To examine and compare firefighting operations on the urban/bush interface in countries that experience bushfire disasters similar to Australia and document practices Australian fire authorities can adopt to better manage tactical operations during a bushfire disaster.

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I also warrant that my final Report is original and does not infringe the copyright of any person, or contain anything which is, or the incorporation of which into the final report is, actionable for defamation, a breach of any privacy law or obligation, breach of confidence, contempt of court, passing off or contravention of any other private right or of any law.

Signed

Date 31 / 1 / 2008
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Introduction

1983. Victoria/South Aust. - 2463 buildings lost - 75 Dead
1994. Sydney, NSW. - 287 buildings destroyed - 4 Dead
2003. Canberra, ACT. - 501 buildings destroyed - 4 Dead
2005. Eyre Peninsula, SA. - 93 buildings destroyed - 9 Dead

The dread of most fire commanders is the classic urban interface fire where firefighters are required to defend hundreds of homes from a major fire running through them. These fires are far from routine. They are dynamic, high stakes, time critical, complex events that often overwhelm emergency responders.

Unfortunately, Australia is one of the most bushfire prone countries on the planet but it shares this unenviable position with the United States and most Mediterranean countries. Climatic conditions in these places produce frequent bushfires which have a devastating impact on urban fringe communities. This urban fringe, where the bush meets the houses, is commonly referred to by firefighters as the urban interface or I-zone.

Generally, in Australia, the management of an urban or rural community fire risk is assigned separate fire authorities. The I-zone is like a ‘twilight zone’; a blurred intersection between jurisdictions where we have attempted to apply traditional bush or structural firefighting techniques to a different type of fire, something that is a dangerous hybrid of both categories. In my experience, urban interface firefighting is, at best, controlled chaos. No fire agency in the country has documented the tactics and methods that we should employ when working with these fires. (ref. Australasian Fire Authorities Council [AFAC], Operational Services Strategy Group meeting minutes, 15th September 2005).

A scan of bushfire prone countries across the globe indicated to me that some of them have special ways of combating urban interface fires that we could learn from. I, therefore, made application to the Churchill Fellowship Trust to visit the US, Spain, Portugal, France, Italy and Greece. Like Australia, these are all developed countries with a Mediterranean climate and I selected fire departments with the highest urban interface risk in each to visit.

This paper reports on my findings. Its focus is on the operational tactics and techniques fire authorities in other countries use to defend structures during bushfires. Reference is also made to the associated land management, building protection and public safety issues that directly impact on firefighting operations.
**Acknowledgements**

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Finally, I would like to express my gratitude to the Australian Branch of the Churchill Fellowship Trust and sincerely thank Ms Clover Moore, MP, Lord Mayor of Sydney without whose sponsorship this study would not have been possible.

Please refer to Appendix 1. for complete details of the Fellowship programme.

Contact Details

Chris Arnol
Deputy Regional Chief
Tasmania Fire Service
Phone: 03 6230 8450
Email: c.arnol@fire.tas.gov.au
Executive Summary
Fires on the urban/bush interface are one of the greatest challenges facing Australian fire agencies today. These fires can threaten multiple dwellings very quickly and often overwhelm emergency services. They are a major problem that is simply not going to go away. Our urban sprawl is expanding deeper into the landscape and climate change experts are predicting longer and more intense summer bushfire seasons.

Urban interface fires are dynamic, high consequence, complex emergencies where traditional structural and bush firefighting practices don’t necessarily apply. However, fire agencies in the US and Europe have developed specific firefighting strategies and methods to deal with these fires and I visited them to see what we could learn.

This paper reports on my findings. In it I conclude a re-think of urban interface firefighting is in order and a lot can be achieved by simply enhancing current firefighting systems with contemporary urban interface practices that I found overseas.

From this the Tasmania Fire Service (TFS) is adopting the following recommendations:

- Map the Urban Interface Hazard and control urban developments in proportion to the level of hazard.
- Communicate there is a ‘Danger Zone’ to people living on the UI and what they should do to prepare, stay and defend their homes.
- Create response plans for the UI risk in cities and towns.
- Seek Commonwealth funding for fuel reduction/modification programs.
- Increase standard initial response to urban interface fires and use strike teams in routine operational response.
- Write a manual of UI firefighting practices.
- Train all firefighters in UI operations, tactics and techniques.
- Identify teams that will support residents during bushfires and conduct UI drills in residential areas.
- Create UI Interagency working group to plan future operations.
- Organise multi-agency patrols on days of Total Fire Ban.

I have further recommended TFS approach the Australasian Fire Authorities Council to unite fire agencies Australia wide in their approach to urban interface fires.

It would be magnificent to think the above recommendations could be adopted across the country so all states would be delivering the best services possible. The reality is fire authorities in Australia have advanced in different areas with regard to urban interface firefighting and need to audit their position individually. This paper could, however, be used as a reference to do that.

I will be promoting my findings and recommendations in TFS publications and at fire service conferences over the coming year.
Glossary of Terms

**Defensive Operations**: protection of structures by firefighters during a bushfire.

**Defendable Space**: the area clear of vegetation from around a home that prevents a fire from reaching it. Called Defensible Space in USA.

