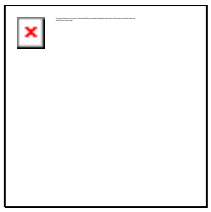

Title	Mr
First name	Daniel
Last name	Tyler
I am making this submission as	Emergency services
Submission type	Personal
Organisation making the submission (if applicable)	n/a
Your position in the organisation (if applicable)	n/a
Consent to make submission public	Public
Your story	I am an emergency service pilot with about 4 decades of experience including fire fighting operations mainly in NSW and Queensland - but also in Victoria during the past fire season. I am concerned that lack of a single comprehensive database of hazardous obstructions such as Single-Wire, Earth Return power lines and communications towers make aerial fire fighting much more dangerous than it should otherwise be. This submission was made primarily to the Commonwealth Bushfire Royal Commission - but a copy is submitted to the NSW inquiry for consideration as it is relevant to both state and federal jurisdictions.
1.1 Causes and contributing factors	

1.2 Preparation and planning	See attached detailed submission.
1.3 Response to bushfires	
1.4 Any other matters	
Upload files	Submission-to-Bushfire-Royal-Commission-regarding-SWER-lines.pdf - Download File

Submission to the

Bushfire Royal Commission

constituted by

Commonwealth of Australia Letters Patent

dated 20th February, 2020.

Re: Hazards posed by unmarked power distribution lines and communication towers to bushfire fighting fixed- and rotary-wing aircraft and measures to mitigate those hazards.

Prepared by

Daniel E Tyler LLM

dated

12th April, 2020

Executive Summary

Pursuant to Commonwealth Letters Patent dated 20th February, 2020, terms of reference (a) and (d), the following submission is made.

1) Helicopters and aeroplanes are used extensively in combating bushfires in Australia and around the world. Helicopters are used for water bombing and retardant dispersal, surveys, spotting, and aerial ignition of backburns. All these roles are critical to the bushfire fighting effort – and all involve low level flying under a time imperative.
2) Rural Australia is criss-crossed with power transmission and distribution lines. Single-wire, earth return (SWER) lines are unique to Australian rural areas and are particularly hazardous to low level aerial work craft.
3) The widespread use of mobile phones has resulted in a proliferation of communication towers facilitating phone coverage in both urban and rural areas.
4) Much of the power distribution and communications infrastructure is not required to be plotted on aeronautical charts or marked with high visibility devices under existing standards and legislation – despite posing a real hazard to low-flying helicopters and aeroplanes engaged in firefighting and other public safety aerial work operations.
5) Wire strike incidents have occurred during bushfire operations in Australia – including at least two occurrences in the past bushfire season. Wire strike occurrences have a high risk of fatalities – but even minor wire strike occurrences can take resources offline for repairs and divert attention from the firefighting efforts at a critical time.
6) Despite recommendations from State Coroners and the Australian Transport Safety Bureau in the past – there is still no Australia-wide single source of locational data for such hazards to low flying operations that is generally available to pilots and aerial work operators on short notice.
7) Evidence given by the utilities to prior inquiries indicate that digitised locational data for power transmission and distribution infrastructure is typically held by most – if not all - power companies.
8) Some anecdotes indicate a reluctance by some utilities to make the digitized data available generally – possibly due to apprehension that liability might flow from an inaccuracy in the locational data supplied.
9) Among the recent developments in information technology are “electronic flight bag” (EFB) applications running on iPads or other tablets. Utilising the built-in Global Positioning System (GPS) within the tablet – a moving map display showing the aircraft’s present position can be displayed to a pilot in flight to aid in navigation and situational awareness. The three main EFB Apps used in Australia are “OzRunways” “RWY” and “AvPlan”. OzRunways is widely used by aerial work operators engaged in fire suppression operations. As currently configured, EFB Apps depict only the towers and powerlines that are required to be notified to Airservices Australia by legislation and are shown on existing paper charts. They do not depict SWER lines.
10) The head of software development at OzRunways has indicated: a) if they received a geographic information service (GIS) file containing the locational data for SWER and other power distribution lines – and also communications towers – they would be able to depict those obstacles on the moving map display of their App, and b) they are interested in pursuing that project as an optional overlay in their App – PROVIDED they can get the locational data – for Australia.

We ask the Royal Commission to make strong recommendations to the Australian Government and the various State and Territorial Governments that they should use their legislative and administrative powers to compel the power transmission/distribution companies and communications companies to provide their digitized locational data to the EFB providers AND to such other bodies who may legitimately need access to the data for air safety purposes. Since (as we understand) the data is already held by those utilities, it should be made available without cost or – at worst – for only the administrative cost of forwarding the files.

Introduction

During the 2019-2020 bushfire season, at least two water bombing helicopters struck powerlines and sustained damage which took them out of action during periods when they were urgently required to help contain fire fronts. There may have been other wire strike occurrences during the season that have not been publicised.

