Management – 12 March 2007 cautioned that the project was on track, but that there was the potential for slippage. On 18 July 2007, CASA advised that Part 61 will not be available until mid-2008 at the earliest.

18 Also termed the 'low flying rating' in the CASA developmental documentation.

for pilots that conduct a number of low-level operations, exclusive of those covered by the existing agricultural ratings and stock mustering approval. That includes pilots conducting aerial survey operations.

In addition, CASR Part 61 proposes to establish a number of low-level endorsements that will authorise related activities in the respective categories of aircraft. Included, is the creation of a low-level helicopter endorsement.

A Manual of Standards (MOS) – Pilot Licensing will support the creation of the various licences, ratings and authorisations defined under Part 61, and will specify the competency-based standards for the award of the relevant licences, ratings or authorisations. As at 12 March 2007, the available information from the CASA website indicated that the MOS was 'being prepared and circulated for consideration/comments.'

The privileges, conditions and requirements for the award of the proposed low-level rating and helicopter endorsement, and flight review proposals are examined at Appendix B.

Contemporary information on the hazards of operating in the low-level environment

Efforts by the aviation industry

A large amount of information regarding the nature, identification and avoidance of low-level hazards, including powerlines, continues to be promulgated throughout the aviation industry via a number of publications, articles and seminars. That investment reflects the recognition by industry of the hazards associated with low-level operations, and the commensurate efforts by the industry to minimise their impact on those operations, particularly the incidence of wirestrikes.

Several of the incentives undertaken by the aviation and related industries to heighten pilots' and other involved persons' awareness of low-level hazards, and to reduce the incidence of wirestrikes, have been highlighted in a number of recent ATSB Aviation Safety Investigation Reports:

- **Investigation BO/200404285, Bell Helicopter Co Jetranger, registration VH-JVW that occurred at Forbes, NSW on 30 October 2004.** As a result of that investigation, CASA convened a round table discussion on 31 January 2005 to consider possible safety activities affecting aerial work in proximity to powerlines. Initial planning was commenced by CASA for a follow-on conference to be held in September 2005, involving relevant industry associations and other bodies and affected Government departments and agencies. The aim was to progress the consideration of the safety activities that were identified at the January discussion. However, due to funding constraints and other financial difficulties identified by the prospective attendees, the follow-on conference was unable to be progressed further.
- **Investigation BO/200601663, Bell Helicopter Co 206B (III), registration VH-JIV that occurred at St Albans, NSW on 4 April 2006.** In response to that investigation, extensive safety action was taken by the involved power supply company. That included the development of an Industry Forum that was held on 18 August 2006, and was attended by other power supply companies and industry bodies from throughout Australia. The power supply company

presented the lessons learned from the St Albans accident, and encouraged the establishment of industry standards and a uniform approach to the conduct of the aerial surveillance/inspection of powerlines.

In addition, the power supply company that was involved in this investigation indicated its ability and willingness to offer seminar-based briefings to pilots and other personnel involved in low-level operations regarding the risks of operating in the low-level environment.

Similarly, in mid-2006, a NSW operator, supported by the Helicopter Association of Australia sponsored a roving 1-day course that discussed the human, environmental, engineering and structural factors and risks affecting flight in the low-level environment. That course sought to build on pilots' and other personnel that were involved in low-level operations existing skills and knowledge in those areas.

Finally, a number of recent articles in the CASA *Flight Safety Australia* magazine have attempted to enhance pilots' awareness of the hazards of operating in the low-level environment, most recently including in the:

- November-December 2005 issue, in which the article 'One Strike and You're Out' examined the risks of flying near wires and discussed the difficulties of locating and avoiding powerlines.
- November-December 2006 issue, in which the article 'Watch Out for Wires' examined how agricultural pilots managed the risk of a wirestrike during low-level operations.

There was no permanent source of information available to pilots that reflected the available contemporary knowledge on the nature, identification and avoidance of low-level hazards, including powerlines. That included a lack of guidance in respect of possible risk management strategies available to pilots and other involved parties when planning for, and/or embarking on a low-level operation.

Utility of a Civil Aviation Advisory Publication/Advisory Circular in order to provide guidance and information

A Civil Aviation Advisory Publications (CAAP) and Advisory Circulars (AC) represent two of the tools with which CASA can provide guidance information to pilots and other aviation personnel on a designated subject area. Alternately, a CAAP/AC can describe acceptable methods of complying with related regulations. CAAPs/ACs are advisory only, and take care to illustrate a recommended method, or methods for legislative compliance, rather than the only method. In addition, CAAPs/ACs can be used to enhance understanding of identified requirements by relating interpretive or explanatory guidance to the reader.

For example, CAAP 155-1(0) – *Aerobatics* was written in response to the rate of fatal accidents experienced during aerobatic flight. Specifically, CAAP 155-1(0) was written:

- To provide information and guidance on safety issues related to aerobatic flight
- To clarify rules relating to aerobatic flight
- To provide information on risk management and Threat and Error Management (TEM) principles that may be applied to aerobatics.

In addition to the discussion of the aircraft airworthiness and human factors affecting the conduct of an aerobatic flight, CAAP 155-1(0) also examines the rules, endorsements and permissions relevant to that flight. Risk and Threat and Error Management is applied to the planning and conduct of aerobatic flight before in-flight and post-flight aspects are discussed.