**Direct Attack**: immediately extinguishing a fire at close quarters using hose lines or hand tools.

**Fireground**: the general operating area where firefighters work around a fire.

**Fuel Management**: the activities put in place to remove, reduce or modify bushfire fuels.

**Indirect attack**: A fire is created in the path of the oncoming bushfire to burn out the area in front of it. The fire is starved of fuel.

**Initial attack**: the first response of firefighting vehicles and or aircraft to an alarm of fire.

**Parallel Attack**: clearing vegetation along the fire edge using tools or machinery so it goes out when it reaches bare earth.

**Span of control**: the maximum ratio of subordinates to commanders throughout an incident management structure.

**Strategy**: is the overall plan used to determine and prioritise the major Operational objectives needed to manage a fire. The strategies elected to control a wildfire depend on rate of spread, intensity, spotting potential, values at risk, size, resources available, cost.

**Structure**: house, shed, factory, shop, building etc.

**Structure protection**: firefighting activities that are designed to defend structures

**Tactics**: are applied actions used to accomplish the overall objectives identified in the strategy. Firefighting Tactics involve the use of hose lines, handline construction, dozer lines, foam support or burning out.

**Total Fire Ban**: a Fire Service ban on any naked flames being allowed in the open by the public.

**Urban interface (UI)**: a bush area with homes in or adjacent to it.
Background and Context

The Natural Fire Environment
Terrain in the US and Europe is generally the same as in Australia. All countries have their grassland and agricultural areas. Brush is usually found in the dryer, more elevated areas. Pine and Oak trees dominate both US and European forests, but they are not as fire-adapted as the Australian Eucalypt. Fire can totally destroy forests, leaving a denuded landscape which overseas foresters and community leaders find very distressing.

In summer, high temperatures (35°C +) combine with low humidity to dry out vegetation and fires inevitably occur. Fires are either plume dominated (a vertical smoke column generated by convection currents that draw air in at the base) or wind driven (wind conditions are more powerful than convection currents). The most damaging fires occur where weather and terrain combine to create strong, dry winds. Throughout the world it is the wind driven fires that cause most concern for firefighters.

The Built Environment
Buildings in the United States are generally timber construction. Many have shingle roofs and are much more vulnerable to ember attack than the brick and tile bungalows of Australia. From February 2008 California is introducing more stringent building codes for urban interface areas to strengthen their resistance to fire.

Virtually all buildings in Europe are made of non-combustible material (i.e. concrete or stone with ceramic roofs). They appear much more resilient than houses in Australia and the US but homes will still catch fire if left undefended.

Urban fire agencies have traditionally prepared themselves for response to fires that start within a structure and the intent of building codes has been to prevent or withstand fire that starts inside a building. This convention goes out the window in a bushfire where buildings are ignited by external ember attack or direct flame contact.

The Urban Interface Zone
The urban interface is where the built environment meets the natural environment. It is where towns or suburbs mix in with the forest. Unfortunately, in Mediterranean climates this is a very dangerous place to live, but people cannot help themselves. Everyone wants to live in the bush – it’s the sea-change to tree-change – but that ‘slice of heaven’ in the bush guarantees ‘a taste of hell’ on the day that inevitably bushfire arrives.

The interface can be classified in a number of ways. In Tasmania a bushfire prone area is loosely defined as an area within 100 metres of bushland of two hectares or more. Tactically though, there are two basic situations firefighters have to face; a) isolated structures in the bush, or b) structures grouped together in or near the bush. (see below)
Usually the State provides the infrastructure (good roads, rail, schools etc) needed to support expansion into satellite suburbs and towns. However, this can all fall apart at the local level; town planning can fail communities. Arbitrary street design, no signage, inadequate water supplies and homes located on hills with trees nestled up against them, all become a nightmare for emergency responders when a fire strikes.

The countries I visited have all mapped their urban-interface fire hazard. Factors like vegetation, terrain, housing density, predicted radiant heat intensity, access and water supplies are all merged into a risk map that is used for response planning and urban development approvals.
Program Findings

Evacuate or Stay
Fire agencies in the US and Europe evacuate residents during fires to eliminate any life risk. Only in Australia and France are residents encouraged to remain with their properties to help defend them for the home is regarded as the best place to shelter during bushfires. Also the number of assets at risk demand fire fighting efforts are supported by residents. Either way, structural fire fighting is still required. Buildings are still subject to ember attack and gardens will spread fire through residential areas (see photograph Z. below) and firefighters must use tactics that ensure they are in the right place at the right time as the fire passes through.

Whether residents evacuate or not, emergency services must clearly communicate what is expected of them. If evacuation is the call, emergency services must relocate everyone; which in itself is a major logistical undertaking. People must leave well before the fire arrives so they are not trapped in it (most bushfire deaths occur in the open) or blocking the path of additional fire units. If people ‘stay’ police are presented with a different traffic management problem. Residents will be returning home to defend their property and frightened citizens may even decide to flee at the last moment.

Bush Firefighting - General
Given fire conditions overseas are very similar to those of Australia it is hardly surprising that the firefighting principles and strategies used are virtually identical. Where a fire is small, direct attack is used: i.e. firefighters with hand tools or hoses extinguish the immediate fire edge. Where the fire is more intense parallel attack is used; firefighters clear vegetation along the fire edge using tools or machinery and the fire dies out when it reaches the bare earth. An indirect strategy is used on fast moving sections of the fire, which are too intense to attack otherwise. A fire is created in front of the oncoming bushfire and allowed to burn back - against the wind - to consume all the fuel ahead of the bushfire. Australians call this ‘backburning’ and yes, it is where the term ‘fighting fire with fire’ came from. Of course, there is always the possibility a backburn could contribute to the oncoming fire and make the situation much worse.

