THE WINSTON CHURCHILL MEMORIAL TRUST OF AUSTRALIA

Report by – Anthony de Wit BHSc, BEdSt, Grad Dip Emerg Health –
2011 Churchill Fellow

THE SIR WILLIAM KILPATRICK CHURCHILL FELLOWSHIP
Improving aero-medical patient care and mission safety practices in Australia

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Signed: Anthony de Wit
Dated: 7th October 2012
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Introduction

In 2011, I was the recipient of the ‘Sir William Kilpatrick Churchill Fellowship’ to benchmark world practices in aero-medical patient care and mission safety practices against that of the Australian system. Particularly, this paper considers Helicopter Emergency Medical Service (HEMS) operations.

Awarded travel for 6 weeks and to visit 5 organisations, this paper has been produced after I self funded additional travel to undertake the study over a 12 week period within Europe and North America. Ten organisations were visited including the attendance at a meeting in Rome of various worldwide aero-medical leaders to prepare for the ‘Airmed 2014’ conference.

This report will not provide the reader with an analysis of ‘which organisation’ or ‘system’ is the ‘best’ as was often asked whilst travelling for this fellowship. It will though, make the reader aware of what was discovered during this fellowship with the intent that the reader consider this paper when he/she is looking to establish, improve or change an aero-medical system within their State/Territory and thus improve patient care and outcomes.

Reviewed will be some of the most basic of issues through to some of the more advanced practices of hoisting/winching operations for both land and water. It should be noted that based on this fellowship, it is my opinion that Australia is doing well but there is room for improvement.

I wish to acknowledge and thank the following people who assisted me in making this fellowship possible; Mr Greg Sassella (CEO), Mr Mark Rogers (General Manager), Mr Paul Holman (Operations Manager) and Mr Philip Hogan (Manager Air Operations and Churchill Fellow) from Ambulance Victoria and Air Ambulance Victoria for their support and encouragement.

In particular, I wish to genuinely thank Ms Louise Niggemeyer CCRN, for all her support and counsel and Ms Yvonne Singer RN, who as a Churchill Fellow, encouraged, supported and ensured that she left no stone unturned as she prepared me for my successful Churchill Trust application process.

Lastly, I wish to sincerely thank the Churchill Trust and especially the family of Sir William Kilpatrick for whom I am deeply honoured to receive such an award.
Executive Summary

Name: Anthony de Wit BEdSt, BHSc, Grad Dip Emerg Health (MICA Paramedic)
Address: c/o Air Ambulance Victoria, Unit 4/12 Larkin Crt, Essendon Fields, Victoria, 3041
Position: HEMS Team Manager & Intensive Care Flight Paramedic
Telephone: (03) 99459913

Project Description

Medical air retrieval services in Australia such as Air Ambulance Victoria are responsible for the pre-hospital management and retrieval of the critically injured, quite often from remote and austere environments.

Australia's terrain coupled with the variable and often severe climatic conditions can make the recovery and ensuing care of the patient rather challenging for both the patient and the rescuer.

The aim of this fellowship was to benchmark mission safety practices and training with other international aero-medical services and colleagues.

Itinerary

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*The USCG cancelled planned visits upon the day of entry into the USA. After further negotiations, Capt. Deal from Air Station Kodiak provided a modified program to enable this fellowship to be completed, albeit not to the original intended outcome.
Recommendations

- Creation of a national body under the Civil Aviation Safety Authority (CASA) to be responsible for aero-medical regulations and standards. This body would be responsible for:
  
  o Creation of a national standard for HEMS pilot experience/qualifications (preferably twin engine) for employment.
  
  o Creation of a national standard for fixed wing pilot experience/qualifications for aero-medical operations (preferably twin engine) for employment.
  
  o Developing a national standard for minimum aircraft capability for HEMS (e.g. twin engine, IFR, HTAWS, Category A helicopter).
  
  o Developing a national standard for minimum fixed wing aero-medical aircraft capability (e.g. twin engine, IFR, TCAS, two stretcher capable if required).
  
  o Developing a national HEMS/Aero-medical fixed wing safety notification system. This could be industry lead via Aero-medical Society Australasia (ASA).
  
  o Formulating aero-medical regulations to include members of the medical team working for an aero-medical operation to be included as ‘aircrew’. Thus subject to the same fatigue management system as pilots.
  
  o Implementation and carriage of the ‘electronic flight bag’.
  
  o Creation of an Australian database of all HEMS helipads Australia wide, which is to include photographs and the ability for upload to the electronic flight bag.
  
  o Develop a national standard for hospital helipads.
  
  o Develop a national standard for winch/hoist hand signals.
  
- State/Territory governments to factor HEMS into future infrastructure planning for population growth, increased traffic congestion and access to specialist medical facilities.
  
- State/Territory governments through their Ambulance Service to remain ultimately responsible for the provision of aero-medical services, in a manner befitting that state.
• Helicopter and fixed wing operations to remain under the coordinated response of one service, ideally the State/Territory Ambulance Service.

• An amendment to the National and State/Territory Emergency Management Act to include Ambulance/HEMS for the provision of support to Police/Rescue Services for land and water based rescues.

• Inclusion of one national radio frequency that all emergency services can access in the event of a combined cross border response especially involving the use of HEMS.

