APF

An MDM PUBLICATION
Issue 43 – September 2012

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ASIA PACIFIC FIRE MAGAZINE

REPORTING TO THE ASIA PACIFIC FIRE PROTECTION AND FIRE SERVICE INDUSTRY

G-Force Nozzles: The Inside Story

Based on a highly customizable global nozzle platform design, the unique G-Force series of fixed, selectable, and automatic nozzles combine over 40 years of Task Force Tips design innovation and experience into true next generation firefighting tools. Manufactured exclusively at TFT's USA production facilities, the G-Force series is supported by an extensive infrastructure of 24-hour technical service representatives, on-line documentation, digital video training library, exclusive product serialization and tracking capabilities, and a proven 5 year product warranty. Incorporating unique performance components such as a stainless steel slide valve, inlet debris screen and protective fog pattern choices, the G-Force series delivers high performance and rugged dependability.

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ALAMO GROUP

September 2012
Issue 43

The G-Force fixed, selectable and automatic, highly customizable global nozzles, combine over 40 years of Task Force Tips experience into true next generation firefighting tools

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APF is published quarterly by:
MDM Publishing Ltd
The Abbey Manor Business Centre,
The Abbey, Preston Road, Yeovil,
Somerset BA20 2EN, United Kingdom
Tel: +44 (0) 1935 426 428
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Email: mark.seton@apfmag.com
Website: www.mdmpublishing.com

Subscriptions: For your free subscription, please register at **www.mdmpublishing.com**

ISSN – 1476-1386

Page design by Dorchester Typesetting Group Ltd
Printed in the UK

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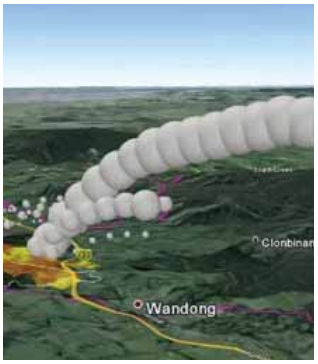

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By Graham Collins

The Season is Upon Us

Bushfires, wildfires or forest fires are by no means new and while changing global weather patterns undoubtedly have a part to play, archaeologists and geologists have discovered evidence to show that the world has been plagued by them throughout its history.

That being said, there was a time in more recent history – and not too long ago – when they seemed to be more or less confined to a few unfortunate countries and regions. They did occur in other parts of the world now and again, but were usually seen as very occasional if alarming events. Those days seem to have been well and truly confined to the history books.

Today, these fires are cropping up with ever more frequent regularity in just about every corner of the globe. According to the National Oceanic and Atmospheric Administration's National Climatic Data Centre, in July the USA experienced 9,869 wildfires that destroyed 2,014,395 acres. In the year to date 37,576 fires in the USA devastated 4,088,349 acres. In the past month alone, significant wildfires have broken out across the Asia Pacific region in Malaysia, Thailand, Sri Lanka, Indonesia, Vietnam and Pakistan.

Many wildfires though are unmonitored and undocumented so the full record of wildfires around the globe is a long way short of complete. However, the World Health Organisation's international disaster database estimates that 2,000 people have been killed and US$49 billion lost in 339 major fires worldwide since 1970, making them among the world's costliest disasters. The United Nations Office for the Coordination of Humanitarian Affairs is on record as stating that weather conditions, wind and terrain conditions all contribute to fire risk but, alarmingly, humans started most of the past decade's wildfires.

Right now parts of Australia, for example, are bracing themselves for what the experts are predicting will be a high risk bushfire season. Bushfire CRC (Cooperative Research Centre) has identified large areas of southern Australia, from the east to west coast, as having above average fire potential this summer. Its latest seasonal outlook concludes: "The above average forecast is due to the abundant grass growth from the high amount of rain from two strong La Niña events seen in the past two years across the country's eastern seaboard and South Australia. Fuel moisture content within forests is still high, but this rainfall has continued to provide widespread vegetation growth in the grasslands, which remain a threat."