CAAP 155-1(0) also provides a range of recommended aerobatics competency standards for application by aerobatics instructors and aspirant pilots. Performance criteria and underpinning knowledge is listed in support of a number of competencies, and sample achievement records are provided for possible adoption by training organisations. Finally, sample application forms are available for use and an example assessment proforma and a low-level aerobatic permission form are provided for consideration.

There was no similar CAAP or AC affecting the planning for, or conduct of low-level operations.

Examination of wirestrike accidents and incidents over the period 1994 to 2006

ATSB Aviation Research and Analysis Report B2005/0055[19] examined the wirestrike accidents in general aviation in Australia from 1994 to 2004. An overview was provided of the reported wirestrike accidents in general aviation operations, together with their associated characteristics, for the period.

The report showed that, after a peak in the number of wirestrike accidents in 1997 and 1998, the number of wirestrike accidents decreased over the period 1998 to 2003. There was an increase in the number of wirestrike accidents in 2003 to 2004, with 11 accidents reported in 2004 that resulted in seven fatalities. The report considered that the increase in accidents during that period may have reflected an easing of the previous period of drought conditions.

Of interest, the report identified that 63 per cent of pilots were aware of the wire hazard before they sustained the wirestrike. The report postulated that that finding appeared to support claims that pilot distraction was one of the major contributors to the number of wirestrikes during aerial agriculture and other aerial work operations.

19 ATSB Aviation Research and Analysis Report – B2005/0055, *Wire-strike Accidents in General Aviation: Data Analysis 1994 – 2004* (revised report released September 2006).

As part of this investigation, an examination was made of the raw wirestrike accident data for the period 2005 to 2006 inclusive. That data was combined with the raw wirestrike accident data, and under the same statistical groupings, as was presented for the period 1994 to 2004 in Aviation Research Report – B2005/0055. The results of that combined raw wirestrike accident data for the period 1994 to 2006 are at Table 1.

Table 1: Raw wirestrike accident data by ATSB statistical category, 1994 to 2006

Year	Charter	Agriculture	Flying training	Other aerial work	Private/ business	Total wirestrikes	Fatalities
1994	0	9	1	3	1	14	4
1995	0	8	0	3	3	14	7
1996	0	8	0	5	0	13	4
1997	1	8	0	3	4	16	5
1998	0	12	1	1	2	16	7
1999	0	8	0	0	3	11	4
2000	0	6	0	2	1	9	2
2001	0	6	0	2	2	10	4
2002	0	2	0	1	0	3	1
2003	0	1	0	0	1	2	0
2004	0	6	0	4	1	11	7
2005	0	2	0	0	2	4	0
2006	0	2	0	2	3	7	7
Total	**1**	**78**	**2**	**26**	**23**	**130**	**52**

There have been 52 fatalities as a result of wirestrike accidents in Australia over the period 1994 to 2006. The average number of wirestrike accidents during that period was just under 11 per year, and the average number of fatalities per annum was four.

ANALYSIS

The witness and on-site physical evidence was consistent, and confirmed that the helicopter struck the powerlines that crossed the Parkes to Orange road about 88 m before the accident site. There was no evidence of any technical or other failure of the helicopter, or its associated systems prior to that wirestrike, which resulted in fatal injuries to all three occupants of the helicopter.

Risk management and the planning of the survey

Despite the availability of a number of personal, aircraft equipment and other risk treatment options with the potential to decrease the consequence of a wirestrike, the consequence of a wirestrike can generally be expected to be severe to catastrophic. As a result, and in an effort to minimise the risk of a wirestrike, a large investment has been made by many stakeholders in order to decrease the likelihood of a wirestrike.

The regulatory requirements of Civil Aviation Regulation (CAR) 157 affecting the conduct of the noxious weeds survey below 500 ft above ground level (AGL) were an attempt to reduce the likelihood of an adverse event during that operation. However, there was no requirement in that CAR, or in its administrative low-flying instruments, to specifically define the area in which any low flying was planned to take place. That increased the potential that the context of a low-flying operation, in terms of the planned time and location of any low flying, might be ill-defined, or varied at short notice or in-flight.

In addition, the establishment by the operator of pilot competency and experiential requirements affecting the conduct of low-level operations by its pilots, and of the Chief Pilot's pre-survey/spotting operational briefing requirement were in excess of those regulatory requirements. Each represented an additional risk management strategy on the part of the operator that sought to further reduce the likelihood of an adverse event in that environment, such as a wirestrike. However, the inability in this instance of the Chief Pilot to satisfy the pre-survey/spotting briefing requirement meant that the consideration of any risks that may have affected the conduct of the survey rested with the pilot.

Similarly, the informal nature of the Parkes Shire Council's (the council) assessment of the risks likely to affect the conduct of the survey adversely affected the council management's understanding, and therefore ownership of those risks. Council management's incomplete understanding of a number of parameters that had the potential to have affected the conduct of the survey, and the Chief Pilot's lack of specific knowledge of the operation and intended survey area, appeared to confirm the inadequacy of the informal communication between stakeholders prior to the survey.