• Hospital helipads to remain primarily for HEMS use unless otherwise approved by the respective State/Territory Ambulance Service.

• Protected airspace to be provided for major hospital helipads.

• Major Hospital helipads to have GPS approach technology and weather reporting capability with video and Internet technology.

• Implement point in space (PinS) technology for hospital helipad approaches.

• HEMS bases and hospitals to have 24-hour weather reporting capability with Internet and video technology.

• Improve response capability to significant medical conditions such as Neurological and Cardiac cases in the age bracket of 18 to 70 years of age.

• Improve the sharing of information between state agencies with regards to aero-medical operations and in particular safety related matters.

• Helicopter and Fixed-Wing response times to only be monitored locally but not as a Government key performance indicator (KPI).

• The provision of training and education via a mobile simulation vehicle.

• The establishment of a combined emergency services training facility to incorporate hoist/winch operations, swift water, chair lift/gondola and stranded parachutist rescues.

**Methodology/Ethics**

Organisations were contacted formally and personnel visited and interviewed were informed that I would be taking notes and photographs for the purpose of this report.
Dissemination

Dissemination of information contained in this report will be by means of, but not restricted to; conference presentations, peer review journals, industry professional bodies and via the Council of Ambulance Authorities.

System of Operations

Worldwide there are many and varied aero-medical systems that are in operation and when one tries to compare Australian operations against their counterparts overseas one must take into account these various systems and the training and education that some of the aero-medical personnel have undertaken.

The European model uses a Doctor/Paramedic based system, whilst in North America they use either a Paramedic/Paramedic, Paramedic/Flight Nurse based approach, with the United States system also requiring State Licensure.

The European model generally uses twin engine, single pilot, and mainly daytime operations except in Switzerland and Czech Republic where it is 24-hour operations. Germany also has a number of bases that are 24-hour, being Christoph Munich, Christoph Regensburg and Christoph Sande to name a few.

The North American system needs to be separated between the United States of America (USA) and Canada, with the Canadian model visited having two pilot, twin engine, day/night operations and the USA being about a 50/50 split for single and twin engine operations.

Another example is the difference in training and education that Paramedics receive around the world. What has been identified during this study is that there are many differences between Australian Paramedics and our counterparts worldwide. Australian Paramedics could be closely aligned with Paramedics from Canada when we look at training, education, skills and autonomy.

However this difference is not restricted to Paramedics as there were similar issues for that of the medical doctor tasked with crewing aero-medical helicopters, especially in Europe. There appeared to be no consensus as to which type of doctor should staff these aircraft and as such you may encounter an anaesthetist, trauma surgeon, emergency physician or perhaps a general practitioner.

A common theme amongst the systems visited within Europe and raised for discussion during the ‘Airmed 2014’ pre-meeting by Doctors was the lack of Doctors within the world healthcare system and that, where once the Doctor was
called out whilst on shift within the hospital he/she worked, they are now asked to complete their duty on the helicopter when on days off from their normal hospital duties. Thus ensuring that Hospital’s maintain their staffing requirements.

This point is raised within this document purely as a result of many discussions regarding the Doctor based system versus the Paramedic or Flight nurse based system (excluding inter-facility or inter-hospital missions) and this discussion will no doubt continue.

In the US the crew configuration has evolved to principally the RN/Paramedic model with physician delegated practice, and has been more cost effective amongst US (for profit and not for profit) HEMS providers. If as reported, there is a shortage of Doctors within Australia and not the same shortage of Paramedics or Flight nurses, then one could argue to gradually change all aero-medical services to a system that uses a specialist medical retrieval Doctor for complex cases between hospitals.

The advantages would be an increase in the availability of Doctors within the hospital or private system, reduced organisational training and associated costs (uniform, wages, aircraft operations, etc), as the required pool of medical retrieval specialists would be less. Of course this would be dependent upon the skill set, training and education of the Paramedics within that State/Territory system and may result in requiring further education and/or ‘up skilling’ the Paramedic within that State or Territory.

During the various ‘scene call’ aero-medical missions flown whilst undertaking this fellowship, there were no medical interventions by any Doctor or Flight Nurse that could not have been undertaken by a Critical Care or Intensive Care Paramedic within the Australian system. Provided the Australian Critical Care or Intensive Care Paramedic was skilled in Rapid Sequence Intubation (RSI), which is a procedure that places a patient into an induced coma, then inserting a breathing tube and subsequently controlling the patient’s breathing.

Additionally, the skills of chest decompression, emergency airway procedures, arterial line placement and monitoring, ventilator support, inotropic support, various forms of analgesia and paediatric RSI to name a few, are some of the other clinical skills and education required. An example of such education and skills is the Victorian Intensive Care Flight Paramedic.

**System of operations recommendations:**

- HEMS should be part of the State/Territory Health system.
- HEMS should be integrated with the State/Territory Ambulance Service.
- HEMS should be despatched through the State/Territory Ambulance Service.
• Develop a National Standard for HEMS Aircraft specifications.

• Develop a National Curriculum for HEMS medical crews.

**Figure 2: Hoist/Winch Training near Nuremburg, Germany**

**Performance Indicators and Reporting**

There was no consistent theme in performance indicators and reporting other than all organisations’ objective to be airborne as soon as possible. Some organizations monitored this as a ‘Key Performance Indicator (KPI)’ whilst some did not.