Such a scenario was the focus of attention of many of the delegates from across the world to the recent annual AFAC (Australasian Fire & Emergency Service Authorities Council) and Bushfire CRC conference in Perth. The conference (which is reviewed in more detail one page 13 of this edition of Asia Pacific Fire) showcased the work that scientists and firefighters are undertaking to more accurately predict where these fires will occur, how to most effectively monitor and track them and, of course, how best to defeat them.

Understandably, the often frightening scale and environmental impact of a bushfire or wildfire and the consequential human tragedies tend to grab the news headlines. However, it must never be forgotten that those involved in front-line bushfire and wildfire firefighting activities – both professional firefighters and the many volunteer firefighters involved – face an assortment of serious health related risks. This is why in this and recent editions of Asia Pacific Fire, and in our sister publication International Fire Fighter, editorial attention has focused on a broad spectrum of firefighter health and safety issues. For instance, in this edition of the magazine we are addressing the serious challenge of heat stress on firefighters, while the current edition of International Fire Fighter magazine carried a research article on protecting firefighters' respiratory systems. These, and similar subjects, are topics to which we will undoubtedly be returning in coming editions. APF

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Social Media & International Outreach

No one was more surprised than I was when, a few years ago, I agreed to test an iPad for NFPA's Information Services Division and actually ended up liking it.

Gary Keith

NFPA

Like millions of others around the world who spend a lot of time on the road, I rely on applications that can organise work communications and files when I am away from the office and make meetings more efficient, such as the personal digital assistant (PDA) application for NFPA's Conference & Expo.

I like not having to lug around a laptop when I travel, and I have come a long way in the brave and binding digital world. But I admit, I am still a holdout on social media.

Actually, that puts me in the minority. The number of people using social networks globally has nearly doubled since 2008. According to a recent survey by the Pew Research Center, 79 percent of American adults say they use the Internet. And 59 percent of Internet users say they use at least one social networking site, mostly Facebook.

Social media presents fire and life safety educators with valuable and growing access to their audiences, helping to spread the word about the need for more fire and life safety legislation around the world.

Even if I am slowly inching my way into social media, I readily acknowledge that it presents fire and life safety educators with valuable and growing access to their audiences. This is even more evident as NFPA continues to reach out to the international community.

Whether it is reaching the "digital natives" of the millennial generation (my three children, for example) or higher-risk populations such as older adults, social media can expand our reach in order to better educate the public about fire safety. The American Association of Retired Persons' (AARP) research found that two-fifths of adults over age 50 in the United States consider themselves extremely or very comfortable using the Internet. Approximately a quarter use social media websites.

These online tools can also help us spread the word about the need for more fire and life safety legislation around the world. Because these tools are so nimble, they are ideal for addressing the on-going worldwide fire problem and for quickly sharing both successes and areas for improvement.

NFPA recently topped 31,000 Facebook fans and has a strong Twitter and LinkedIn presence. Interestingly, LinkedIn has an enthusiastic international participation with many of its members from outside the United States. In addition, 45 percent of NFPA's Facebook fans are also from outside the U.S. It is rewarding to see the tremendous international interest and communication exchanges on fire and life safety issues using NFPA's social media throughout the world. We hope to continue to strengthen international activity throughout our varied social media programs and welcome APF readers to become active participants.

We have had the opportunity to share in previous issues of APF two important initiatives at NFPA with tremendous interest from our international constituents: *Fire Wise Communities* and the *Electric Vehicle Safety Training* program. NFPA's *Fire Wise Communities Program* offers an updated website, www.firewise.org, with social media integration. *Fire Wise* is fairly new to social media, but it is already finding a strong and growing base of interest including international audiences. In addition, the *Electrical Vehicle Safety Training* program, www.evsafetytraining.org is also somewhat new to the social media outlets but we are seeing increasing interest, particularly from one of the most global industries, automobile manufacturers.

We may not yet have an app that can solve the new challenges of fires, but as these examples demonstrate, we certainly have a much broader array of educational tools available to us today to fight those fires.

Become a fan of NFPA on Facebook or follow us on Twitter at @NFPA.org APF

Gary Keith is NFPA's vice-president for Field Operations & Education, and is vice chair of the Confederation of Fire Protection Associations – International (CFPA-I)

For further information, go to www.nfpa.com

Intelligent Fire Suits

Marine and fire safety equipment company, VIKING LIFE-SAVING EQUIPMENT has added technology to its range of fire suits that enables them to detect if a firefighter is in increased danger as things heat up. Every VIKING suit can now be ordered with the option of adding the company's thermal sensor technology (TST), which provides firefighters and those around them with clear warning signals as temperatures increase.