The author of this submission was one of the pilots involved in a wire strike incident during bushfire operations in Victoria – having struck a Single-Wire, Earth Return (SWER) line after picking up a load of water from a farm dam in a rural area adjacent to an uncontained forest fire.

There have been other wire strike occurrences during bushfire operations in Australia – though the author has been unable to find any record of fatalities as a result of wire strikes during firefighting operations. There have been several fatal wire strike accidents in similar low-level aerial work operations – some of which occurred during aerial campaigns conducted by local or state government authorities.

An analysis by the Australian Transport Safety Bureau of wirestrike occurrences between 1994 and 2004 showed that 39% of helicopter wirestrikes in that study resulted in fatalities.[i] That figure may be slightly lower now because of increased use of Wire Strike Protection Systems (WSPS) – however there have been wirestrike crashes with fatalities involving WSPS-equipped helicopters. WSPS is a mitigator but not a complete cure.

Many of the collisions between aircraft and overhead wires have involved relatively low voltage distribution lines that do not meet the published criteria for either annotation on aeronautical charts[ii] or marking[iii] with high-visibility balls.

The author is unaware of any incidents in Australia involving collision between firefighting aircraft and telecommunications lines or towers – however unmarked and uncharted overhead telephone lines and mobile phone towers pose a similar risk to that from overhead electrical transmission or distribution lines.

The recent development and popularity of tablet-based "Electronic Flight Bag" applications[iv] mean that affordable moving map displays portraying a variety of aviation charts can be viewed by a pilot to assist with navigation and improve situational awareness – especially during high-workload low-level operations where most of the pilot's attention must be focused outside the cockpit. "Layers" or "overlays" of information such as the location of controlled or restricted airspace, air routes, reporting points, or aeronautical facilities can be managed to provide pilots with desired information for the current circumstances without permanent "clutter" in the display.

The author believes that – if the locational information relating to ALL overhead power transmission and distribution lines and ALL communication towers and overhead lines - rather than just those meeting the current legislative criteria – were made available via a single national database, then the developers of those apps could make it available to pilots and operators in a user-friendly format.

We hope that the Commission will recognise the extent to which this would improve the efficacy and safety of aerial firefighting operations and make recommendations to facilitate the creation and maintenance of a single database available to the EFB app developers and to developers of any future terrain or obstacle-avoidance devices.

Discussion

Use of rotary and fixed wing aircraft in bushfire operations

"The responsibility for suppression of wildfires (bushfires as they are known in Australia) rests with the Governments of each of the Australian States and Territories. Each State and Territory Government has one or more agencies that are responsible for bushfire prevention and suppression. Where it is safe, efficient and cost effective to do so, most States and Territories utilise aircraft to support their fire suppression and other fire management activities . . ."

"Aircraft undertake a wide range of valuable support tasks, including:

- *Firebombing – the dropping of water, or foam or fire retardant slurries on, or in front of the fire, to reduce or halt the spread of the fire;*
- *Rapid delivery of firefighters to remote areas by rappelling or winching;*
- *Fire detection, reconnaissance and mapping (including with highly sophisticated infra-red sensors;*
- *Command, communications and control;*
- *Transportation of firefighters and equipment; and*
- *Aerial ignition – dropping of approved incendiary devices to ignite backburns or planned fuel reduction burns."*

"A wide range of fixed-wing and rotary-wing aircraft are used to support fire operations. . . ."[v]

It should be obvious that most of these bushfire fighting operations necessarily involve low level flight. In the case of helicopter water bombing operations using belly-tanks or water buckets – water is normally picked up from a local water source in the vicinity of the bushfire. This requires descent to a low hover over the water source. Visibility in the vicinity of a bushfire is often reduced in smoke. The closer the water source to the fire front – the more effective the aerial fire suppression operations will be. Fixed-wing water bombers invariably pick up water or fire retardant after landing at an airfield. The susceptibility of fixed-wing water bombers to wirestrike is mainly during the drop phase, whereas helicopter water bombers are vulnerable during both the uplift and the drop phases of flight.

Power transmission and distribution infrastructure in rural Australia

"Wires are an insidious hazard for any pilot who has to fly low for a living: easy to hit and hard to see, they seem almost designed to take down aircraft."

"The best defence against wires is knowledge - of where the wires are and how to look for them – forewarned is forearmed. Pilots who fly for a living at low levels must constantly keep their knowledge up to date. . . ." [vi]

High-tension, high-voltage power transmission lines in Australia typically carry from 66kV to 500kV. Local distribution overhead lines in some instances are only 240V. Some distribution lines have multiple conductors – however at the lowest end of the distribution network Single-Wire, Earth Return (SWER) lines up to 12.7kV are used.