**Time to airborne**

Germany’s requirement was to be airborne in two minutes from receipt of call and this was achieved in all missions flown whilst undertaking this fellowship. There was no running to the aircraft as is often speculated, rather systems in place to aid in short airborne times. Some of which will be discussed further in this report.

Flight times within Germany were generally short, around fifteen minutes with a radius of approximately 50 - 70 kilometres and this aids in being airborne within the two minutes.

REGA of Switzerland does not report on time to airborne as they rely on the crew getting airborne as soon as possible. All staff know the company philosophy and therefore comply with it and the helicopter crew are also aware that they are required to advise if there is a delay for any reason.

The belief of attaching a KPI to airborne times pressures the crew to respond and as such conflicts with the safety message and this is something that I concur with.
Arguably, rather than reporting time to airborne as a standalone KPI it should be monitored ‘within house’ and strategies taken to ensure that aircrews have systems in place that allow them a timely response.

**Improving time to Airborne**

There were various innovative systems in place to aid time to airborne, some simple and some requiring more technology.

The first obvious one is having the crew and the helicopter located at the same base, with only a short walk to the aircraft and helipad. While some may say this is common sense, it is still the practice in some organizations to have their crews located some distance from the aircraft and thus requiring the medical crew to drive to their aircraft.

It is also prudent to have the medical crew solely rostered to an aircraft rather than being rostered on multiple platforms such as a road response unit. That is to say, that if you have a medical crew that is also required to provide a normal road Ambulance response then you have to accept that your time to airborne will never compare to that of other organizations.

Technological advancements of mission status systems can improve response times by the use of a mission and navigation system that allows a case to be placed onto the helicopter navigation system upon receipt of call. Thus allowing the crew to program navigation within seconds of entering the aircraft.

Alternatively, fitting a GPS mapping system to an aircraft that is able to be sent case details by an 'email' that contains all mapping information etc. from Google maps and alike will also aid time to airborne. Upgradeable GPS so that obstructions or wires can be entered into the system once a new obstruction or wire is identified is particularly beneficial from a safety point of view and for improving future response.

Helicopter base operations room should have computerized weather reporting, phone, facsimile, Internet, and radios thus allowing timely checks of weather conditions, ease of flight preparations and monitoring of local emergencies.

Weather cameras at major hospital helipads linked to the Internet with a direct feed back to the aero medical organization would also prove beneficial in flight planning.

Hangar doors that are fast opening/closing remotely controlled from within the helicopter would also save time, in particular for bases that once the helicopter departs has no other personnel present to ensure base security.

Helicopters that are based where they may be subject to snow and require their helicopter to land on a portable pad for ease of movement into and out of their
hangar may benefit from a heated rail that the helicopter is then rolled in and out on. Again this would be remotely operated.

Fueling facilities should be onsite thus negating the need to wait for airport refuellers if located at an airfield as this can effect time to airborne. It also allows for a ready response for the next mission.

**Scene times**

Scene time can be described as the time from a helicopter landing following despatch, to the time the helicopter becomes airborne with the patient. Again another controversial KPI, as what constitutes a good scene time? Is it 10, 20, or 30 minutes and does it matter if you are in a hospital or on a roadside?

Is your scene time driven by maintaining availability or is there another driver?

Scene times vary according to the task at hand. A patient trapped in a silo, motor vehicle, under a house, or in a trench are just a few of the many scenes that can be complex and take time. Sometimes missions can take hours and all need to be undertaken safely.

All operations visited strived for the shortest possible scene time whether it was a ‘scene call’ or an inter-hospital/facility transfer. There was no unnecessary procedure undertaken to delay transport to hospital.

Monitoring this KPI is beneficial in the sense of trying to improve the system, whether that is via a teleconference whilst in-flight to a hospital so that they can prepare for your arrival or to have particular clinical intervention completed and paperwork at hand to ensure a shorter hospital time.

Little systematic improvements like those mentioned above can achieve a shorter hospital scene time. As for the out of hospital environment, well that depends on your crystal ball, because if you know exactly what you are going to find when you land then you’re already ahead of everybody else.
Flight times, missions, patients transported, locations, etc

It would be beneficial to have an easy and appropriate reporting system which allows tracking of an organisation without any implication on the safety message or the implied pressure upon staff performance to potentially ‘cut corners’.

A report capturing this information allows you to understand your business and future planning needs with regards to helicopter base location or even fixed wing and thus minimising time to scenes or areas of high workload.

An example maybe the moving of a helicopter base or the temporary location of a helicopter to access the snowfields easier during the winter months that equates to improved time to scene, time to patient and thus time to hospital.

It may also mean that consideration is given to the relocation or establishment of a fixed wing base in another area following the ongoing analysis of your workload. Such reporting may even be of use to other emergency services and governments if it is highlighted that a particular location is associated with a high incidence of motor vehicle accidents which could ultimately result in an improvement to roads.

Safety

During this fellowship, a number of organisations had varying ways of managing safety and also had varying philosophies to aid safety. The adage in a 4-person crew of “4 to go” and “1 for no” was a consistent theme during this fellowship.

Also, there was the philosophy of some to not advise the pilot of the complete mission details but rather broad information that allowed for flight planning but prevented any undue pressure on the pilot to ensure that a mission was undertaken.
Safety reporting should be undertaken and available to all staff thus ensuring transparency and a means to advise staff, create a sharing environment, make staff think about their own practice and ultimately improve your organisations’ safety.