The company says that research shows that heart attack due to heat stress is the leading cause of death among firefighters in action, and that Viking fire suits equipped with TST technology are designed to reduce some of the factors that cause heat stress. Temperature sensors attached to two displays on the arm and shoulder indicate to firefighters and their teams critical temperatures, both inside and outside the coat.

Paradoxically, the company says that its technology is partially an answer to a problem that arises because today's fire suits have become so good at protecting their wearer. The heat insulating textiles in modern fire suits, together with other equipment, protect the skin so well against radiant heat that it is becoming a challenge for firefighters to detect critical temperatures in the critical minutes before they result in injury. If heat increases rapidly, the TST technology equipped suits generate a warning signal much more quickly than if temperatures are slowly rising, recognising that when things are heating up fast, firefighters need to exit more rapidly.

The TST microelectronics are durable and can be washed in a washing machine once the small computer/battery pack has been removed from an inner pocket. Beyond replacing the AA batteries, no further maintenance is required.

For more information, go to www.viking-life.com

Star Performer

DELTA FIRE AUSTRALASIA has installed the latest-technology kitchen fire protection systems at a number of the high-profile eateries at The Star, promoted as being Sydney's newest entertainment destination.

All now rely on what Delta Fire believes is the world's most frequently installed kitchen fire protection solution, the Ansul R-102 system – a pre-engineered system that meets all of the relevant Australian and international standards. R-102 is an automatic system that quickly detects and suppresses a kitchen fire before it has time to take hold, utilising a suppression agent that was specially designed for kitchen applications, offering fast flame knock-down, vapour securement, and the ability to cool hot surfaces and cooking oils. In addition to being non-corrosive, post-fire clean-up calls for no more than flushing the affected area with water or steam, helping to ensure that the kitchen is back in full operation in the shortest possible time.

The system protects both the cooking appliances and the hoods and ductwork, and does not demand manual intervention; it can be triggered automatically or manually. Immediately the system detects a fire, the gas or electric power to appliances is cut-off prior to suppressant discharge.

For more information, go to www.deltafire.com.au

Aerial Firefighting

CAYLYM TECHNOLOGIES INTERNATIONAL has recently carried out demonstrations of its new Guardian System that the company says introduces a new capability for fighting wildfires from the air, and particularly at night.

The system was built on the Precision Container Aerial Delivery System (PCADS) platform and now boasts a capacity in excess of 1,000 litres. This is over 15 percent larger in volume than earlier PCADS systems. Almost any cargo plane with rear ramps – including most commonly the C-130 Hercules military cargo plane and cargo helicopters – can use the system to precision drop the units that are approximately 1.2-metre cubed, using GPS 24 hours-a-day. At night, the system can be dropped using GPS precision from a safe altitude flying a level profile to the target.

The recent test drops in Arizona involved three guardian units, each containing 3000 litres. The saturated area was larger than a football field – over 4,000 square metres.

The Guardian unit complies with standard and internationally recognised Container Delivery System (CDS) protocols adopted by international and domestic air drop units.

For more information, go to www.caylym.com

Achieving Building Management Systems Integration

As technology in all areas of our lives becomes increasingly more integrated, Eva Kosanovic, Head of Product Management at Apollo Fire Detectors, explains why we should be expecting the same from our fire detection systems.

In the past, facilities managers were faced with the challenge of trying to run a site at maximum efficiency with a host of independent systems. Thankfully, as technology has progressed, security, heating, lighting and ventilation can now all be combined into a single, integrated building management system (BMS). However, full fire detection integration has, to date, been difficult to achieve. There are sound reasons for this, largely stemming from the risk of having a safety critical system linked to those that are not, and the special work involved in integrating the system. Generally, fire detection systems are subject to much stricter standards than other BMS but this need not mean that integration is not viable.