Like it is in Australia, control of a large fire is usually achieved by a combination of direct or parallel attack along the flanks, anchoring from the point of origin to pinch out at the head (see diagram below for parts of a fire). Ground crews, bulldozers and aircraft all have a role to play here. However, on hot days the head of a bushfire is usually so intense indirect attack is the only option. This can be handled in number of ways:

a) Aircraft support ground crews with water drops directly on the fire ahead of them as they work along the flanks.

b) Aircraft using retardant coat the vegetation ahead of the fire to slow its progress so ground crews can extinguish it.

c) Back burning operations.

On very hot, windy, days when control of a bushfire is impossible firefighters adopt defensive operations, where they only protect individual homes as the fire passes through. This report concentrates on those defensive operations.
The adjacent diagram shows the parts of a bushfire perimeter and fire spread on flat ground. The arrow indicates wind direction and fire travel.

source - http://learnline.cdu.edu.au/wip/fire2/resources/Figure2.20.gif

Urban Interface Response
Virtually all the agencies I visited protect major population areas. They are very pro-active when it comes to the urban interface and respond a large number of firefighters to any fire they detect. Besides the obvious threat to life and property, they believe that keeping fires small reduces environmental damage (ecology, water table, air pollution) and long-term firefighting costs.

All fire agencies pledge to protect life, property and the environment, in that order. Therefore structural fire protection always takes priority over bushfire control and dedicated resources are assigned to do that job, separate from bush firefighting. However, where fire engines are dedicated to property protection and not used to contain the wildfire, the fire perimeter will continue unchecked and wreak even greater devastation in communities later. This ‘catch 22’ situation is a dilemma that confronts fire commanders world-wide.

Command and Coordination at Major Incidents
In all countries I visited firefighting vehicles are pre-formed into groups of 5 or so - called Strike Teams in the US and Groups or Sections in Europe - each has its own commander. They assemble for briefing prior to deployment on fires. This means command structures expand automatically as the level of firefighting resources increase. All countries pre-position firefighting teams in locations where fires are anticipated.

Every country has an incident management system that accounts for major functional responsibilities at fires (Logistic, Finance, Planning, Command and Operations). Most are modelled on the US system (see appendix 2; Australian version). Responsibilities for various geographical sectors of a bushfire are delegated to different commanders under an Operations officer.
I found functional responsibilities across government were also surprisingly similar but agency coordination could be complex. This coordination factor seemed to be the most telling feature in determining whether or not a large operation was likely to be effective.

In the US, emergency services are local government responsibilities. Even at small fires many jurisdictions are involved (i.e. state, city, county police and fire agencies; federal forest and park authorities) and Americans are quite practiced at unified command. A fire Chief normally heads up an integrated incident command team located near the fire and reports to a central coordinating body. This seems to work well.

In Portugal and Italy the Civil Protection Authority normally coordinates major emergencies at local or regional level. Forestry is responsible for forest fires and they call on urban firefighters to assist them on the interface. Agencies are coordinated through their respective operating rooms.

In Spain the Fire Service is the operational arm of the Civil Protection Authority. In Greece and France, Fire Services are solely responsible for all firefighting.
Urban Interface Firefighting Overseas

United States
As far as the urban interface is concerned, the US is well organised. Standard response plans pre-empt the level of resourcing an incident will require. The minimum number of initial attack vehicles that respond to any fire is four; and aircraft often arrive ahead of them. Commanders measure firefighting progress against a timeframe to determine if the next alarm level is required. The following decision points are commonly used in wildfires to measure progress:

a) The first 2 hours from the time the fire is reported; to determine if initial attack has been successful.

b) If the fire can be contained before 10:00am the next day. An extended attack will be called for; where additional resources to support those initially dispatched.

c) If the fire cannot be contained in 24 hours. The fire becomes a major incident; long term resource commitment and logistical support is arranged.

Americans use a specific approach to urban interface fires. In short, Structure Protection is managed separately within the incident command system. Multiple strike teams are coordinated by a ‘Structure Protection’ Group Supervisor. Each strike team is assigned an area to protect, and reassigned as the fire passes. Being organised this way eliminates a lot of confusion. Crew leaders are also taught the tactics they should use to protect individual houses. The basic urban interface drill is; to reverse into the drive - using the dwelling for cover - and run hoses either side of the home to attack the fire as it approaches from the other side, report back and move on as soon as they can (see photographs E, F, G & H).

In brush Aircraft are the preferred option to control the head fire. Firefighters are hesitant to backburn where lighter flashy fuels ignite quickly and fires move faster. If firefighters cannot stop the fire heading into a community, aircraft are used to narrow the fire front to reduce the destruction it is likely to cause.