Elements of effective safety reporting appeared to be:

- Computer based safety management system.
- Anonymous entry reporting if required.
- Talking culture encouraged and developed.
- Incident and accidents reported.
- Safety alerts sent to all staff, coupled with a yearly presentation.

On the point of a talking culture, one organisation tends to keep their black out curtains in place for all missions thus isolating the pilots from the medical crew. The medical crew are also isolated from all communications except for take offs and landings, albeit that they can alert the pilot that they wish to talk to them. One could question if this behavior is developing a talking culture and does it provide for good crew resource management? In my opinion it does not.

In regards to a yearly presentation to staff on safety related matters, this was witnessed whilst in Switzerland and a presentation provided to on duty staff as well as mountain rescue guides who were attending for their yearly training.

Presented were the statistics and then a précis of significant safety issues where attending staff could learn, share and discuss the issues surrounding the reported incidents.

Safety reporting affects not only the aviation operator, but also the air medical crew and sundry personnel that may help out at incident scenes. Safety is to be promoted to all and not shied away from.

**Clinical reporting**

All organisations provide a written or computer based report to the receiving hospital, but what about establishing a clinical KPI? Something that does not
have safety implications, however does look at improving patient outcomes or clinical care?

An example of some clinical KPIs could be:

- Pain score less than 3/10 on arrival at hospital.
- Time to CT scan upon arrival at hospital is less than 10 minutes (cooperation required from the hospital).
- All intubated patients require oesophageal temperature monitoring.
- Patient vital sign documentation is achieved every 15 minutes.
- All patients with a GCS of 10 or less are intubated for flight.
- All eyes taped closed for intubated patients.

These examples are only offered to create a discussion within your organisation on how you may choose to monitor your clinical performance and as such improve patient outcomes.

There are many ways to monitor clinical performance and clinical audit is another means whereby a senior clinical person reads, audits, critiques and provides feedback to the aircrew in an effort to support and improve staff development and improve patient management.

During this fellowship it was not clear that all organisations were undertaking such a clinical audit process.

**Performance indicators and reporting recommendations:**

- Develop national clinical KPIs.
- Develop a national Aero-medical safety reporting database.
- Develop national Aero-medical building/facilities standards.
- Include 24-hour weather reporting at all aero-medical bases.
- Include 24-hour weather monitoring at all major hospitals with a helipad.
- Implement yearly safety presentations and education for aero-medical crews.
Regulations and Standards

European countries are working closely together to set standards for airspace, helipads and aircraft standards. In particular, maintaining the twin engine standard for HEMS operations.

It could be argued that there may be a place for single engine HEMS in the remote interior parts of Australia where it would be hard to justify the cost of a twin engine aircraft due to low volume work load. This would be the exception rather than the rule.

America on the other hand continues along a path of single and twin engine operations, including privatisation. Deregulation allows for a competitive market place for aeromedicine and there are a number of Department of Transportation requirements to comply to.

Australia has the Civil Aviation Safety Authority (CASA) regulations and also some State/Territory regulations to comply with. That being said, the European system seems to be well advanced in standardising some areas of the aeromedical system.

Interestingly some countries still have some of the same issues that we appear to have here in Australia. Particularly with regards to noise complaints, helipad construction and aircraft performance requirements.

Helipad design

In one country, there was a helipad issue due to weight limitations with the design of the interior of the hospital and therefore they keep the aircraft defueled and then fuel the aircraft post dispatch. Obviously, this impacts on time to airborne.

Another country had a helipad of poor or faulty design that resulted in ground resonance causing total helicopter damage.

Within Canada, helipads are rated as:
- H1=twin engine (cat a)
- H2=twin engine (non cat a)
- H3=single engine

Most, if not all hospital helipads within Europe, are made to a Category 'A' standard and this should be the standard for Australia regardless of the number of take-off and landings into the said hospital.
Some organisations have or are working on having GPS approaches into all major hospitals with helipads. The use of this technology has the ability to improve flights into and out of hospitals, in particular, during times of some weather constraints.

**GPS approach**

REGA currently have ‘Project Helios’ which is a project considering ‘point in space’ (PinS) approach to hospitals which gives the ability to fly above the cloud and then descend to the hospital. The PinS approach is a concept developed from fixed wing and at the time of writing this paper there was one hospital that REGA were flying into which uses this technology.

**Point in space**

REGA currently have ‘Project Helios’ which is a project considering ‘point in space’ (PinS) approach to hospitals which gives the ability to fly above the cloud and then descend to the hospital. The PinS approach is a concept developed from fixed wing and at the time of writing this paper there was one hospital that REGA were flying into which uses this technology.

**Weight, Balance & Equipment**

The issue of weight and balance is a constant concern for all EMS pilots worldwide. Pilots wish to have aircraft performance and medical crews wish to carry all that they can to deal with that inevitable emergency that may just ‘pop up’.

It is a fine balance between the two and at times the aircraft could be configured mission specific at the time of request, however this can delay response and this delay is not desirable although at times it is necessary, say in the setting of an offshore rescue where special survival equipment for the crew and overhead airborne safety surveillance maybe required.
In an effort to minimise weight of medical equipment (all items required to stock the aircraft) it is recommended that all aero-medical operations stay up to date with the lightest and most practical equipment that is available on the market.