The Practicalities of Integration

While it is important that fire detection devices should be physically separate from other building services equipment, there is no reason closer information integration should not be pursued. But other than convenience, what advantages does full integration bring? In essence it can make all of the building technology work harder and smarter. Faster response times, co-ordinated strategies in case of emergency or failure, and pre-planned and pre-programmed evacuation procedures are among the most effective results of inter-system communication.

What we have witnessed to date with attempts at fire detection integration are complex bespoke solutions. As commercial buildings become larger and more complex, continually adding more physical devices to link building services together becomes increasingly impractical.

Never one to back down from a challenge, Apollo firmly believed that a solution was possible. It went back to the drawing board to engineer a product that allowed for easy and efficient fire system integration while, most importantly, allowing the equipment in place to provide reliable detection.

Opening the Door to Successful Integration

OpenConnect is Apollo's solution – a deceptively simple, off-the shelf gateway product that takes information from a fire alarm control panel and connects it to a building management system using standard protocols such as BACnet, Modbus or LonWorks. The device is effectively a 'plug and play' concept that offers many practical and cost benefits to panel manufacturers, installers and end users.

At the heart of the hardware is the Tridium JACE, designed in conjunction with the well-established Niagara AX Framework, to provide easy physical integration to a host of established networks. The versatility of the OpenConnect standard allows participating fire panel partners to adopt and seamlessly integrate their equipment into building monitoring, automation and control systems using the gateway.

The system has been developed to make life easier for those using BMS. Right from the start, OpenConnect saves time and money – integration of the system can be performed by a contractor as no specialist engineering tools, re-engineering or bespoke drivers are required and full configuration can be achieved in under five minutes. There is also no need for modification of devices used in conjunction with OpenConnect-enabled control panels. Thanks to each box having its own IP address, system modification can also be performed remotely, meaning fewer call out charges. A web-based graphics package is also included through each JACE. OpenConnect means end users will enjoy full integration of the fire system and reduced cost through the use of standard software and a single interface, while the integrity of the fire system remains assured.

OpenConnect is available in four base model options: 200 BMS, 1,600, 12,000 and 25,000 BMS points. For maximum integration, each OpenConnect Gateway includes two Ethernet ports, an RS232 and RS484 port, a 15V dc input and two spare comms card slots.

The development of OpenConnect means that fire detection systems evolved for the purpose of protecting lives and property are no longer excluded from working in synergy with other building technology, resulting in a better outcome for everyone involved in the installation and management of these systems. APF

For more information, go to www.apollo-fire.co.uk

Foam Approval

The UK's largest airport operator, BAA has awarded Dr Sthamer the firefighting foam contract for its Moussol FF, a fluorine-free firefighting foam that has been tested and certified to pass the requirements of the International Civil Aviation Organisation's Level B standard. This included independent verification of the firefighting performance to the ICAO Level B standard at the CNPP Laboratory witnessed by UK CAA and BAA personnel.

Dr Sthamer's Moussol FF foam was developed to meet the stringent requirements of the aviation industry and BAA's environmental requirement to be 100 percent biodegradable within 28 days. This allows the airport rescue fire services to train with the actual foams they will respond with in real fire scenarios. The foam is already in use at London Gatwick and Southend Airport in the UK and all of Norway's and Sweden's airports and Finland's regional airport.

For more information, go to www.sthamer.com

High-Flow Compact Pump

HALE PRODUCTS has unveiled the Qmax-XS, a new concept in compact, high litres-a-minute pumps that are capable of flows exceeding 11,500 litres-a-minute, Qmax-XS has a one-piece, compact body profile that minimises piping requirements and increases premium storage space on an apparatus. The design of the Qmax-XS allows it to be installed in a pump module as small as 860mm wide with manual valves or 700mm wide with electric valves. This gives firefighters the ability to knock down large fires, plus have body side compartment space for tools and EMS equipment.

Qmax-XS is engineered to go beyond the 8,500 litres-a-minute NPFA rating and exceed 11,500 litres-a-minute from a sufficient positive pressure water source along with an appropriate engine. Its double suction impeller with dual cutwater design reduces shaft loading for long life while increasing suction performance and efficiency. The pump's one-piece upper body minimises potential piping leaks, and makes maintenance and servicing easy.