In general:-

- A powerline carrying 110kVA and above would be shown on a 1:250,000 scale map;
- A powerline carrying 66kVA would be shown on a 1:50,000 scale map; and,

- A powerline carrying 33kVA would be shown on a 1:25,000 scale map.[vii]

SWER lines are not usually marked on aeronautical charts and are often not marked on any map likely to be accessible to a pilot. SWER lines are almost impossible to detect in every instance and they are particularly hazardous to bushfire fighting operations where it is necessary to operate low-level for water pickups and drops. The operational tempo of fire suppression operations combined with reduced visibility in the vicinity of bushfires makes visual identification of SWER lines particularly challenging.

Communications towers in Australia

The widespread reliance upon mobile phones in Australia has resulted in the construction of hundreds if not thousands of communications towers sited to provide maximum coverage of the Australian countryside.

While these towers project into the low-level airspace that is likely to be used by water bombing aircraft – not all of them are charted or marked with contrasting paint schemes or strobe lights that operate during daylight[viii] hours.

Existing standards and legislation dealing with notification and marking of obstacles

In general, overhead lines and towers less than 90 metres above the surface are not required to be mapped or marked with identification balls in rural areas.[ix] There is a requirement to notify the Royal Australian Air Force (RAAF) Aeronautical Information Service (AIS) of any man-made obstructions higher than 45 m (or 30 m – within 30 km of an aerodrome). There are also rules about construction and marking of obstructions within the "obstacle limitation surface" (OLS) around major aerodromes. While the RAAF AIS maintains a single Australian database of obstructions – that does not necessarily mean they are all charted or marked. In any event – most SWER lines that are hazardous to bushfire fighting aircraft – especially water bombing helicopters – are not marked or required to be marked or shown on any map readily available to a bushfire fighting pilot.

Wire strikes in bushfire fighting and other low-level aerial work operations

As noted in the Introduction, there has been a history of wire strike accidents involving both fixed- and rotary wing aircraft conducting aerial work operations – including bushfire suppression operations. In most of these occurrences, the wire struck was not shown – nor required to be shown – on any aeronautical charts of the kind available to pilots nor was it marked or required to be marked – by high-visibility balls or flags.

In the period 2004-2006 there were a series of overhead powerline wire strike accidents involving helicopters engaged by public authorities to conduct low level aerial work. Three of the occurrences, including one accident resulting in two fatalities, occurred during an aerial campaign by federal and NSW authorities (using commercial helicopters) in response to a major locust plague. In 2006, a central NSW local council engaged a commercial helicopter operator to conduct a noxious weed survey within its jurisdiction – during which an overhead powerline was struck with the ensuing crash killing the pilot and two council weed control officers.

Coronial Inquest into fatal wire strike accidents during locust plague and noxious weed surveys

A single coronial inquest[x] was convened to investigate the five fatalities from the two fatal wire strike accidents mentioned above. That inquest heard evidence *inter alia* that ". . .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." Other evidence was tendered about how such information could be accessed and downloaded onto schematic maps for use by pilots during low level operations – although some reservation was expressed about information overload possibly detracting from the pilot's primary duties of flying the aircraft.

Among the recommendations made by the Coroner to the Federal Minister for Aviation and the Civil Aviation Safety Authority was that CASA ". . . gives consideration to establishing and maintaining an appropriate data base of information in regard to low level hazards such as power lines and other manmade structures . . . ."

The fatal wire strike accident east of Parkes, NSW, in 2006 gave rise to various civil proceedings which were ultimately consolidated and heard in the Supreme Court of NSW. (The author of this submission was an expert witness in that trial.) Evidence was heard that the local council had been given by the electricity supplier, and had in its possession at the relevant time, digital information regarding the location of all overhead power distribution lines and poles in their area – and that such information could have been depicted upon cadastral maps of the survey area and provided to the pilot for his use in flight planning.

Evidence was also given about how difficult it was to visually identify the overhead line which had been hit, due to the length of the span and the lack of an easement cleared of vegetation beneath the line – and about how useful it would have been if the pilot had been given a map depicting that line in the context of the terrain. The locational information was not passed on to the pilot or to the helicopter operator – possibly because of apprehensions about its accuracy.

In an action for damages brought by relatives of one deceased council weed control officer against the helicopter operator, local council and electricity supplier – with various cross claims – the trial judge found that the council should have passed on the information in its possession about the location of all overhead lines to the pilot.[xi] The Court ultimately found that the Council had breached its duty of care to its employee and that breach was a cause of the accident. There were other breaches of Council's duty of care cited. The case went to the NSW Court of Appeal and ultimately to the High Court of Australia on a separate legal issue.