While this may prove costly at times, it is a cost that can be recouped from less refueling, less flying time, less mission times therefore less impact on the flight crew and more impact on the patient as you will have them to hospital sooner than if you required a refueling stop.

Wherever possible all pharmacology taken on missions should have a dual purpose and items that only have one use should be kept to a minimum. This can prove problematic at times but the clinician should be able to use their judgment and modify their management rather than carry a complete pharmacy for 100% of the time when the likelihood of using that said medication maybe less than 1%.

**Electronic Flight Bag**

Electronic flight bag minimises weight and replaces all flight manuals and helipad booklets and maps. This unit can be synchronized everyday at a dedicated time thus ensuring it is up to date with the latest information, whether that is flight manual or helipad information.

Mission times can be loaded onto this system and directly uploading once synchronization has taken place thus minimising paperwork and ensuring timely data collection.

Again this technology is relatively new and the aviation regulators are slow to move on approving this technology.

**Regulations and Standards recommendations:**

- Hospital helipads to be built to Category ‘A’ standards.
- GPS approach for hospital helipads.
- Monitor/Investigate Project Helios; ‘point in space (PinS)’.
- Standardise medical equipment.
- Introduce electronic flight bag.
Hoisting/Winching Operations

Hoisting/Winching operations is a high-risk activity whether it be water or land based. The crew must be highly trained, competent and must undertake ongoing skills maintenance.

During this fellowship there was strong focus on studying the techniques of hoisting/winching operations in an endeavour to benchmark current practice and attempt to gain insight into systems that have evolved over the years.

Training was sighted and at times participated in with DRF Luftretting, ADAC and REGA with all three of these organisations mainly undertaking land based or mountain based rescues. Water operations were seen as the specialty of the USCG, however all planned activities with the USCG were cancelled at the last minute upon arrival into the USA.

Despite this set back, a modified visit to the USCG at Air Station Kodiak (Kodiak Island) Alaska, was completed and whilst there was no water winching operations or training observed, there was discussion with a senior pilot and senior rescue swimmer and for this opportunity I am truly grateful.

Land Based Hoisting/Winching:

During the visit to Europe all helicopter operations had similar standards and training requirements and all included yearly training for the local mountain rescue guides, Paramedics and Doctors.
Germany has a purpose built facility to undertake winch training for new trainees in a controlled and simulated environment. This facility is shared with the Mountain Rescue Guides and is also used to undertake controlled simulation training for parachutists stuck in trees, as well as various ski lift rescues, ranging from quad seated chairs to gondolas.

The training facility allows the trainee to be flown around inside the building and practice their normal doorway procedures and their on ground procedures in a safe and secure environment. Trainee stress can be increased in a controlled manner by introducing rotor downwash, engine noise and flashing lights, which is all part of the automation system.

Within the building there are various platforms that enable the trainee to practice winching operations at various terrain angles and to undertake various winch procedures.

Refer to the following link [http://www.bw-zsa.org/?id=331](http://www.bw-zsa.org/?id=331) to view some of the specifics of the facility.

![Figure 8: Hoist/Winch Training at the German Simulation Training Centre](Image)

Switzerland undertakes two types of hoisting or winching operations, that being the standard (albeit longer cable) side mounted hoist and they also undertake a ‘long lining’ procedure where the rescuer is secured to a climbing rope up to 200 metres in length below the centre of the helicopter.

At times, the long lining technique is required due to the height of the Swiss Alps and this procedure is also undertaken in some other countries such as the
Canadian Rocky Mountains. Some countries also undertake a similar procedure to execute water winch/hoist operations but this was not sighted during this fellowship.

The rescuer during the long lining procedure maintains communications via a portable radio with the helicopter crew and guides them in for a height perspective while the winch operator judges the distance of travel and maintains close visual contact with the rescuer and relays information back to the pilot.

Generally for hoist/winching operations, the rescuer will take a small backpack that has their snow shovel and a patient harness and some karabiners. They also carry an avalanche transceiver at all times during winter. Also taken is a small medical kit that suits 80% of missions and this fits into the hoist/winch pack.

In regards to winch/hoist procedures, the main aim within the European model was to shorten hover time and winch the rescuer out or in whilst moving forward in an obstacle free environment and come to a hover when the rescuer was in close proximity to the target. This procedure can be problematic in an obstacle filled environment but it does also negate the use of an anti-rotation (tag-line) as the forward motion inhibits the effects of rotor downwash.

![Image](image.png)

**Figure 9: Long lining near Wilderswil, Switzerland**

It is also an option where there is no suitably trained personnel to operate the anti-rotation/tag-line. Generally, in Europe only trained personnel are used to operate the anti-rotation/tag line due to a number of incidents over the years.
Communications between the winch rescuer and helicopter was either achieved by radio communications via a portable radio or through the use of hand signals. Hand signals were generally seen as reliable for most hoist/winch operations except in the setting of long lining where at 200 metres it may be difficult to see certain hand signals.

The use of a hand signal that means you are attached to two points is a valuable sign as it clearly indicates that for a brief period of time (maybe 10 seconds) aircraft fly away capability is compromised and would mean cutting the winch/hoist cable immediately should there be an engine failure or other emergency.