Property Protection
Property protection tactics involve assessing whether properties are defendable or not. Building fire resistance and geographical location are considered (i.e. on a hill/slope, near water, near other structures, hidden from view, access, clearance-of surrounding flammable vegetation, structure already on fire). Firefighters will clear flammable material from around homes if they feel it is necessary to defend them. Firefighter training involves:

- Capabilities of hand crews, appliances, bulldozers, and aircraft
- Decision to defend structures or not (Structural triage)
- Preparing the structure (interior and exterior)
- Fireground command and accountability

- Placement of appliances and hose lines
- Fighting the fire
- Disengaging from firefighting
- Safety
- Using the engine as a refuge
- Advice to residents
Driving is important, but not speed; manoeuvring vehicles in smoke around houses is practiced. Decisions to apply direct or indirect attack are kept simple using the correlation between flame height and fire intensity to decide on suppression options in all fuel types.

**Preparing the Battleground**

The County Fire Departments I visited regard ‘defendable space’ as their first weapon against wildfire. Knowing fire is inevitable firefighters understanding community education and vegetation management around homes helps them to do their job. After all, the area will be evacuated and left for them to defend. Many counties prescribe fuel modification zones adjacent to their communities and along evacuation routes.

In Santa Barbara County fire crews assess defendable space. Where residents don’t comply the County clear around a building and access roads and charge the resident for the works. Ventura County has a rigorous abatement system. Residents are fined $1000.00 for non compliance. Out of some 2000 abatement notices issue last year only 17 properties had to be cleared by local government.

In California, San Bernardino is the gold standard for fuel modification. That is, mechanically thinning and removing the surface and understorey fuels in a mosaic pattern across the landscape. This is done to prevent fires from entering communities some distance away and to reduce overall forest loss. (see photographs T, U, V, W, X & M)

Where the forest is not divided, firefighters are inevitably forced to adopt defensive tactics. However, while they are waiting to defend homes, nothing is being done about perimeter control.

US fire authorities pre-plan urban interface firefighting operations ahead of the fire. Operational plans for sections of the community detail things like; wildfire hazard, access, briefing points, evacuation management, safe areas, water availability, and tactics to be employed in urban areas. These plans align bushfire risk with fire response and home fire safety plans. Their development brings together stakeholders like police, community leaders and fire authorities prior to a fire. As a result operations run more smoothly during emergencies.

**Mediterranean Europe**

**Spain**

In Catalonia, initial fire response consists of three ground vehicles (cars), an attack helicopter and a command helicopter. A commander is assigned to a regional control position every day and dispatched by helicopter to oversee any fire that starts in the region. Once operations are up and running the fire is divided into manageable sectors.

Fire behaviour specialists are employed by the Civil Protection Authority. They work with the fire commander who continues to direct operations either from the air or from the headquarters operating room throughout the duration of the fire. Catalonia uses state-of-the-art mapping and GIS tracking to dispatch, monitor and control the location of fire vehicles. It is, however, common for urban firefighters to focus exclusively on property protection and to wait at houses for the fire reach them.
**Portugal**
In Portugal the Civil Protection Authority runs the nation’s central dispatch and communications centre in Lisbon. Initial response to any vegetation fire is a helicopter crew of 6 (helitack) personnel and the nearest car. A car is vehicle with a 700 - 2200 litre water tank and 4 - 5 firefighters. It takes charge of the incident. In future the Portuguese plan to increase initial fire response to three cars.

After the first 90 minutes a decision whether to call for more resources must be taken. If additional firefighters are requested, vehicle operations scale up to a District (municipal) level; where pre-formed Groups of 1 large (10,000 litre) tanker and 4 cars (minimum) are responded. Beyond that resourcing is coordinated at national level and Groups of cars that have been pre-deployment across the country in anticipation of fires are swung into action. Firefighting aircraft are stationed throughout the country. They are managed by the Civil Protection Authority in Lisbon.

No training for structural protection during wildfire has yet been developed. Operational success is largely attributable to firefighter resolve and command initiative.

**France**
In France the community is required to stay and defend property during a bushfire. The French have some interesting firefighting techniques and focus a lot of attention on the urban interface. The Fire Service is responsible for all firefighting in the country. Operations are very well coordinated and firefighters know both bush and structural firefighting techniques.

Initial response standards demand a minimum of 6 vehicles and 2 helicopters arrive at a fire in 10 minutes. Support resources are organised in groups called GIFF (Groups Intervention Forest Fire). A GIFF comprises 4 large firefighting vehicles (2000-6000 litre vehicles) plus a command vehicle. During a wildfire one GIFF is assigned suppression of approximately 100m of fire line or roughly 10 houses (if they are close together) at one time.

The French use the same urban interface firefighting tactics and techniques as the Americans. All four GIFF vehicles shelter behind dwellings and run hoses either side. Span of control seems much tighter than in other countries with 3 GIFF making up a sector and 3 sectors being managed by an individual Chief.

The Var Fire Department covers the worst bushfire area in France. The Departments highest level of preparedness requires; 2 attack aircraft to be airborne all day and initial response may involve up to 40 vehicles (i.e.10 groups of 4 units each). Police, Volunteers, Foresters, and Fire Departments all patrol the urban interface to dissuade arsonists and columns of firefighting vehicles pre-position in likely fire locations. Newly discovered fires are always given priority over another. Resources will even be redirected from an existing fire to prevent a new one from spreading.