Other features of the Qmax-XS include: 12 standard 100mm discharge ports; tank to pump connections; large suction inlets; and close-supported impeller. Additionally, it is available with three heavy duty gearbox options: The Hale G-Style gearbox, the Hale K-Style gearbox and the Hale GXS Gearbox.

For more information, go to www.haleproducts.com

FM Approved Sprinkler

The VIKING CORPORATION has introduced a new FM-approved version of its dry ESFR (Early Suppression Fast Response) pendent sprinkler. The new model VK502, which complements Viking's existing UL Listed model VK501 dry ESFR sprinkler, is claimed to eliminate the need for in-rack sprinklers and a dry or pre-action system in certain freezer and cold storage applications.

Viking's ESFR sprinklers, which must be installed on a wet-pipe system, are suitable for cold storage facilities where the system piping is installed in a heated space above the freezer area. In these applications, the VK501 (UL) and VK502 (FM) sprinklers reduce the installed cost of a fire sprinkler system by providing ceiling only protection, without the additional costs associated with a dry or pre-action system, including an in-rack sprinkler system, detection system, air maintenance system, low point drains, and other components.

Each dry ESFR sprinkler is shipped with two insulating boots. These boots, which are installed above and below the ceiling penetration, help to seal the clearance space around the sprinkler's barrel, decreasing the potential for condensation and ice to build-up around the sprinkler. Both the VK501 and VK502 are offered in a single barrel length of 900mm. The 74°C sprinkler is available with a 50 mm grooved or 40 mm threaded connection.

For more information, go to www.vikinggroupinc.com

Get Snapping

To celebrate the 40th anniversary of the development of the first hydraulic cutter, which revolutionised rescue work, LUKAS is holding a photography competition. The company is looking for photographs showing historic Lukas tools in action, firefighters, or personal memories that are associated with Lukas equipment.

The deadline for entries, which can be either photographs or digital shots, is September 28th 2012. The three most impressive photos will be selected by a jury and will win valuable equipment. The best photographs will also be published on the company's website from October.

For more information, go to http://rescue.lukas.com/Photocompetition.html

Staying a Cut above the Rest

Advances in new car technology over the past twenty years have had a huge impact on how we think about rescue. We all acknowledge that vehicles are much stronger, have wider profiles and react differently both during the collision and the extrication process. However, rescuers themselves, and the tools they use, have advanced at an even greater pace. An amazing achievement for rescuers, when considering that training on new vehicles is nearly impossible.

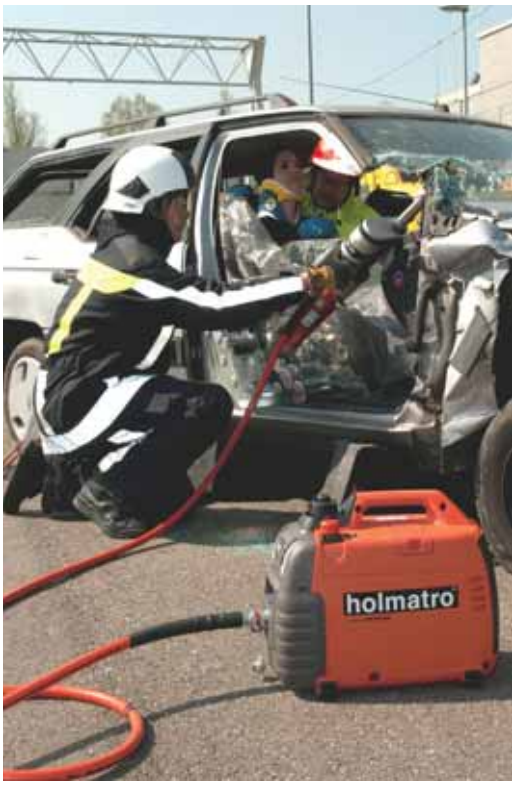
More and more rescuers around the world now use the 'extrication challenge' concept as a platform for learning and improving their performance. This year, the World Rescue Challenge will be held in London, England and will attract teams from around the globe. This event, and similar national and regional competitions, promote the "team approach' to road traffic collisions. This method gives rescuers a standard approach that can be used for any type and number of vehicles and casualties involved.