Another valuable hand signal inclusion is the tapping of the ear to mean “come up on your radio” if equipped.

**Water Based Hoisting/Winching:**

As mentioned earlier this part of the fellowship research was not as thoroughly researched as was initially proposed due to the cancellation of some of the USCG visits. With this in mind, the following is offered for consideration.

Water based communications still relies on the tried and trusted use of hand signals within the USCG. Water based communication systems are still being perfected, but to date, given the water and proximity of helicopter operations to the rescuer, hand signals still prevail.

Diver drops or free falls maybe undertaken during day rescues but not at night with the decision regarding which rescue method to use and which equipment (rescue basket alone or rescue basket +/– rescue swimmer) being made once on scene. Planning times usually allow for approximately 20 minutes of hover time.

**Hoisting/Winching Equipment:**

Currently in Europe the general winch stretcher of choice is a canvas/vinyl bag type device that accommodates a vacuum mattress. This device is very light and given that most HEMS carry a vacuum mattress, it is very convenient to use. Whilst this device is suitable to Europe, it’s use maybe limited in Australia due to the different terrain that we operate in.

The above mentioned device has it's place in the snow fields and some rock
environments providing you do not have to haul/drag the patient over rocks as the device could become damaged. It also has limited use in the water environment.

Also used is the rescue strop, nappy harness and a winch stretcher net which is surprisingly very secure for the patient, albeit a little uncomfortable. It is very light, does not catch the down wash from the aircraft easily and the hoist/winch technique adopted for its use and that of the canvas device is to provide some forward motion when there is no anti rotation (tag line) device/cord attached.

All operations visited with regards to winching/hoisting operations used a static discharge cable attached to the winch hook to prevent the conduction of electricity through to the rescuer. The cable was generally only a few metres in length and ensured ground contact prior to winch rescuer ground contact which proved to be a simple and effective device.

Winching equipment is not necessarily aviation approved but rather the operators are accepting of the European standards that are applied to rock climbing or mountaineering equipment as this equipment arguably would be of such a standard that it would be rated above that of the aviation standard.

A good example would be that a European rated karabiner can withstand a 3000kg loading but the helicopter winch is rated to 270 kgs. Climbing equipment is rated for some form of shock loading whilst shock loading a helicopter winch is to be avoided wherever possible.

By opening up the door to have non-aviation approved equipment used during winching/hoisting operations does not lower the safety standard and in fact can make the opportunities for equipment selection more easily accessible and financially cheaper.

It is arguable that a person certifying a piece of equipment already rated by the European standard is merely charging a large fee for a piece of paper. That cost is then passed down the line and it is my belief that the certifying person may not have necessarily carried out any further research or development work than the original manufacturer.

In regards to water based equipment, the USCG uses the rescue basket, quick strop, rescue strop, and a titan rescue stretcher with floats attached in their armament of equipment. Personal equipment includes a dry suit/wetsuit, inflatable buoyancy vest, helmet, mask, fins, gloves and knife.
Hoisting/Winch Incidents (as advised during interview or training):

- Rescue bucket caught causing recoil of the winch head or cable into the rotor head, which eventually lead to the aircraft crashing. Since then, a clutch has been fitted to the hoist so once a certain resistance is reached the cable will free spool.

- Several accidents have occurred by using non-trained personnel to operate the stretcher anti-rotation/tag line.

- Person deceased post winch using strop without rescuer attached to cable with patient.

- Tree branch broke injuring a patient and is being investigated by the aviation authorities. Tree appeared alive from the air but was in fact dying from the inside and had a hole in it made by woodpeckers and this is where the tree broke.

- Attempted to winch a Doctor into a confined area and during the winch the trees closed over making it difficult to winch.

- Rescue of patient and mountaineer from peak and the karabiner became horizontal in the winch hook.

- Alpinist required rescue after a fall killed his friend. Rescuer sent down and was unable to get secured and the alpinist slipped taking the rescuer with him. Fortunately the rescuer was able to hold him and another rescuer was sent in to assist.

- Snowboarder winched up and the snowboarder’s backpack contents went flying out of his bag and resulted in multiple winches to be retrieved. At the time the temperature was minus 15 and this may have caused the backpack not to be secured properly, perhaps due to gloves being worn.

- Doctor with improper fitting harness that was noticed when he was about to be winched up from the ground, essentially by his chest harness only. The winch operator noticed the problem and the doctor was placed back on the ground and the situation corrected.

- Skier being rescued covered in a space blanket and upon landing it flew loose and was ingested in the engine and struck the rotor blade.

Does HEMS have a role to undertake hoist/winch operations?
Throughout some parts of Europe HEMS undertaking hoist/winching operations is relatively commonplace and this is the case here in Australia. In North America on the other hand, it is not so common with most hoist/winching operations either being undertaken by the National Guard or USCG.

In discussions with the National Guard and USCG it became apparent that response times to incidents requiring hoisting/winching can at times be significant depending on the time of day, location and specific situation. Also there can be a lengthy process for the rescue request to reach the response agency.

Within the medical fraternity the term ‘golden hour’ is well known with regards to the trauma patient and this term can also apply to those stranded out in the ocean or on the side of a cliff-face following an incident. Timely response to this cohort of people should be commenced as soon as it can be undertaken safely.