ATSB Investigations and Reports dealing with low level aerial work and wire strike accidents

After the series of wirestrike accidents during the locust control campaign in 2004, ATSB published a data analysis of wirestrike accidents in general aviation for the period 1994-2004. Following the Parkes fatal wirestrike accident in 2006, ATSB re-released that report – which examined the scope of the problem, identified causal factors and considered possible mitigators. Aerial agriculture was identified as the most significant category of "aerial work" at risk from wirestrikes, however firefighting operations were also identified.[xii]

The ATSB report into the Parkes fatal wirestrike accident[xiii] - having found that *"There was no single source or database of information on the location of know powerlines and tall structures available to pilots, operators and managers of aerial campaigns for use during the planning of those campaigns"*, commented that *". . . the indication was that the creation of a single source or database . . . was most likely prohibitive in terms of its resource implications, and that access to state and territory powerline data may prove problematic."* Nonetheless, the report stated that *". . . ATSB has commenced initial discussions with Geoscience Australia and the Energy Network 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" and that "ATSB will publish an update on those discussion on its website . . . "

ATSB's follow up report[xiv] on the feasibility of a single database of wires and tall structures summarised the extent of the problem and explored one possible solution:-

> *"There were 52 fatalities throughout Australia as a result of wirestrike accidents in the period 1994 to 2006. During that period, there was an average of just under 11 reported wirestrike accidents each year and the average number of fatalities was four per annum."*
>
> *. . . .*
>
> *"During a series of recent ATSB investigations into fatal and other wirestrike accidents,* ***a number of different sources of information on the location of known powerlines and tall structures was identified. However, despite the apparent utility and safety benefits inherent in the availability to pilots, operators and low-level campaign managers of a single source or database of the location of known powerlines and tall structures, initial discussions with aviation authorities on the potential development of such a resource were non-productive"*** (emphasis ours).
>
> *"However, Australian Transport Safety Bureau (ATSB) investigators commenced initial discussions with Geoscience Australia (GA) and the Energy Networks Association (ENA) to examine the feasibility of the establishment of such a database. Those discussions determined that GA was amenable to working with other relevant agencies in order to promulgate that data for use by pilots and other parties. ENA indicated that the proposal to establish a national database would be considered as part of its 2008 priority issues."*
>
> *. . . .*
>
> *"There can be little argument that, despite the application of risk strategies such as the wearing of helmets and full-cover clothing, advanced seat belt harnesses, the possible installation in aircraft of wire-strike protections and so on, the consequence of a wirestrike can often be expected to be catastrophic. In that case, a large investment is made by operators, pilots and other parties involved in low-level operations to minimise the likelihood of a wirestrike. That includes by ensuring awareness of all known low-level hazards, including powerlines and tall structures, before commencing, and during the conduct of low-level operations."*
>
> *. . . .*
>
> *"During the series of recent ATSB investigations into fatal and other wirestrike accidents (all available on the ATSB website at www.atsb.gov.au), a number of different sources of information on the location of known powerlines and other low level hazards was identified."*
>
> *"Investigation BO/200404285 determined that the power supply company involved had digitally-mapped its infrastructure and would, with stipulated provisos, have no in-principle difficulty providing that information for use by pilots. The company cautioned, however, that national security concerns could impact on the availability of that data."*

"Similarly, investigation BO/200601663, in which the aircraft struck a telecommunication cable support wire during a powerline survey, found that the power supply company had also digitally-mapped its infrastructure and would, given the appropriate legal and other protections, release that data for use by pilots. . . ."

. . . .

". . . as a consequence of the investigation into the circumstances of the Parkes wirestrike, a number of safety issues with the potential to influence the conduct of future low-level operations were identified. That included that there was no single source or database of information on the location of known powerlines or tall structures available to pilots and other parties involved in low-level operations and campaigns."

. . . .

"The potential safety benefits of the availability to pilots, operators and low-level campaign managers of a single source or database of the location of known powerlines and tall structures are obvious . . . the apparent availability of that information as indicated by at least two power supply companies and the telecommunications company was cause for optimism. That and the likely safety benefits of the availability to industry of a single source or database of known powerlines and tall structures precipitated discussions by ATSB investigators with Geoscience Australia (GA) and the Energy Networks Association (ENA) to examine the feasibility of the establishment of such a database."

"Geoscience Australia - The initial indications from GA were that it would be happy to combine with a relevant agency that had the capability to 'pull together' all of the digital data provided by power supply companies, etc in order to promulgate that data for use by relevant parties. In addition, it appeared that there might be scope for the data to be made available for public access via the GA website."

"Energy Networks Association - The possible involvement of ENA in the development of a national database of information on the location of known powerlines and tall structures has been discussed by the ENA Electricity Technical Regulatory Committee. ENA has agreed to consider the scope of work involved in the creation of such a national database of powerlines and tall structures, however, has not yet committed to the project. The proposal to establish a national database will be considered by ENA as part of its 2008 priority issues."