Using radiant heat exposure calculations the French have determined that homes must have 100 metres clearance to withstand a head fire. Defendable space is more than double most other countries. Firefighters apply the same 100 metre formula to attacking a head fire. I believe the French are unique in this respect. Aircraft are used to slow the fire’s
progress and a minimum of 3 GIFF (35,000 litres capacity) assemble in front of it to make a stand, where the 100 metre fuel clearance exists – often on the lee side of a hill (see photographs L & M). Fire departments prepare clearances of 100 metres or more across the landscape where head or flank fires can be attacked. This network of fuel breaks is mapped alongside previous fires, safety zones and water points so fire departments can plan where to control fires before they reach the populated areas.

The Var Fire Department has a dedicated urban interface management unit. This unit has assessed urban interface areas, mapped the risk and it now guides local government in urban development matters. Because property owners can be difficult to find in Europe, Var has begun to target building occupant for compliance with fuel clearance regulations. After all, it is the occupant who is at risk. Var has created special fire crews that move through an area during a fire solely to encourage and support residents who stay and defend their property.

Italy
In Italy the Forest Corps is responsible for forest management and forest fire fighting. They use a 6 hour fire prediction model to alert local volunteer teams of bad fire conditions. Provincial arrangements for initial response to forest fires vary throughout the country. Normally a single vehicle responds, assesses the fire and calls further support if required. This is usually in the form of aircraft, local volunteers or urban fire brigades. The Forest Corp coordinates all firefighting operations. Fire Services are responsible for urban fire protection but have no laid down urban interface firefighting tactics. However, they always operate in teams and always within line of sight. Firefighters work in sections. A Section is a 5-6 person team with a (400 litre) command vehicle, another 600-800 litre capacity vehicle and a 2000 litre vehicle. Where the situation demands it, a self-sufficient nine person section can be mobilised for a 12 to 48 hour period. They will have a small 600-800 litre vehicle, an 8000 litre vehicle, 2 camper vans (with beds, shower freezer etc), and a transport vehicle. 4 sections are mobilised for a local disaster.

In major emergencies urban fire brigades become the operational arm of the Civil Protection Authority. Brigades are required to mobilise large numbers of personnel in a very short time to combat disasters like fires, earthquakes, volcanic eruptions or terrorist attacks. The city of Genova, for example, has the capacity to deploy 100 additional firefighters in 1 hour and 200 firefighters within 2 hours anywhere in the country.

Firefighting demands transfer from one authority to another as a fire enters the urban environment; where the fire service will be waiting for the fire to arrive. The Forest Corp and fire brigades have separate communication systems so agency operations have to be coordinated through respective communication centres.

Greece
My enquiries in Greece were limited. The country had just come through a disastrous fire season. 72 people had died in fires. Fire Service personnel I had hoped to interview were pre-occupied with post fire season inquiries. The Forest Officers I spoke with explained that responsibility for forest firefighting transferred from the Forest Service to the Fire Service more than a decade ago. The Fire Service appears very well equipped. It has
purpose built vehicles and a scaleable incident command system that it applies to all incidents. Unfortunately, I was unable to obtain specifics about urban interface firefighting.

Europe is consistent with the US in many respects. It is highly populated and often well resourced. Many countries have mapped the urban interface risk and pre-position resources in high risk areas but where no forest management is in place property protection becomes the only viable strategy. All agencies use an ICS system, aircraft play a major part in fire attack and firefighters are organised in groups or sections so they can respond support resources effectively. There are some differences though. Structure protection on the urban interface is seen as integral part of overall firefighting operations but is often left to the urban fire service. Foresters are responsible for land management and urban firefighters protect buildings and this can become a coordination problem.
Conclusions and Recommendations

Discussion
There is no question in my mind the ultimate solution to the urban interface fire problem is community resilience and self-sufficiency. That is, fire resistant structures with adequate fuel clearance around them not to catch fire, but this is not a reality. Whilst ever people expect to live in the bush society will always need to manage the consequences of fire.

Urban interface fires will confront firefighters well into the 21st Century. On days of extreme fire danger when bushfires cannot be controlled, firefighters have no choice but to move from house to house to defend them. These fires are dynamic, high stake emergencies that present different technical challenges to firefighters. Conventional firefighting practices were never designed to handle houses as a bushfire fuel or houses burning from the outside in. An operational rethink is required.

Not only must fire agencies apply appropriate techniques to the situation they find but, police and the community must be incorporated into the overall response as well. Urban interface fires require pre-planning, anticipation, rapid high-volume response, ongoing resourcing and high levels of coordination. It’s about external ignition sources and getting organised quickly; to affect the ‘fire and movement’ strategies firefighting demands in these particular circumstances. I have found that overseas countries employ the very techniques that we need to apply here and they are willing to share them with us.

High Performing Organisations
From my travels it is easy to deduce that ‘world class’ WUI organisations pre-plan extensively, are well organised and tailor their firefighting approach to urban interface fires.

- ‘Defendable Space’ is universally acknowledged as a crucial element of any property protection strategy so the removal of vegetation around buildings is strictly regulated and enforced. Strategic fuel breaks are created in forests so firefighters can stop bushfires before they have a chance to reach communities.

- Many organisations have mapped the urban interface hazard and they restrict urban development in dangerous locations.