Equipment too has been developed with new car technology in mind, and we have tools specifically designed to operate on the latest vehicles, both in terms of overcoming increased strength and larger profile construction. This ability to get through the latest strength with wider blade opening capacity means that the number of cuts on scene is reduced, making extrication quicker.

Cutters and spreaders that are light and ergonomic lighten the physical burden on rescuers. These smaller, lightweight tools are easier to control, of course improving the safety of the handler. Rams that manually extend before they use hydraulic force mean that physical entrapment can be removed far quicker.

Manufacturers are committed to reducing time on scene, which is why we now have single hoses and couplings that can be changed under flow with one hand in the standing position, again reducing the impact on rescuers. These single hose systems are quicker to deploy, easier to manage on scene, and far quicker to make up and restore on the vehicle, making the scene a safer environment.

Hydraulic pumps advances now see three-stage units delivering more oil at critical pressures, allowing more tool speed. They are also casualty friendly



due to very low noise output; this allows casualty assessment to go on, uninterrupted throughout the space creation phase of the rescue.

Do not forget the smaller tools – glass management tools, seatbelt cutters, stability blocks, sharp edge protection covers and tools for exposing interior trim prior to cutting. Without these assist tools, extrication would be less safe, much more difficult and take far more time.

There is no doubt that new car technology will always move on at a great pace. They will continue to get stronger, use more advanced materials and offer challenges and it will always be difficult to obtain brand new vehicles for realistic training. However despite this, and if the past is any kind of benchmark, rescuers will continue to stay ahead of the game by continuing to seek out the best methods of extrication, and by using the correct tools, which are specifically designed with new car technology and the rescuer in mind. A good place to start is by forming your own team and taking part in the extrication challenge events. APF

For more information, go to www.holmatro.com

Flexible CBRN Training

ARGON ELECTRONICS has launched the latest version of PlumeSIM CBRN/HazMat response training simulator that offers enhanced flexibility and ease-of-use in field exercises and table training for counter terrorism, HazMat or nuclear incidents.
The PlumeSIM software, which is used with Argon chemical and radiological detector simulation instruments, enables users to plan exercises on a PC or laptop without system hardware, offering a portable simulation system with easy-to-use menus that can be swiftly set up and used to create a virtual emergency scenario.

PlumeSIM brings great flexibility to the planning of CBRN/HazMat emergency training exercises. It enables an instructor to plan a scenario that involves single or multiple releases of hazardous materials and offers the potential to define a series of release characteristics, such as duration, direction, persistence and deposition, from a variety of substances. The instructor setting the training exercise can even define the environmental conditions that would affect the movement and/or state of the virtual plume during the timespan of the operation.

Trainees can interact with Plume SIM in three modes: table-top mode, field exercise mode and post-event exercise review mode. Table -op mode offers the opportunity for trainees to navigate a scenario using a standard gamepad controller, offering a familiarisation with the simulation that enables trainees to gain more from the subsequent field training exercises. Field exercise mode enables students to investigate a training area physically, while PlumeSIM triggers readings and alarms on the simulation tools they carry by tracking their progress using GPS data relayed from personal player units. Finally, post-event exercise review mode enables all player movement and simulator activity to be reviewed by instructors and trainees at debriefing, maximising the potential for students to learn from their experiences.

In addition to its flexibility and ease-of-use, the modular Argon Plume SIM system is also cost-effective for end-users, since the number of simulation tools used can be expanded as and when budgets permit, and because all simulators can be used independently of Plume SIM there is no redundancy of equipment. Existing users of Argon detection simulation instruments are able to upgrade their equipment for use with PlumeSIM.

For more information, go to www.argonelectronics.com

21st Century Rescues

RESQTEC is claiming to be the first manufacturer of hydraulic rescue equipment able to deal with the real challenges encountered when extricating a victim trapped in a car built in the 21st century.

In recognising that the number of cars with an NCAP star rating grows by the day, ResQTec tests its equipment on several NCAP 5 star rated cars. ResQTec also recognises the growing number of armoured cars on our streets today. However, the difficulty with armoured cars is that they cannot be distinguished from the outside or inside when compared with regular cars and the materials used in armoured cars are a huge challenge in extrication.