The important things arising from the 2008 ATSB reports are that:- 1) It seems clear that most power and communications utility companies know exactly where their infrastructure (including overhead lines and towers) is located and have recorded that data in digital format that would be compatible with at least some geographic information services and could be superimposed on paper maps and added as layers or overlays onto a GPS-interfaced moving map display; and, 2) existing facilities such as a "dial-before-you-dig" are not practical for planning aerial bushfire suppression operations because they focus on a precise location and not an entire area of operations. The firefighting environment is too dynamic and too urgent to be adequately covered by such a service.

Current situation with respect to power lines, communication lines and communication towers in Australia

Examination of the ATSB Report[xv] into a recent wirestrike accident during a private helicopter flight in rural Victoria summarises the extent to which the 2008 discussions have been implemented.

> *"Mapping - Energy companies in New South Wales and Queensland provide general aviation pilots (including those conducting authorised low-level operations) with access to network maps of high voltage electricity transmission lines and lower voltage distribution lines. The information is provided with a caveat that it may not be current and accurate."*
>
> *"Similar access to network maps **is not provided by Victorian energy companies*** (emphasis ours) *although the Victorian Department of Environment, Land, Water and Planning has a Spatial Datamart, which includes high-voltage transmission network information. The data does not contain information on the lower voltage distribution network. Additionally, use of the data for flight planning purposes requires extraction of the powerline information from a large dataset and processing to present it in a readily usable format such a map overlay."*
>
> *"In addition to network maps, Queensland's Ergon Energy Network brochure "Working safety around electricity when low-level flying" reminds pilots to practice safe work habits including:*
>
> - *conducting a pre-flight briefing and reconnaissance*
> - *applying appropriate flying techniques*
> - *reading the physical structure indicators, e.g. poles and insulators*
> - *knowing the location of powerlines on and around the property or the area you are flying in."*

The situation with respect to marking overhead powerlines with high visibility balls is essentially unchanged since the 2004-2006 series of wirestrike accidents. The current Australian Standards are dated 2008 – but the marking criteria is essentially the same as in the prior Australian Standards.

The availability of locational information about low voltage overhead distribution lines, communication lines, and communication towers in West Australia, Tasmania and the Northern Territory is not known to the author. It is understood that electrical utilities in South Australia do make the information available to pilots – but in what format is not known.

Even though locational information is theoretically available to pilots and operators in some states – it is not necessarily available to pilots in a readily usable form. Paper maps with ALL powerlines and tall structures overlaid in their correct context with the surrounding terrain would be better than nothing – but handling paper maps while operating low-level could be distracting at a time of high piloting workload. Being able to switch "on" an overlay of powerlines and tall structures onto a moving map display showing the present position of the aircraft would be vastly more helpful in providing situational awareness to a fire fighting pilot.

It is not clear that the electrical or communication utilities would make the digital data they (in most cases) already hold, available to the developers of Electronic Flight Bag applications – absent a government directive to do so.

Potential for use of EFB's to provide advice of the location of lines and towers

As previously stated, modern Electronic Flight Bag (EFB) apps (OzRunways, RWY or AvPlan) running on iPads or Android tablets are a) widely used already for navigation during bushfire operations; and b) capable of displaying the location of power lines and communications towers as an optional "layer" or "overlay" superimposed on the moving map display.

It is anticipated that – even if provision of an optional "layer" of powerlines and communications towers incurred an additional cost – such a feature would be affordable to operators and the uptake of that optional feature would probably be universal among the aerial work operators engaged in firefighting operations.

The author understands that the main EFB supplier has contacts at each State's rural fire service headquarters, and is already working on some bushfire fighting-specific enhancements to their EFB. They have indicated their interest in providing a powerline and tower overlay if they can get the various networks' data.[xvi]

Possible Contrary Viewpoints

It should be noted that the ATSB data analysis[xvii] concluded, somewhat surprisingly, that in 63% of Australian wire strike accidents during the period 1994-2004, the pilot knew of the existence of the wire that was hit – but either forgot about it or misjudged distance from the wire and hit it anyway. This statistic might appear to challenge the author's submission that making a database of all overhead wires and tall structures available for incorporation into EFB moving map displays would be effective in reducing wire strikes during bushfire fighting operations.

The author submits, however, that there are two broad groups of low-level flying operations. One broad group would include aerial application operations and powerline patrol operations. These operations account for a good deal of the exposure to low level flight and a similar proportion of the wire strike accidents. The thing that distinguishes these operations from other low level aerial work flying such as firefighting, search and rescue, plague locust or noxious weed control and the like – is that in aerial ag and powerline patrol operations it is essential to know where the obstacles are - but it is also necessary to operate in close proximity to those powerlines in order to complete the job. Any temporary lapse of attention, misjudgement of distance, or misapplication of the controls can result in a wire strike or collision with a known obstacle.