More specifically, the apparent lack of a consistent interpretation by the council of the intended survey area/area requiring 'closer attention', the nature of the survey, the intent of the north to south line through Lake Endeavour, and of a reason for the helicopter to be so low in the Bumberry Ridges area, reflected the ill-defined context on which the council's risk controls were based. There was the possibility that the degree of autonomy afforded to the weeds control officers during their inspections, the reported anticipation by one of the weeds control officers of the

potential need to momentarily descend below the survey height, and the capability of the pilot to legally operate not below 50 ft AGL, might have combined during the pre-flight induction/risk assessment to influence the conduct of the survey. In any event, by descending to commence low-flying to the west of the western boundary of the area requiring 'closer attention', the pilot/weeds control officers varied the context on which the council's risk controls were based. That action increased the risk that a wirestrike might occur.

The absence of a single source or database of information regarding the location of known powerlines and tall structures, and the geographic dispersal, and opportunistic nature of the pilot's aerial work meant that the Chief Pilot was unable to conduct the pre-survey/spotting operational brief with the pilot prior to the Parkes survey. That included the inability to confirm the boundaries of the intended survey area, and the location and description of the known hazards and obstacles with the pilot. Similarly, the action by the council to not contact the local power supply company prior to the survey, in order to identify or chart the known powerlines, meant that the responsibility for establishing the location of relevant powerlines and other hazards fell wholly on the pilot and weeds control officers on the morning of the survey. That included those powerlines which, by passing overhead undulating terrain, valleys and so on, resulted in an elevated height AGL over such lower terrain as compared with the height above the terrain on which any supporting structures were located.

Risk management and the execution of the survey

Based on the reported plan by the pilot to depart his Dubbo accommodation at 0700 on the morning of the accident, and the estimated time to prepare for and fly to Parkes, the pilot was unlikely to have had sufficient time to have conducted a comprehensive induction/risk assessment with the weeds control officers prior to refuelling the helicopter at 0820. The application of the estimated flight time from Parkes to the area of 'The Dungeons', and the reported time of the wirestrike, meant that the pilot would likely have taken off from Parkes no later than about 0923. In that case, the telephone advice to council management at 0900 that the group was about to take off most probably coincided with the group moving out to the helicopter in order for the pilot to: conduct a final pre-flight inspection of the helicopter; assist the weeds control officers to strap into their respective seats and prepare for the flight; secure himself in the helicopter; start the helicopter's engine; and complete the required systems and other checks prior to takeoff. Therefore, it was likely that the only opportunity for the pilot and weeds control officers to have carried out an induction/risk assessment was sometime between 0820 and 0900.

The pilot's apparent unfamiliarity with the eastern border area, the lack of any routinely available map that showed the location of the powerline in 'The Dungeons' area, and the unavailability of a single source or database of information that included the known powerlines and other obstacles in the survey area emphasised the importance of the weeds control officers' local knowledge in that area. Had a single source or database of that information been available, the pilot would have had the option of preparing an appropriately-marked map for use during the planning and execution of the survey. That would have enhanced the induction/risk assessment and the two-way exchange of information at that brief, facilitated the pilot's navigation around the survey area and, potentially, contributed

to the avoidance of any powerlines and other obstacles encountered during the survey.

Inability to identify and avoid the powerline

The investigation considered how, given the observers' apparent knowledge of the powerline, no-one onboard the helicopter appeared to have identified the powerline in sufficient time to avoid the wirestrike. The observers were reported to have most likely developed their understanding of the location of the powerline when routinely driving along the Parkes to Orange road. In addition, they may have successfully located the powerline during the mid-May 2005 survey. However, it was possible that the time interval between the surveys, the observers' airborne inexperience, and the differing perspective and rate of movement over the ground when in the airborne environment, could have combined to diminish the observers' understanding of their position relative to the powerline. The limited time between the takeoff and wirestrike for the observers to have reaccustomed themselves to the airborne environment would have increased the likelihood for that to have occurred. The result could have been that the observers were not aware of their proximity to the powerline.

The obscuration of the powerline support poles on the widely-separated ridgelines to either side of the road, and the nature of the environmental backdrop, reduced the likelihood that those onboard the helicopter might identify and avoid the powerline. In addition, during low-level operations, pilots routinely employ the identifying access track or easement that often accompanies a powerline through any underlying vegetation as an indicator of the location and orientation of that powerline. The lack of a following access track or easement between the ridgelines, and probable blue sky background to the powerline in this case, further reduced the likelihood that the helicopter's occupants might identify and react to the presence of the powerline in sufficient time to avoid a wirestrike. Moreover, although the early morning sun was some 66 degrees to the right of the helicopter's direction of travel, the investigation could not discount that the sun, or its associated glare, may have been a factor in the inability of those onboard to identify the powerline. Finally, there was the possibility that the pilot and/or observers may have been momentarily distracted by the vehicle travelling along the Parkes to Orange road.

Pilot competency requirements affecting the conduct of low-level operations

The pilot held an Agricultural Pilot (Helicopter) Rating Grade 1, and was experienced in the conduct of low-level operations. However, the lack of regulated low-level pilot competency requirements affecting all low-level aerial work operations, other than those affecting the conduct of agricultural or mustering operations, was inconsistent with pilots' exposure to a large number of common hazards across those operations.