HEMS bases within Australia are generally a 24-hour operation and many bases are situated close to the ocean thus making water and land based hoist/winch rescue in a timely manner a very real possibility. Streamlined notification through normal Ambulance processes can ensure ease of despatch and response.

Arguably, the majority of people (excluding times of natural disasters) who require some form of hoist/winch rescue are generally injured thus making even more sense that HEMS operations maintain some form of hoist/winch capacity thus benefitting the total Australian population and supplementing other rescue or emergency service agencies that may also have hoist/winch capabilities.

**Hoisting/Winch Recommendations:**

- HEMS to have hoist/winch capability.
- Explore the introduction of a mission task/navigation system for HEMS.
- Maintain the minimum current Australian winch training standards but look to improve and refine practices as required.
- Develop standards to ensure consistency of hand signals throughout Australia.
- Explore the options for the use of European/Australian (CE Standard) approved climbing equipment where appropriate.
• Continued use of one-piece hoist/winch harness as opposed to separate chest and waist harness.

• Introduce the use of a safety lanyard when the patient is required to be flown outside of the cabin as a back up to the hoist/winch hook.

• Consider the option to introduce a hoist/winching procedure that has the aircraft in the hover for the shortest amount of time. E.g. winching the rescue crewman out prior to being over the target.

• Inclusion of the USCG rescue basket into rescue operations.

• Introduce the use of an anti-static line to the winch/hoist hook.

• Consider the inclusion of alternative winch/hoist equipment such as the nappy harness and the ‘net’ type stretcher for land based operations.

• The establishment of a combined emergency services training facility to incorporate hoist/winch operations, swift water, chair lift/gondola and stranded parachutist rescues.

Personal Protective Equipment (PPE)

All operations visited wore flight suits as part of their day-to-day PPE. Equally, the majority of personnel wore flight helmets of some form. Where flight helmets were not worn, standard aviation headsets were provided.

REGA used a specially developed helmet that allows the clinician the ability to have head protection whilst still being able to lift their earphones and converse with the patient either within the helicopter or at the roadside.

All operators where mountain guides are used wore climbing helmets with earphones and the ability for communications. This offered a standardised approach to training and equipment and the ability to ensure that the mountain guide was readily visible.

In regards to clothing, generally a layered approach was used with woollen thermals, or fire retardant thermals, nomex (a fire retardant material) flight suits and then a ‘polar fleece’ type jacket made from fire retardant material.

Wet weather clothing also consisted of material that allowed for breathability that was also lined with nomex. The combination of this layering system allows for the clinician to move freely and undertake medical procedures, rescues, etc whilst remaining comfortable, maintaining warmth and still retaining the ability to have fire retardant capability.
The use of a leather jacket for flight operations was limited throughout this fellowship and predominantly worn by personnel who were not required to undertake patient management duties.

**Training**

Generally all organisations had some form of continuous education with regards to either clinical practices or rescue procedures. Training standards for pilots was based on their respective National regulations and company policies and procedures.

As for the pilots, training for rescue crewman and hoist/winch operators was undertaken consistent with their respective National regulations and company policy and procedures.

Simulation training formed a strong part of the STARS program in Alberta, Canada for their clinical personnel and that of the health system with this organisation having the ability to take their simulation training mobile via either a converted trailer or a motor home.

The trailer reflected the internal size of a helicopter interior and the converted motor home had the ability to reflect a hospital or ambulance interior. Simulation training was undertaken and monitored via a computer based learning system which included video recording thus allowing for effective debrief, self review and monitoring of the scenario.

The advantage of this mobile simulation centre allowed for STARS staff to visit either their outlying bases or regional hospitals and provide education without impacting on the resources of the facility they were visiting. It works towards improving relationships with external health providers whilst aiming to also improve patient outcomes.

**Training recommendations**

- Provide simulation training and education via a mobile simulation vehicle that allows for such training to be undertaken.

- Provide education to pre-hospital and hospital staff in the area of trauma management.

- Provide helicopter safety training to emergency service organisations, in particular in relation to the setting up of an emergency helipad.

- Meet or exceed the minimum regulatory requirements for mandatory aviation training, in particular in the field of hoist/winching operations.
HEMS and the competitive market

The purpose of this study was not to investigate competition in aero-medical operations, however over time it became quite obvious that this paper could not be written without some reference to this ideal. It is my opinion that aero-medical commercial competition does at times negatively impact patient care and potentially encourages unsafe practices to gain the competitive edge.

Arguably, it may have led to injury or death of patients and crew over the years due to certain unsafe practices where companies that are facing financial difficulties may choose to fly in unsuitable weather conditions. By responding to this one case in difficult weather conditions the company may make the financial difference in getting through to the next month.

It also means that patients are transported by a private aero-medical provider when they may not necessarily need it as this is the only way the private company can make financial remuneration for their outgoing flight. At times, the patient is flown past a suitable hospital to a hospital affiliated with the private provider. Later, the patient is transferred to an alternative hospital due to the initial receiving hospital not being able to cater for the patient's injuries or medical condition.

An aero-medical system that is not part of the overall health service may lead to other potential issues, such as lack of radio communications, clinical
accountability, governmental reporting and integration with other emergency service organisations, to name a few. There are also reports of private providers providing incorrect ‘airborne’ to ‘arrival at scene’ times so that that particular private operator receives despatch to the case in lieu of their competitor.