In the second broad group of low-level flying operations (including aerial fire suppression), the area to be surveyed is much larger than is the case in spraying a specific paddock, or patrolling a particular section of powerline. With a much wider area to survey, there is an increased chance of failing to see a wire or a tower. It is the unseen wires and towers that pose the greatest threat to firefighting operations.[xviii] If the pilots of those aircraft know where a wire is – they can usually avoid it by finding another water supply for uplifts or another landing site. No single solution is 100% effective - but for firefighting aircraft – the author believes an early warning about location of a powerline will go a very long way toward preventing a wire strike involving that obstacle.

The different broad groups of low-level operations were lumped together by ATSB in deriving the figure of 63%. It seems likely to the author that a significant proportion of the "prior knowledge" occurrences involved aerial ag and powerline patrol operations where it was essential to operate close to the known obstacle.

In any event, wire awareness training and the current procedures for conducting a "high reconnaissance" before descending into the wire environment and other traditional wire avoidance procedures should still be carried out by firefighting aircraft even if wires are depicted on a moving map display. A comprehensive obstacle database should be considered an additional safety layer – not an alternative layer. Similarly, none of the "preventative" measures should be seen as obviating the need for "mitigations" such as WSPS, flight helmets, protective flight suits for all crew, flight following, etc. ALL of these measures are needed.

Feasibility of Alternative Wire Avoidance Systems

The danger of low-level aerial work craft – especially helicopters – encountering man-made structures has been pervasive world-wide and affects both civil and military aircraft. Several on-board avoidance systems have been proposed – and some have gone into production.[xix]

Passive Detection Systems

The Safe Flight Instrument Corp's "Powerline Detection System" senses the electromagnetic fields developed by live electrical power lines carrying 50 Hz or 60 Hz alternating current – and emits an audible alert through the aircraft's audio system and illuminates a red warning light in the cockpit. This system has been fitted to some air medical helicopters operating in Victoria. It is a relatively lightweight system – however it is believed the cost of acquisition and installation is very significant. The system only responds to live powerlines. It does not provide an alert for inactive lines or for overhead telephone lines or towers. The author has been informed that many overhead powerlines are not used all the time. Though often inactive, they are left *in situ* so that they can be used to bypass other lines that have been taken out of service for maintenance. Thus, the passive powerline detection system would provide alerts for only some of the overhead lines and towers that would be hazardous to low-level flying operations.

Active Detection Systems

The "HELLAS system" is an early-warning "ladar" (a combination of eye-safe laser and radar) device designed for helicopters that is said to reliably detect obstacles in the flight path, such as power lines and poles, which are difficult to detect visually during flight. The system detects ALL obstacles including trees. Since most bushfire fighting operations occur in forested areas, it seems likely that a helicopter on water bombing operations would receive constant alerts from trees that are easy to see – and a cluttered display that might conceal a SWER line that is otherwise impossible to see. The author has not been able to ascertain a price – however it is believed to be significant. HELLAS has apparently been installed on some military helicopters in Europe and the USA.

Database Systems

Airlines and high-end corporate aircraft are usually equipped with "Enhanced Ground Proximity Warning Systems" (EGPWS). GPWS is a radar altimeter-based system that uses algorithms to predict whether an aircraft is on a flight profile that will result in collision with terrain. "Enhanced" GPWS

adds a database of obstacles to the radar altimeter-based system to warn of collision with either known obstacles or terrain.

Many general aviation aircraft are fitted with Terrain Awareness and Warning Systems (TAWS) – which compare the aircraft track and altitude with a database of terrain and obstacle to provide a display of potential collision hazards on the aircraft's flight path. Some helicopters are equipped with HeliTAWS – a development of TAWS with modified algorithms to account for the fact that helicopters normally operate much closer to the terrain and obstacles than fixed-wing aircraft. One of the most popular brands of GPS navigation systems used by helicopters in Australia has HeliTAWS as an optional feature.

Because most of the low-end power distribution network and many of the smaller communications towers in Australia ARE NOT required to be reported to the RAAF AIS – they are not included in the database of any of the EGPWS or HeliTAWS systems. Conversely, if the location and height of these obstructions was made available in a single database – then warning of those obstructions would likely be available to the pilots of aircraft equipped with EGPWS or HeliTAWS.

In essence, displaying locational data for the lower end of the overhead distribution network, and the communications infrastructure would make that information available to any pilot in possession of an iPad or Android tablet and a subscription to OzRunways, RWY, or AvPlan - whether EGPWS or HeliTAWS were installed or not. Tablets with those apps are already widely used by firefighting aircraft so that the cost to implement a databased wire avoidance system would be relatively low.