The action by the Civil Aviation Safety Authority (CASA) to develop a Low-level Rating, and a number of Low-level Endorsements as part of the draft Civil Aviation Safety Regulation (CASR) Part 61, recognised the need for specific pilot competencies in all low-level operations. That included ratings and endorsements for application during the conduct of aerial work other than agricultural and

mustering operations. Although not mandated, the operator's requirement for his pilots to have completed the low-flying training in Civil Aviation Order (CAO) 29.10 Appendix 1 before undertaking low-level operations was broadly consistent with the intent of the 'Low flying in helicopters' endorsement in the draft CASR Part 61. A similar operator requirement was identified in a previous wirestrike investigation.

Given the uncertain schedule for the introduction of CASR Part 61 and its supporting documentation, and the apparent support amongst operators for the importance of the existing CAO 29.10 Appendix 1 low-flying training, it is reasonable to suggest that an interim low-level skills requirement should be considered for application to relevant aerial work applications. In regard to the identification and avoidance of powerlines and other low-level obstacles and hazards, that would provide a low-flying skills and knowledge bridge between the basic pilot competencies of the Day (VFR) Syllabus Helicopters, and the requirements for the award of the existing Agricultural Pilot (Helicopter) Ratings Grades 1 and 2 and/or the Mustering Approval.

Contemporary information on the hazards of operating in the low-level environment

Despite extensive and ongoing efforts by the aviation industry to promulgate contemporary information regarding the hazards affecting low-level operations, and the potential risk management options for application during those operations, the average number of accidents and fatalities per year remains of concern. Community concern, including by members of the public, Government Departments, operators, power supply companies and State coronial authorities suggests that additional investment in an effort to reduce the incidence of wirestrikes during low-level operations would be appropriate.

There are parallels between the justification for writing Civil Aviation Advisory Publication (CAAP) 155-1(0) – *Aerobatics*, and the applicability of a similar CAAP/Advisory Circular (AC) for application to the conduct of low-level operations, including the provision of:

- information related to safety issues affecting the conduct of low-level flight
- clarification of the regulatory aspects affecting the conduct of low-level operations
- guidance on relevant risk and threat and error management principles applicable to low-level operations.

The development of a low-flying CAAP/AC would ensure a permanent, widely-available repository for relevant contemporary low-flying knowledge, information on the identification and avoidance of powerlines and their supporting structures, risk and threat and error management strategies, and so on. In addition, a CAAP/AC would allow evolving information in those and other areas of interest to be promulgated to a wide audience.

Finally, a low-flying CAAP/AC would also be of benefit to bodies and agencies when contemplating or engaged in contracting for the provision of low-level aerial services for use in new, or ongoing operations. In the case of the Parkes noxious weeds survey, if such a CAAP/AC had been available, the council would

conceivably have been able to more appropriately tailor its own induction/risk management practices to the proposed airborne operation. A more effective risk management process, and ownership of the residual risk at the appropriate management level, could have been expected as a result.

FINDINGS

Contributing safety factor

- No-one aboard the helicopter identified the powerline in sufficient time for the pilot to avoid the wirestrike.

Other safety factors

- The requirements of Civil Aviation Regulation (CAR) 157 and the operator's *Approval to conduct Low Flying Instrument* did not include any requirement to specifically define the area in which the low flying was carried out.
- The helicopter was to the west of the area that was intended by Parkes Shire Council (the council) management for 'closer attention' when the pilot descended to below 500 ft above ground level (AGL).
- Apart from those affecting the conduct of agricultural and mustering operations, there were no regulated low-level aeronautical knowledge, experience or supervisory requirements mandated before pilots were able to undertake low-level aerial work operations, such as survey/spotting.
- The Chief Pilot was unable to carry out the pre-survey/spotting brief stipulated in the company operations manual.
- No formal risk assessment was carried out by council management prior to the conduct of the survey.
- The council's induction/risk assessment did not fully address the relevant content of the Australian/New Zealand Standard AS/NZS 4360 *Risk Management*
- Prior to the accident, the council's management was unaware of the operator's authorisation to operate to 50 ft AGL.
- There was no single source or database of information on the location of known powerlines and tall structures available to pilots, operators and managers of aerial campaigns for use during the planning of those campaigns.
- The likelihood that the occupants of the helicopter might identify the powerline was reduced by the:
  - obscuration of the supporting poles on the widely-separated ridgelines
  - nature of the environmental backdrop
  - lack of an identifying access track that a pilot might normally associate with the location and orientation of a powerline
  - probable blue sky background to the powerline.
- There was no permanent, widely-available source of contemporary low-flying knowledge and information for access by student and qualified pilots, operators, or by bodies and agencies contemplating or engaged in contracting for the supply of low-level aerial services.

Other key findings

- There was no evidence of any technical defect or other failure of the helicopter, or its associated systems prior to the wirestrike.
- The investigation was unable to determine to what extent the pre-flight induction/risk assessment might have changed the planned conduct of the flight.
- The powerline was not required to be marked in accordance with the existing Australian Standard's affecting the marking of overhead cables.
- When implemented, Civil Aviation Safety Regulation Part 61 will introduce a Low-level Rating and a number of Low-level Endorsements for application to pilots conducting low-level operations, including the conduct of survey/spotting operations.

SAFETY ACTION

This report identifies four safety issues. The resolution of those safety issues has the potential to reduce the risk of wirestrikes during future noxious weeds surveys and other similar low-level campaigns.