To put the above statements into context, basic issues around using equipment like a patient stretcher that is compatible with that of the road based EMS system is certainly beneficial to the patient and medical teams. It minimises patient transfers from one stretcher to another, minimises the associated occupational health and safety (OH&S) risks for the medical teams and minimises scene times.

Whilst not sighted first hand, it appears there is the potential for arguably behaviour that may offer financial or other incentives by some parties for calling out their ‘affiliated’ aero-medical provider, who at the time may not necessarily be the closest to the patient’s location. Similar to that of the old tow truck ‘spotters fee’ that occurred many years ago in Australia.

Another concern with this type of system is the occasions when some dispatch centres undertake what is termed ‘helicopter shopping’ when one private aero-medical operator chooses not to fly due to prevailing weather concerns and the dispatch centre calls around to other providers to see if they will undertake the mission despite already being told that the weather is poor.

It is arguable that this practice has led to incidents, accidents and possibly death. Again, this was not sighted first hand but was reported during my various interviews. It has also been reported that this type of behaviour is being vigorously discouraged and management have taken steps to ensure that all HEMS crews are made aware when one provider states that weather is an issue for their inability to respond.

Commercial competition is about profits; it’s not necessarily about the patient. A sound system puts the patient before its’ profits. Any State system that has multiple aero-medical providers needs to mandate for cross company collaboration in the areas of safety and helipad information to name but a few.

It is my view that where an Australian state is considering privatisation of its aero-medical service it does so with extreme caution and it ensures that it does not encourage a competitive market place. One operator contracted to provide a service to the State and answerable to the State’s Ambulance Service primarily or the State’s Health Department is recommended.

The preference would be to have a system that is controlled by the State’s Ambulance Service so that the benefits afforded within that system are passed on. Those benefits are one patient being managed by one system. One state/territory trauma system, one state medical system, one state health system.
Is there a best system

The short answer is no.

Systems throughout the world are developed based on their individual needs and what the aero-medical personnel and road based Ambulance crews within that country are able to do clinically, based on their training/education. What was noticeable was that there were marked differences between all aero-medical personnel and all aero-medical operations, although Europe has gone along way to ensure there is the European standard specification for HEMS aircrafts.

A lot of the main differences related to clinical skills, training and expertise of the various aero-medical personnel. Of particular note was that of the European Paramedic which depended on which country you were in and the evolution of their EMS or Ambulance system. In part, it was akin to the variances in the Australian system with regards to Paramedic training, education and clinical skill set.

Training and education for those in Canada were similar and for the USA model there were also some variances. This differential though was not only restricted to Paramedics or Flight nurses, but also to Doctors worldwide with regards to their training, education and medical background.

Some systems are integrated strongly with the road based ambulance system and some are not. Those that did not have integration with the road ambulance system had some limitations with direct notification of missions and then subsequent communication with the road based organisation.

Not only that, there were also significant OH&S concerns that could be mitigated quite easily with road based integration through stretcher standardisation, thus leading to shorter scene times, which benefits the patient as well as personnel.

Some countries in Europe had a common radio frequency that all emergency services were able to use, so that when a helicopter was despatched to a scene, everybody at that scene knew, and there was an integrated response from all agencies to assist with a landing site and patient management.

Again this should be placed into context of much smaller countries with larger populations and greater police and fire resources. Albeit that some fire services
were volunteers and called in from their normal jobs to assist with a helicopter request.

So some of the components that make a good operation include road ambulance interface, ambulance service coordination, strong liaison with other emergency service organisations and a good communications system.

**Conclusion**

Australia has the uniqueness of being a vast land with greater distances between towns and cities than that of Europe, whilst America and Canada do have similar distances to Australia between their medical facilities. Inside the European system their helicopter mission times are really no greater than one hour where within Australia our mission times are much greater, sometimes up to 6 plus hours.

European standards are well developed with a number of countries combining their efforts to ensure a consistent standard of delivery and adoption of similar if not the same regulations. Also, there does appear to be a good collaboration between the countries to share any helicopter operational information, specifically safety related matters, fuel supply and helipad information.

Competitiveness between HEMS operations within the Australian and North American markets does not have the same goodwill as in Europe. This could ultimately lead to a negative impact on patient care as the lack of information shared can increase flight planning times thus leading to an increased response time and potentially safety implications.

European countries are working closely together to set standards for airspace, helipads and aircraft standards. Particularly in regard to maintaining the twin engine standard for HEMS operations.

In closing, the Australian Aero-medical system can benefit from some of the developments of other countries and it is prudent for the Australian aero-medical fraternity, state/territory and federal governments and agencies to keep abreast of advances in the aero-medical system. Particularly around helicopter design, airspace technology, helipad design and regulations.

Above all else, it is incumbent upon any aero-medical system or company within Australia to share their learnt or developed safety information so that ultimately we can be sure that we are benefiting the patient before profits or company development.

The Australian aero-medical system is in a good state, but there is room for improvement. That improvement should be aimed at anything that can improve response times, flight times to hospital, airspace priority, aviation regulatory
development priority and most importantly placing the patient first and ensuring we remain patient focused.

Finally, this paper would not have been at all possible without the kind assistance of the various organisations and people I visited whilst I undertook this fellowship. To all those organisations and people (and there are many), I say a big thank you, as your time and effort to share your knowledge is truly appreciated. Safe Flying!