Infrastructure-based Avoidance System

An Obstacle Collision Avoidance System (OCAS) was developed in Norway consisting of L-band radars installed on mast-mounted antennae, near obstructions such as power lines or towers. When an approaching aircraft is detected, the OCAS activates ground lights and warnings when a collision looms, and it then illuminates the obstruction, using any lighting near these structures. If the lights don't convince the pilot to change course, the system broadcasts an aural warning on all aeronautical VHF frequencies at low power – to keep the broadcast from propagating beyond the immediate hazard area.

The author understand OCAS has been used in Norway, Germany, Canada and the USA. Its predominant application appears to be in arctic or near-arctic latitudes where dark sky prevails for months at a time.

It seems obvious that the cost of installing such a complex system along every section of the power distribution network in Australia would be astronomical – and would likely require the upgrading of line capacity just to power the alerting system.

Who has a greater entitlement to access low level airspace?

The issues surrounding a landholder's property interests in the airspace superjacent to their property have been addressed by common law, statutes and international treaties – and the law is reasonably settled.[xx] An occupier is entitled to claim exclusive control only over as much of that airspace as they can reasonably use. Like all property rights, it is subject to the doctrine of eminent domain – the right of which is presumed to accrue to public utilities.

The question of whom, if anyone, among the other competing users of airspace has a greater entitlement to that access is not settled at all. In general, Civil Aviation Regulation 157 prohibits

flight below 500 feet above ground level (AGL) over a non-populous area without specific approval from the authority. Specific low-level authority is normally granted to holders of an air operators certificate authorising aerial work operations such as aerial application, cattle mustering, pipeline or powerline patrol, search and rescue, or aerial fire suppression operations. Low level permissions are invariably granted by CASA subject to conditions requiring safety and risk management programs plus special crew training and licensing qualifications.

Since 2014, CASA has required a "low level rating" to be held by pilots engaged in low level aerial work with an appropriate endorsement – such as the "winching", rappelling", "sling load", or "Fire Fighting – Helicopter" endorsement.[xxi] Fixed wing firebombing requires an "aerial application" rating.

Thus, helicopter operators and pilots appropriately authorised by CASA can legally operate in low level airspace on firefighting operations; power and communications utilities may be authorised to construct overhead lines and towers intruding into that same low level airspace, and drones may also operate within that airspace subject to some CASA regulation. Does anyone have a greater right of access to that airspace than another – or an earlier claim?

Obviously, farmers and occupiers of rural residences want the convenience of electrical power (and reliable telephone coverage) – ideally at a reasonable price. Presumably they also would like to have wildfires that might threaten their property contained by the most expeditious means possible. Helicopter operators and pilots would like to be able to assist the fire authorities in containing wildfires – but would prefer not to place their assets or their lives at unreasonable risk in so doing.

It seems inevitable that legislation or administrative action by governments pursuant to a cohesive policy will be necessary to properly balance the legitimate but sometimes competing interests among users of low level airspace. It is hoped the Commission will encourage formation of such a cohesive policy.

About the author

The author of this private submission is an Air Transport Helicopter Pilot, Flight Instructor, and Flight Examiner with fifty (50) years and 12,000 hours rotary-wing aeronautical experience. The author has extensive low level flying experience and is approved by CASA to train and test for the Low-Level Rating (Helicopter) with sling load, winching and rappelling endorsements. The author has worked most of the last forty (40) years for emergency services in eastern Australia including the Surf Lifesaving Westpac Rescue Helicopters, Child Flight, CareFlight NSW, CareFlight Queensland, and the NSW Police Aviation Support Branch. The author also flew US Army helicopters in the Republic of Vietnam prior to immigrating to Australia. The author was involved in what is believed to be the earliest use of a helicopter for water bombing in Australia during the 1977-78 bushfire season while engaged by the ACT Bushfire Council in Canberra – and has participated in bushfire fighting campaigns periodically since then. The author holds undergraduate and graduate law degrees from Sydney University and UTS, respectively; and is a non-practicing solicitor of the NSW Supreme Court and High Court of Australia.

Recommendations

We urge the Commission to highlight to the Federal Minister for Aviation and CASA, and to the Federal Minister for Communications, and to the respective State Ministers responsible for power distribution, the hazards posed by unmarked and uncharted overhead power and communications infrastructure, and the adverse impact these hazards have on timely firefighting efforts.

We further urge the Commission to recommend the establishment of a single Australian database of known powerlines and tall structures to be administered so that the digital data can be accessed by Electronic Flight Bag application developers at minimal cost.

Lastly we urge that the Commission should recommend to Federal and State Governments the enactment of legislation compelling those power transmission/distribution and communications utilities who erect or have erected towers or overhead lines, to provide and update as necessary the locational data for those items of infrastructure in a format compatible with at least one geographic information systems (GIS) capable of generating an overlay on aeronautical charts.