All of the responsible organisations for the safety issues that were identified during the investigation were provided with a draft report in April 2007 and asked to respond to the draft. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue that was relevant to their organisation.

The following discussion details the safety actions that were communicated to the Australian Transport Safety Bureau (ATSB) during the investigation and in response to the draft report. Where safety action was not forthcoming, or not considered sufficient, the ATSB has issued safety recommendations.

Civil Aviation Safety Authority

Aeronautical knowledge, experience and supervisory requirements affecting the conduct of low-flying operations

Safety issue

Apart from those affecting the conduct of agricultural and mustering operations, there were no regulated low-level aeronautical knowledge, experience or supervisory requirements mandated before pilots were able to undertake low-level other aerial work operations, such as survey/spotting.

Safety action by the Civil Aviation Safety Authority (CASA)

In its response to the draft investigation report, CASA advised that it was considering the development of a Civil Aviation Order (CAO) with the effect that anyone carrying out low-level operations would have to satisfy the low-level flying standards. The intent was that those standards would reflect those to be mandated by Civil Aviation Safety Regulation (CASR) Part 61, where a Low Flying Rating will be introduced.

ATSB comment

The content of CASR Part 61 and its anticipated effect on low-flying competencies and qualifications was highlighted on page 23 and in Appendix B to this report. The ATSB acknowledges the extensive investment by CASA in that regard.

However, the indication on 12 March 2007 was that there was the potential for the implementation schedule for CASR Part 61 to slip. The uncertain implementation schedule affecting CASR Part 61 was confirmed by CASA on 18 July 2007. Any delay in the implementation of CASR Part 61 would be cause for concern.

The ATSB will monitor any progress in the development of a CAO that will require anyone carrying out low-level operations to satisfy the intent of the low-level flying standards of CASR Part 61.

Australian Transport Safety Bureau

Requirement to clearly define the area in which low-flying operations are to be carried out

Safety issue

The requirements of Civil Aviation Regulation (CAR) 157 and the operator's *Approval to conduct Low Flying Instrument* did not include any requirement to specifically define the area in which the low flying was carried out.

CASA comment

In its response to the draft investigation report, CASA advised that low-flying approvals are given after consideration of suitable procedures in an operator's operations manual. Those procedures relate to the relevant operational task on the operator's air operator's certificate.

In addition, CASA advised that, in accordance with CAO 82.0, Appendix 1, Sub-section 2.1 a Chief Pilot is required to have control of all operational matters affecting the safety of an operator's flying operations.

ATSB comment

The ATSB acknowledges the regulatory requirements affecting an operator's low-flying and other operations. However, the safety issue highlighted the potential under existing *Approval to conduct Low Flying Instruments* for unnecessary exposure to low-level hazards, such as powerlines, when outside the specific area in which an operational task was intended to be carried out.

The ATSB action to issue a safety recommendation reflects an effort to minimise the unnecessary exposure of an aircraft and crew to low-level hazards, including powerlines, in an attempt to reduce the risk of a wirestrike.

ATSB safety recommendation 20070013

The Australian Transport Safety Bureau recommends that the Civil Aviation Safety Authority address this safety issue.

Availability of a permanent, widely-available source of contemporary low-flying knowledge and information

Safety issue

There was no permanent, widely-available source of contemporary low-flying knowledge and information for access by student and qualified pilots, operators, or

by bodies and agencies contemplating or engaged in contracting for the supply of low-level aerial services.

CASA comment

In its response to the draft report, CASA indicated that, in Fiscal Year 07/08, it would examine the development of pilot educational material that was specific to the conduct of low-level operations. That material would address the pilot responsibilities and threat and error management-type issues affecting the conduct of low-level operations. In addition, CASA advised that its *Flight Safety Australia* editorial group would consider publishing the resources available to pilots that could be expected to assist in the location of powerlines that were recorded or mapped by the various electricity authorities.

ATSB comment

The ATSB notes CASA's efforts to enhance pilot's understanding of the hazards affecting the conduct of low-level operations.

However, the intended CASA action specifically targets pilots. It does not address the provision of a widely-available source of contemporary low-flying knowledge and information that can be accessed by bodies and agencies that might be contemplating the conduct of low-level operations. In addition, a magazine article is not considered to be a permanent source of information, could not be expected to be distributed to all prospective aerial campaign managers, and would not represent an information source that was able to be efficiently amended and configuration managed to ensure the availability of reliable, up-to-date information and guidance.

The ATSB action to issue a safety recommendation is an attempt to make available for general use permanent and widely available guidance material for application by pilots, operators and prospective low-level aerial campaign managers.

ATSB safety recommendation 20070014

The Australian Transport Safety Bureau recommends that the Civil Aviation Safety Authority address this safety issue.

Establishment of a single source or database of known powerlines, and tall structures

Safety issue

There was no single source or database of information on the location of known powerlines and tall structures available to pilots, operators and managers of aerial campaigns for use during the planning of those campaigns.

ATSB comment

During the investigation and in subsequent discussions with aviation authorities, the indication was that the creation of a single source or database of information on the location of known powerlines and tall structures was most likely prohibitive in terms of its resource implications, and that access to state and territory powerline and other data may prove problematic.

Given that advice, the ATSB has commenced initial discussions with Geoscience Australia and the Energy Networks Association to examine the feasibility of the establishment of a national database of information on the location of known powerlines and tall structures for access by pilots, operators and managers of aerial campaigns.