- They have fire attack plans for urban interface areas. Pre-fire assessments determine; what buildings can be successfully defended, the number of fire trucks required to protect structures, the best tactics to use, what residents should do etc.; immediate information firefighters must have to conduct an effective operation. Agency collaboration is critical if operations are to be well planned and executed.

- Fire agencies anticipate where resources will be required and pre-deploy firefighters to high risk areas; where a fire could have the most damaging impact on the community. Multi-agency patrols are also used to dissuade would-be arsonists.

- Pre - planning is supported with aggressive initial attack. The aim is to limit fire damage with a rapid, high-volume fire fighting response, hence the need to be organised quickly.
• The urban interface is treated as a unique or special risk. Firefighters learn specifically how to defend structures against external ember attack and dedicated crews guide residents who stay and defend their homes during the crisis.

Immediate Actions
TFS is already doing many things well as far as UI firefighting goes. Firefighting is core business so TFS only needs to enhance its current processes to attain best practice. Significant advances can be achieved quickly, within budget and without the usual trauma associated with change. I have made the following recommendation to the Chief Officer of the Tasmania Fire Service. Some formalise initiatives we have introduced in the past and all have been accepted.

From a planning point of view;
• Map the urban interface hazard throughout the State – identify various classes of risk to help regulate building development and prepare operational plans.
• Control urban fringe development through state legislation and local government planning schemes
• Maximise State/Commonwealth funding partnerships to complete strategic fuel reduction/modification programs
• Re-focus public communication strategies - deliver community safety messages that identify who is living on the urban interface, how severe their fire risk is, and that residents are expected to prepare, stay and defend their property.
• Have fire brigades assess the defendability of properties on the urban interface and develop pre-incident response plans for urban interface risk areas in cities and towns.
• Conduct drill exercises with fire, police and residents to better prepare for urban interface fires.

From an operational response point of view;
• Increase initial attack on the urban interface to limit fire spread and damage. Weight of response is to be measured according to predetermined risk; using weather parameters and fire spread thresholds to set response benchmarks.
• Use the phases of a fire; (initial attack [first 60 minutes], extended attack [10am the following day] and major incident) to prompt reporting times and decisions about the management of fires.
• Develop pre-formed strike teams in all fire Districts. Use strike teams in all facets of emergency response and practice exercises; so they become the norm.
• Write an operational practices and tactics manual for urban interface firefighting. This will underpin the development of new capability, procedures, equipment and training programs.
• Train Crew Leaders in specific urban interface tactics, sector commanders in urban interface operations and firefighters in specific urban interface firefighting techniques; use the US training programs to develop our own training regime.
• Introduce urban interface teams that will support residents who stay and defend their properties during bushfires.

From an interagency point of view:

• Create Interagency Working Group, incorporating Police, Parks, Forestry and local Government, to develop unified command arrangements and multi-agency operational procedures, plans and/or agreements that deal specifically with urban interface fires.

• Arrange multi-agency patrols on days of very high fire danger to discourage would-be arsonists and to detect fires in the early stages.

From here the next step is to create the policies, procedures and training programs that breathe life into these recommendations and to share my findings with other Australian fire authorities. Therefore, I have also recommended the AFAC Operational Service Strategy Group be approached to develop universal operating principles and tactical guidelines for urban interface firefighting that all Australian fire agencies can apply in their respective States or Territories.
Photographs

A. Riverside County, California USA 2007.


C. Catalonia, Spain 2007. This fire blocked the main highway between Spain and France and caught passing trucks alight.
Note the 4 photos above show just how similar the UI fire problem is worldwide.

E. Illustration of US fire attack methods. Structure Protection deployed on left. Direct flank attack on the fires.
F. UI Drill position in the drive; using a standard Type 3 Engine, purpose designed for urban interface fires in the US.

G. UI Drill: Connect hoses from same point and run either side of home.

H. UI Drill being used in anger with an urban pumper.
I. Example of strike teams in use at a fire in Montpellier in France. This home was unoccupied when a fire in crops spread to it.

J. The French in action using medium size fire units.
K. A Canadair in action France: one of the most commonly used aircraft.

L. The French deployed for head attack on a fire. 15 trucks; each with 4000-6000 litres of water The clearance in front of them would be about 100 metres.
M. A cleared area where head attack could be contemplated in France.

N. A structure at the Cal Fire Academy fabricated for urban interface drills.
O. Cal Fire props compare pretty well with the real thing.

P. Aftermath of a fire outside Athens. House to the left saved, houses to the right lost, all solid construction.
Q. Genoa in Italy. A fire officer there told me he has had 5th floor apartments alight during interface fires.

R. Peschici 2007. A resort area in Italy. The forest was totally destroyed. 4 died. 2000 evacuated onto the beach. Businesses crippled - no one returned to holiday this year.
S. Foreground - Where a fire totally destroyed pine forest in Greece two years ago. The fire was stopped at the trees and houses in the background.

T. Forest fuel modification in France.
U. USA. Fuel Modification – Before

V. Field trip with Kevin Turner, Assistant Chief Cal Fire, looking at fuel modification programs San Bernardino

After – Defendable Space.
W. California forest that has been thinned out and the lower limbs of trees removed.

X. Streetscape in Santa Barbara

Fuel modification in Santa Barbara suburb
Y. Bushfire Appliances and Equipment - Ventura County Fire Dept.