We believe that certain issues – such as, for example, an appropriate, standardised GIS format, what (if any) infrastructure should be excluded from the database on national security grounds, the possibility of a statutory indemnity for inadvertent misdescriptions or omissions, definitions of what constitutes a "tall structure" for the purposes of the single database, and a standardised depiction of the information on a moving map display – should be resolved by consultation among the aviation firefighting communities, the bushfire fighting and emergency services communities, the power and communications utilities and the EFB app developers.

Endnotes

[i] ATSB Transport Safety Investigation Report – Aviation Research and Analysis Report – B2005/0055 – Wire-strike Accidents in General Aviation: Data Analysis 1994-2004 – at P. 49.

[ii] Advisory Circular AC 139-08(0) - April 2005 - Reporting of Tall Structures. See also CASR 139.365 requiring the owner of a structure (or proponents of a structure) that will be 110m or more above ground level to inform CASA.

[iii] AS 3891.1—2008 - Air navigation—Cables and their supporting structures—Marking and safety requirements - Part 1: Permanent marking of overhead cables for other than planned low-level flying operations; and, AS 3891.2—2008 - Air navigation—Cables and their supporting structures—Marking and safety requirements - Part 2: Marking of overhead cables for planned low-level flying operations.

[iv] E.g. "OzRunways", "AvPlan", or "RWY".

[v] National Aerial Firefighting Centre - Aerial Firefighting website; http://nafc.org.au/?page_id=113.

[vi] Wire Strike Resources – Civil Aviation Safety Authority (CASA); https://www.casa.gov.au/standard-page/wire-strike-resources

[vii] ATSB Transport Safety Investigation Report – Aviation Occurrence Report 200600523 – Wirestrike 15 km east of Parkes, Aerodrome, NSW, 2 February 2006 – VH-MFI – Bell Helicopter Co. 206B (III) at P. 19.

[viii] While nearly all water bombing operations have been conducted during daylight hours to date, there are now extant trials in Australia of night firefighting operations including water bombing by crews equipped with night vision goggles. One feature of NVG operations is that the goggles produce monochromatic images. The red warning lights traditionally installed on tall structures in the vicinity of airports cannot be distinguished from any other light sources when viewed solely through NVG's at night.

[ix] Aviation Occurrence Report 200600523 – *supra* – at P. 7. See also AS3891.1, AS3891.2, CASR 139.365 and AC139-08 – *supra*.

[x] *Inquests into the deaths of Ross Kenneth Mill, Benjamin McDonnell, Shane Haldane Thrupp, Ian Phillip Stephenson and Malcolm John Buerckner*; NSW Deputy State Coroner Milovanovich; Mudgee Coroners Court 3/4/2007 to 4/5/2007 and Forbes Coroners Court 21/7/2008 to 1/8/2008.

[xi] Per Bellew J *in Ingrid Margaret Stephenson v Parkes Shire Council; Natalee Stephenson v Parkes Shire Council; Jay Stephenson v Parkes Shire Council; South West Helicopters Pty Limited and anor. v Essential Energy (formerly Country Energy); Parkes Shire Council v South West Helicopters Pty Limited*; [2014] NSWSC 1758 at para. 232.

[xii] Aviation Research and Analysis Report – B2005/0055 – *supra* at Pp. 15-16.

[xiii] Aviation Occurrence Report 200600523 – *supra* – at P. 37-38.

[xiv] ATSB Transport Safety Investigation Report - Aviation Safety Issue Investigation – AI-2008-019 – Examination of the feasibility of the establishment of a single source or database of known powerlines and tall structures.

[xv] ATSB Transport Safety Report - Aviation Occurrence Investigation AO-2019-031 - Wirestrike and collision with terrain involving Robinson R44, VH-KCH near Mansfield, Victoria, on 6 July 2019.

[xvi] Email exchange dated 1 April, 2020, between the author and Andrew Boniface, Enterprise Accounts Manager for OzRunways and RWY.

[xvii] Aviation Research and Analysis Report – B2005/0055 – *supra* at P. 53.

[xviii] *E.g.* Newman, Brett; "Bird on a Wire"; *Flight Safety Australia*, March-April 2001; Pp. 18-20.

[xix] Aviation Research and Analysis Report – B2005/0055 – *supra* at P. 34.

[xx] Bartsch, Prof. Ronald I. C.; *Aviation Law in Australia* (5th Ed.); Law Book Company; at paras. 1.75, 5.260, 19.130 and 21.70.

[xxi] CASA Instrument 57/18 dated 28th August, 2018 – *Flight Training (Helicopter Firefighting Endorsement) approval 2018.*