The ATSB will publish an update of those discussions on its website at www.atsb.gov.au no later than 6 months after the public release of this investigation report.

APPENDIX A: EXISTING AERONAUTICAL KNOWLEDGE AND EXPERIENTIAL REQUIREMENTS AFFECTING LOW-LEVEL OPERATIONS

The aeronautical knowledge and experiential requirements affecting the conduct of agricultural, mustering and other low-level aerial work operations are discussed in the following sections.

A.1 Day (VFR) Syllabus Helicopters

The Day (VFR) Syllabus Helicopters defines the flying and ground standards necessary to exercise the privileges, with relevant restrictions, of the Student, Private and Commercial pilot licences in a single-engine helicopter. Although the syllabus applies in general to both the private and commercial licences, the extent of the application of the syllabus items, the differences in the flying hours and experience requirements and the completion standard for each licence differ.

In the case of the Aeronautical Knowledge Training Syllabus, the relative importance of each training element is shown via the following labelling:

A Essential – knowledge required to ensure the safety of an aircraft and its occupants.

B Important – knowledge required for the practical operation of an aircraft.

C Necessary – additional knowledge required at a professional licence level.

In support of the management of each syllabus, flying schools are required to produce a detailed instructional syllabus for each sequence and enabling objective.

Where a student pilot completes the minimum of 5 hours low-flying training in accordance with sub-section 14 of the syllabus, the Chief Flying Instructor may certify the student as competent in low flying.

The components of the Day VFR Syllabus Helicopters flying and aeronautical knowledge training syllabi specifically relating to the conduct of low-level operations are outlined in Tables 2 and 3 respectively.

Table 2: Flying training syllabus components relating to the conduct of low-level operations

Section/sub-section	Item
9	**Turning – specified for private and commercial licences**
9.19	Takeoff, climb to a specified altitude not above 500 ft above ground level (AGL), fly a low-level circuit, approach, hover and land to the following standard: (a) maintain nominated airspeed within ±5 kts (b) maintain safe circuit height throughout (c) fly an accurate circuit pattern and maintain safe separation from other traffic

Section/sub-section	Item
	(d) maintain a good lookout (e) perform all checks related to circuit and low-level flying precisely, without error.
14	**Low flying – apart from sub-section 14.6, which affects both the private and commercial licences, the following components are specified for the commercial licence only**
14.1	Fly square, rectangular, circular and other ground reference patterns at airspeeds/heights outside the avoid areas of the height/velocity diagram for the helicopter to the required standard[20].
14.2	Turn at medium angles of bank through 90° and 180° at airspeeds/heights outside the avoid areas of the height/velocity diagram for the helicopter to the following standard: (a) co-ordinate collective, cyclic and tail rotor controls smoothly to maintain balanced flight at the nominated angle of bank (b) maintain the nominated angle of bank accurately (c) maintain recommended or nominated height/airspeed accurately (d) coordinate collective, cyclic and tail rotor controls smoothly to effect rollout onto the desired heading (e) maintain a good lookout throughout the turn.
14.3	Initiate quick stops from both into and down wind flight to a hover over a designated point from a height of 30 to 50 ft AGL and from airspeeds outside the avoid areas of the height/velocity diagram for the helicopter to the following standard: (a) maintain a safe height throughout (b) apply controls smoothly to decelerate the helicopter without gaining height (c) reapply power smoothly to bring the helicopter to a hover over the designated area.
14.4	Execute 180° coordinated steep turns from a height of 30 to 50 ft AGL and cruising airspeed and recover to cruising airspeed at 30 to 50 ft AGL to the following standard: (a) smoothly apply sufficient aft cyclic to establish a nose-up attitude of not more than 30° (b) turn the helicopter through 180° by the use of cyclic and tail rotor pedal (c) regain airspeed as helicopter accelerates in the reciprocal direction (d) maintain a safe height throughout

20 As at 30 March 2007, the required standard was not included in the syllabus.

Section/sub-section	Item
	(e) maintain a good lookout throughout.
14.5	Have an appreciation and understanding of the following additional flying techniques: (a) precautions for operating in ground effect[21] in dusty conditions (b) avoidance of obstacles (c) low flying in hilly terrain (d) effect of false horizons (e) effect of the sun, under certain conditions, on visibility (f) approach to high ground – use of escape routes.
14.6	Execute autorotative landings following simulated engine failure from below 200 ft AGL and airspeeds outside the avoid areas of the height/velocity diagram for the helicopter and to the standards specified in the preceding paragraphs.

Table 3: Aeronautical knowledge training syllabus components relating to the conduct of low-level operations

Section/sub-section	Item
3.3	**Flight rules and conditions of flight**
3.3.6	Recall the requirements relating to the minimum heights for flights over: • populous areas • other areas.
11.7	**Vision, spatial disorientation, illusions**
11.7.4	Know the limitations of the eye with respect to: (a) the ability to discern objects during flight, for example: • other aircraft, transmission lines, etc (b) empty field myopia (c) glare (d) colour vision in aviation.

21 Flight above (out of ground effect) or below (in ground effect) the height at which an increase in lift results from the interaction with the ground of the airflow created by a helicopter's main rotor system.