Z. Ornamental gardens carry fire through Tarragona in Spain
Appendix 1
The Fellowship Programme

My fellowship study tour was timed to coincide with the end of the bushfire season in the northern hemisphere. I prepared a questionnaire to generate discussion and gather background information (see Appendix 2) at pre-arranged meetings in each country I visited. The meetings were normally followed up with a field trip to recent urban interface fires to discuss the firefighting operations that were applied.

I visited the following places over a seven week period:

<table>
<thead>
<tr>
<th>Date</th>
<th>Place</th>
<th>Agency</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Sep</td>
<td>Arrive United States of America</td>
<td></td>
<td></td>
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<tr>
<td>2-Sep</td>
<td>San Francisco</td>
<td>Cal Fire</td>
<td>Rest Day</td>
</tr>
<tr>
<td>3-Sep</td>
<td>Oakland</td>
<td>Cal Fire</td>
<td>Visit Office of director Cal Fire</td>
</tr>
<tr>
<td>4-Sep</td>
<td>Travel to Sacramento</td>
<td>Cal Fire</td>
<td>Visit Department of Forestry and Fire Protection HQ – Fire Marshals Office</td>
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<tr>
<td>5-Sep</td>
<td>Sacramento</td>
<td>Cal Fire</td>
<td>Visit Aviation and Fleet management units</td>
</tr>
<tr>
<td>6-Sep</td>
<td>Sacramento</td>
<td>Cal Fire</td>
<td>Visit Cal Fire Academy</td>
</tr>
<tr>
<td>7-Sep</td>
<td>Travel to Los Angeles</td>
<td></td>
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<tr>
<td>8-Sep</td>
<td>Los Angeles</td>
<td></td>
<td>Rest Day</td>
</tr>
<tr>
<td>9-Sep</td>
<td>Los Angeles</td>
<td></td>
<td>Rest Day</td>
</tr>
<tr>
<td>10-Sep</td>
<td>Orange County</td>
<td>Orange County Fire Authority</td>
<td>Discussion -Tactical Operations. Field Trip to survey urban interface risk areas and success of fuel modification program in Coto De Caza and response plans for Modjeska Canyon.</td>
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<tr>
<td>11-Sep</td>
<td>Riverside County</td>
<td>Riverside County Fire Department</td>
<td>Perris Fire Department, Urban interface Fire Stations and discussion of Operational Procedures</td>
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<tr>
<td>12-Sep</td>
<td>Riverside County</td>
<td>Riverside County Fire Department</td>
<td>Field Trip Esperanza Fire. Application of Operational tactics and effectiveness of Fuel modification zones.</td>
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<td>13-Sep</td>
<td>Riverside County</td>
<td>Riverside County Fire Department</td>
<td>Mountain Area Safety Taskforce, Idylwild, San Bernardino National Park - Fuel Modification Programs</td>
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<tr>
<td>14-Sep</td>
<td>Ventura County</td>
<td>Ventura County Fire Department</td>
<td>Discussion and tour of Country Urban Interface risk in Forest and Brush. Visits Fire Stations</td>
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<tr>
<td>15-Sep</td>
<td>Ventura</td>
<td></td>
<td>Rest Day</td>
</tr>
<tr>
<td>16-Sep</td>
<td>Ventura</td>
<td></td>
<td>Rest Day</td>
</tr>
<tr>
<td>17-Sep</td>
<td>Santa Barbara</td>
<td>Santa Barbara County Fire Department</td>
<td>Presentations on Firefighting Operations and Site Assessment. Tour of Urban Interface areas and Zaca Fire aftermath.</td>
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<tr>
<td>18-Sep</td>
<td>Travel to Los Angeles</td>
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<td>19-Sep</td>
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<td>30-Sep</td>
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<td>1-Oct</td>
<td>Barcelona</td>
<td>GRAF. Civil Protection Authority HQ, Catalonia</td>
<td>Discussion on forest firefighting, dispatch and operational procedures.</td>
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<tr>
<td>2-Oct</td>
<td>Barcelona</td>
<td>Tarragona</td>
<td>Field Trip – ‘Staff Ride’ format as analysis of Montroig urban interface fire.</td>
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<tr>
<td>3-Oct</td>
<td>Travel to Madrid</td>
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<tr>
<td>4-Oct</td>
<td>Madrid</td>
<td></td>
<td>Rest Day</td>
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<td>5-Oct</td>
<td>Madrid</td>
<td></td>
<td>Rest Day</td>
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<tr>
<td>Date</td>
<td>Location</td>
<td>Activity</td>
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<tr>
<td>6-Oct</td>
<td>Madrid</td>
<td>Rest day</td>
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<td>7-Oct</td>
<td>Madrid</td>
<td>Tecnoma (David Caballero) Field Trip urban interface areas outside Madrid.</td>
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<td>8-Oct</td>
<td>Travel to Portugal</td>
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<td>9-Oct</td>
<td>Lisbon</td>
<td>Ministry of Agriculture Policy Discussion - Forestry HQ Lisbon</td>
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<td>10-Oct</td>
<td>Coimbra</td>
<td>University Coimbra Fire Research Centre – Travel Urban interface areas</td>
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<td>11-Oct</td>
<td>Travel to France</td>
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<tr>
<td>12-Oct</td>
<td>Marseilles</td>
<td>Marseilles Rest Day</td>
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<td>13-Oct</td>
<td>Marseilles</td>
<td>Montpellier Fire Department Field trip to recent fires agricultural land and urban interface</td>
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<td>14-Oct</td>
<td>Marseilles</td>
<td>Var Fire Department Presentations on firefighting operations and work of specialist Urban interface unit.</td>
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<tr>
<td>15-Oct</td>
<td>Marseilles</td>
<td>Nice/ Draguignon Fire Department Field visit to Draguignon and recent wildfires</td>
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<td>16-Oct</td>
<td>Marseilles</td>
<td>Rest Day</td>
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<td>17-Oct</td>
<td>Marseilles</td>
<td>Rest Day</td>
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<tr>
<td>18-Oct</td>
<td>Travel to Rome</td>
<td>National Forest Service</td>
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<td>20-Oct</td>
<td>Rome</td>
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<td>21-Oct</td>
<td>Rome</td>
<td>Rest Day</td>
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<td>Travel to Genova</td>
<td>Visit to local fire Station</td>
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<td>23-Oct</td>
<td>Genova</td>
<td>Regional Forest Corps HQ Presentations and discussion urban mapping firefighting and dispatch centre operations</td>
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<td>24-Oct</td>
<td>Genova</td>
<td>Italian Fire Service Discussion urban interface tactics</td>
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<td>25-Oct</td>
<td>Travel to Bari</td>
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<td>26-Oct</td>
<td>Puglia</td>
<td>Forest Corps Puglia Field trip to Peschici fire. Holiday Resort Area</td>
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<td>27-Oct</td>
<td>Travel to Greece</td>
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<tr>
<td>28-Oct</td>
<td>Arrive Athens</td>
<td>Rest Day</td>
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<td>29-Oct</td>
<td>Athens</td>
<td>Meeting with Gavriil Xanthopoulos to discuss Greek urban interface tactics</td>
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<td>30-Oct</td>
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<td>National Agricultural Research Foundation Field trip – Attica, aftermath of urban interface fires.</td>
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<td>31-Oct</td>
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<td>Fire Brigades Informal visit to HQ Station to Greek Fire Service</td>
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<td>1-Nov</td>
<td>Athens</td>
<td>Rest Day</td>
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<tr>
<td>2-Nov</td>
<td>Travel to Australia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-Nov</td>
<td>Arrive Hong Kong</td>
<td></td>
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<td>4-Nov</td>
<td>Hong Kong</td>
<td>Hong Kong Fire Services Department Tour of HKFS Departments</td>
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<td>5-Nov</td>
<td>Hong Kong</td>
<td>Rest Day</td>
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<td>6-Nov</td>
<td>Travel to Sydney</td>
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</tr>
<tr>
<td>7-Nov</td>
<td>Return to Hobart</td>
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Appendix 2
Questionnaire distributed by email prior to travel:

Urban-interface Firefighting Questionnaire

Introduction

Generally in Australia the management of an urban or rural community fire risk is assigned separate fire agencies. The urban interface is a blurred intersect between jurisdictions with unique firefighting complexities (fast moving, competing priorities, multi-agency operations, public participation, high risk, high consequence activity). Actual firefighting tactics have only evolved through historical comment or ‘lessons learned’ but no fire agency has progressed this to the next stage by documenting best practices fire agencies could adopt.

This study deals specifically with firefighting operations on the urban fringe, where native bushland carries invading fire into a town or suburb; often overwhelming emergency services that are largely unfamiliar with this form of operation. Its objective is to compare firefighting operations on the urban/bush interface in countries that experience bushfire similar to Australia and document practices Australian fire authorities might adopt to better manage tactical operations during a bushfire.

The following questions are designed to assist in that study and your responses would be extremely valuable.

The Questions

1. Description of your urban interface fire risk; vegetation, landscape, climate/weather, building arrangements etc.

2. Firefighting and Land Management agencies responsible for fire protection of the urban interface.

3. Describe Agency or Government collaborative arrangements that may be in place.

4. What role do the media, police and other emergency services play during fires?

5. Outline the broad land management strategies and fire control policies adopted in the region (ie evacuate or stay, fuel modification zones, burning regimes, permit systems).

6. What do you consider are the main challenges facing those charged with managing fire on the urban interface?

7. Description of community prevention and preparedness activities or programs on the urban interface
8. What is the expected community behaviour during fire emergencies?

9. Describe general fire suppression operations used in the region.
   a. offensive or defensive strategies
   b. Command structure
   c. Resources available
   d. Response procedures

10. Detail the firefighting strategies and tactics used on the interface during days of extreme fire danger. (i.e. tactical priorities, weight of response triggers to alter strategy or tactics, safety, decision to leave or extinguish a building, how firefighting operations are organised across the entire fire, leap frog method, water supply calculations, defined response areas, communication and control methods, changeover/briefings, appliances types/aircraft use etc.)

11. How could you make it better?

12. Key elements of tactical training programs and skills/experience required

13. Any further initiatives being considered? (i.e. community engagement, warning systems, firefighting equipment, technology, local fire protection plans, emergency service collaboration)

14. What are you feelings about global warming?

Name:

Location: Date: / /2007
Appendix 3
Incident Command System; structure.