A.2 Agricultural Pilot (Helicopter) Rating

The aeronautical knowledge and experience requirements associated with the Grades 1 and 2 Agricultural Pilot (Helicopter) Ratings[22] are contained in Civil Aviation Order (CAO) Part 40, Section 40.6. The aeronautical knowledge, experience and skills, authority, examination and tests, recent experience, flight check requirements, syllabus of examinations and initial agricultural flying training requirements are outlined in the following paragraphs.

Aeronautical knowledge

An applicant for the award of an agricultural pilot (helicopter) rating must pass a written exam on the helicopter-specific elements of Appendix I to the CAO. The elements of that examination that specifically relate to the potential location, identification and avoidance of powerlines and other low-level hazards include:

- Operational planning:
  - ground inspection, method and purpose, limitations
  - flight between airstrip and operating area and general low-level navigation
  - flight inspection, method and purpose
  - location of obstructions and ground undulations
  - assessment of wire runs and problems associated with treatment areas and wires.
- CAOs relating to agricultural aviation:
  - low flying permission and operations in the vicinity of occupied buildings or populous areas
  - operations in the vicinity of Government or licensed aerodromes.

Aeronautical experience

The aeronautical experience requirements for an applicant for an agricultural pilot (helicopter) rating grade 2 include that the applicant is required to hold a commercial pilot (helicopter) (CPL(H)) or airline transport pilot (helicopter) licence (ATPL(H)), have at least 200 hours of helicopter flight time and satisfactorily complete a course of helicopter training including:

- Initial agricultural flying training of 3 hours duration as listed in Appendix III of the CAO. The content of that initial training that directly relates to the avoidance of wires and obstacles includes manoeuvring close to obstructions, in and out of ground effect.
- A minimum of 7 hours operational flying training, conducted under operational conditions and with the helicopter's spraying equipment installed, as listed in Appendix III of the CAO. The operational syllabus training that directly relates to the avoidance of wires and obstacles includes:

22 Separate requirements affect the award of aeroplane agricultural ratings and are also published in the CAO.

- inspection of the treatment area from the ground and from the air, obstructions, boundaries, markers, plan of operation
- treatment of a difficult area, including manoeuvring close to obstructions, height and speed to fly, flight over and under wires, irregular terrain and contour flying, dangers of excessive mental load and distraction from the task at hand.

An applicant for an agricultural pilot (helicopter) grade 1 rating must hold either a CPL(H) or ATPL(H), hold or have held an agricultural pilot (helicopter) grade 2 rating, and have at least 500 hours aeronautical experience in helicopter agricultural operations. That excludes the training for the award of the agricultural pilot (helicopter) grade 2 rating and any navigation and ferry flights conducted in agricultural helicopters.

Aeronautical skill

An applicant for the award of an agricultural pilot (helicopter) rating is required to pass a test to confirm competence in the conduct of all normal and emergency procedures that might be encountered in all types of agricultural operations.

Authority given by the agricultural rating

Unless specifically approved by CASA, the holder of an agricultural pilot (helicopter) rating may only engage in agricultural operations if working for or contracted to the holder of an aerial work agricultural operator's licence. A rated agricultural pilot may fly as a pilot in command or copilot of a helicopter that is engaged in agricultural operations.

An agricultural (helicopter) pilot grade 2 is required to complete 20 hours agricultural flying under the direct supervision of an approved agricultural pilot before being able to undertake unrestricted operations. The completion of that period of supervision is annotated in the pilot's logbook.

Exemptions

On the production of satisfactory evidence, exemptions to the initial and operational flying training requirements, and the extent of the period under supervision may be varied.

Recent experience requirements

The recency requirements affecting the conduct agricultural operations by the holder of an agricultural pilot (helicopter) rating include that the pilot must not fly a helicopter in those operations unless, within 1 year of the proposed operation the pilot has:

- flown at least 50 hours in command of a helicopter carrying out agricultural operations, or
- if the holder of a grade 2 agricultural pilot (helicopter) rating, and the pilot has not flown a helicopter in agricultural operations for 13 months since the award of that rating, satisfactorily completed an agricultural helicopter flight check.

That check is not able to be attempted until after 9 months after the initial award of the grade 2 rating.

A.3 Mustering approval

The aeronautical knowledge and experience requirements associated with the award of a mustering approval for use in helicopters[23] are contained in CAO Part 29, Section 29.10. The aeronautical experience and skills, examination and tests, recent experience and flight check and training requirements are outlined in the following paragraphs.

Aeronautical experience

An applicant for a mustering approval is required to have the aeronautical experience requirements necessary for the award of a CPL(H). That experience is required to include:

- 100 hours as a pilot in command, including at least 50 hours in command of the aircraft type for which the approval is sought
- 5 hours low-flying training in the relevant type of aircraft. The elements of that training that specifically relate to avoiding obstacles and powerlines include:
  - low flying (below 100 ft)
  - avoidance of obstacles
  - low flying in hilly terrain
  - under certain conditions, the effect of the sun on visibility.
- 10 hours training in aerial stock mustering operations in the relevant type of aircraft in the preceding 90 days, including:
  - aerial reconnaissance and operational planning
  - the effect on operational procedures of obstacles, sun, wind and cattle fatigue
  - all aerial stock mustering techniques applicable in open country and hilly and timbered terrain.

  The 10 hours operations training is required to include 6 hours dual training. The remainder can be either in command under supervision, or in solo operations under direct supervision.

Exemptions

A number of exemptions have the potential to affect the award of a mustering approval:

- if an applicant has held or holds an agricultural pilot rating in the kind of aircraft for which the approval is sought, the requirement for the completion of the 5 hours low-flying training may be waived depending on the outcome of the required flight test

---

23 Separate requirements affect the award of a mustering approval in aeroplanes and gyroplanes. Those requirements are also published in this CAO.

- where an applicant has logged a minimum of 500 hours in command of helicopters, the 5 hours low-flying training may be reduced to 2 hours
- where an applicant has, in the previous 2 years, held a similar approval in a different type of aircraft, the operational training necessary for the award of the subsequent approval may be reduced at CASA's discretion.

Examination and certificate of competency

An applicant for a mustering approval is required to demonstrate proficiency in low-level flying and emergency flight manoeuvres at the completion of the low-flying training, and before commencing the aerial stock mustering operational training. Where the applicant has completed the operational training, and achieved a satisfactory standard, CASA will, on receipt of a certificate of competency from the approved pilot that provided that training, issue the stock mustering approval.

Recent experience

The holder of a stock mustering approval is unable to engage in aerial stock mustering operations unless he or she has:

- in the preceding 12 months, completed a minimum of 20 hours of stock mustering operations, or
- satisfactorily completed a flight test conducted by an approved officer or pilot.

APPENDIX B: (DRAFT) CASR PART 61 – PRIVILEGES, CONDITIONS AND REQUIREMENTS FOR THE AWARD OF THE PROPOSED LOW-LEVEL RATING AND HELICOPTER ENDORSEMENT

(Draft) CASR Part 61 recognises that activities such as stock mustering, fire-bombing and so on require additional training above that applicable to the conduct of more general low flying. The intent is that additional low-flying endorsements will be attached to a pilot's low-level rating in order to authorise those activities.

The content of the proposed CASR Part 61 with the potential to affect the conduct of low-level helicopter operations is discussed in the following paragraphs.

Low-level rating

Privileges

The holder of a Low-level Rating will be authorised to conduct other than aerial application operations:

- below 500 ft AGL
- that involve the dropping of articles from an aircraft below 350 ft AGL.

Conditions

A pilot that holds a Low-level Rating will not be able to conduct an authorised activity listed in Table 4 unless that pilot also holds the relevant Low-level Endorsement. Unless carrying out private operations, CASR 61 will require that, when exercising the privileges of a Low-level Rating, a pilot must be operating in association with an air operator's certificate that authorises low-level operations.

The recency requirements of the Low-level Rating will include that a pilot may not exercise the privileges of that rating unless:

- within the previous 3 months, the pilot has:
  - completed at least 3 hours in low-level operations as pilot in command or at least 1 hour low-level flying practice in a low-flying training area, or
  - demonstrated competency in low-level operations to an appropriately-qualified instructor, or
- within the previous 6 months:
  - completed at least 6 hours of low-level operations as pilot in command or 2 hours low-level practice in a low-flying training area, or
  - demonstrated competency in low-level operations to an appropriately-qualified instructor, or
- he or she satisfies the training and checking requirements in the relevant supporting Part of the regulations.

Requirements for the grant of the Low-level Rating

Unless the applicant for a Low-level Rating already holds an aerial application rating, CASR Part 61 will require that an applicant for the rating must:

- hold either a private, commercial or air transport pilot's licence
- for a category of aircraft (including an aeroplane, helicopter or gyroplane):
  - hold the relevant aircraft category rating and appropriate aircraft class or type rating for the aircraft used in the flight training and test
  - have completed at least 10 hours of low-level flight training, including at least 5 hours dual instruction and 5 hours of solo flight
  - have passed the relevant Low-level Rating flight test.

Low-level Endorsements

Privileges

The award of a Low-level (helicopter) Endorsement[24] stipulated in Table 4 will authorise its holder to conduct the authorised activities related to that endorsement.

Requirements for the grant of an endorsement

An aerial application-rated pilot will satisfy the requirements for the award of the Powerline Inspections and Fire-bombing Endorsements for the applicable aircraft category.

An applicant for the grant of a Low-level Endorsement, who does not hold an aerial application rating, will be required to:

- have received training from an appropriately-qualified instructor, and exhibit competency, in the relevant competency elements to the standards specified in the Manual of Standards (MOS) Part 61
- satisfy the 'other requirements' flying hours stipulated in Table 4
- certify receipt of the training in MOS Part 61.

Table 4: Low-level Endorsements

Endorsement	Activities authorised	Other requirements
Helicopter	Low flying in helicopters	5 hours of dual low flying in helicopters
Aerial Mustering (aeroplanes, helicopters)	Aerial mustering operations in the relevant aircraft category	10 hours of aerial stock mustering training, including 6 hours of dual training

24 Aeroplane and gyroplane endorsements are also listed in (draft) CASR Part 61.

Endorsement	Activities authorised	Other requirements
Fire-bombing (aeroplanes, helicopters)	Fire-bombing operations in the relevant aircraft category	
Powerline Inspection (aeroplanes, helicopters, gyroplanes)	Powerline inspection operations in the relevant aircraft category	
Powerline Maintenance	Powerline maintenance in helicopters	