The test included an armoured Audi A6 and a variety of ResQTec hydraulic tools: the G6w cutter, the X4 spreader and the telegram V5t. The recently introduced G6w is equipped with 1200kN of cutting capacity, a blade opening of 200mm and weighs only 17.5 kg, making it the lightest tool in its class for heavy duty cutting such as armoured cars. Like all other RESQTEC equipment the G6w has the UltimatePressure technology incorporated eliminating the forces travelling through the blades. This technology proves that, even in its first stage cutting capacity (350bar), it cuts armoured cars in a smooth and controlled motion, eliminating any unnecessary movements to the object being cut and therefore eliminating the chance of possible additional injury to the trapped victim.

The X4 spreader (1010kN spreading force and 700 mm spreading opening) was included in the test to create sufficient space for the G6w cutter to reach the hinges of the door. The V5t ram with 202kN spreading force in first stage also proves it can cope with the strong and thick armoured car materials. The hydraulic ram is useful in situations where dashboard rolls are required to release the victim.

For more information, go to www.resqtec.com

Industry First Sensor

Claimed to be the industry-first CO/NO2 XCell sensor for Altair 4X Multigas detectors, ideal for monitoring for diesel emissions, has been unveiled by MSA. The new CO/NO2 XCell sensor provides a range of 0-2000 ppm CO and 0-50 ppm NO2, 1 ppm and 0.1 ppm resolution respectively. The sensor's fast response time allows users to bump test in less than ten seconds and perform full span calibration in 60 seconds.

For more information, go to www.msasafety.com

Sharing Knowledge & Experience

The 2012 AFAC/Bushfire CRC Conference

If the AFAC/Bushfire CRC Conference in Perth, Australia demonstrated one thing, it showcased the sheer volume of the endeavours that are going into improving resilience and response to fire. The amount of expert research that is coming to fruition is awesome and most certainly encouraging for those seeking to better understand how to protect lives, property and the environment across the Asia Pacific region.

Firefighting and emergency management is undoubtedly getting tougher, but thankfully senior officers and policy makers have never before been so well armed with scientifically valid guidance on policies and procedures. More and more, firefighting and emergency response operational decisions are being based on research, substantial volumes of which is collaborative – particularly at strategic levels – across the globe. Just a quick glance at the scores of AFAC (Australasian Fire & Emergency Service Authorities Council) and Bushfire CRC poster abstracts displayed at the Perth Conference demonstrates the depth and breadth of these world-class achievements.

The way we live ensures that fire will remain a daunting fact of life. The processing, storing and transportation of highly flammable and often highly toxic substances upon which manufacturing processes and our way of life increasingly depend means that the risk is on-going. This risk is further increased by the manner in which the urbane environment is being developed, particularly – but by no means exclusively – in the developing nations. In this respect the AFAC/Bushfire CRC Conference this year made a significant contribution to understanding the importance of being problem focused when embarking on research, developing new thinking and devising solutions.

The theme of this year's conference: "Diverse country. Common ground." aptly encapsulates that challenges faced by many countries in the Asia Pacific region. In the past couple of years the region has faced what appears to be more than its share of natural disasters, ranging from the Japanese nuclear disaster following an earthquake and tsunami, the Christchurch earthquake in New Zealand, and the flooding of vast tracts of south-east Queensland in Australia. Diverse country being the only term to describe what is possibly the world's most climatically, metrologically and typographically varied region; common ground highlighting the need to appreciate that fire-fighters and rescue personnel face the same challenges, underpinning the need to share research, experiences, procedures and techniques.

Despite the first day of the conference being devoted to a Research Forum, this was most certainly no academic or ivory tower talking-shop event. It brought together all sides of the industry to share knowledge and experience. In an environment where the word emergency is spelt with a capital E, this is a major achievement. All too often, those at the sharp end of firefighting and emergency response understandably have to dedicate 100% of their attention on today's challenges, while those involved in formulating policy or deciding on resources are often embroiled in responding to aftermath of the latest disaster.

The three-day conference also comprised a number of Panel Sessions with topic spanning from the future of emergency management to good practice in urban firefighting, and from public safety and bushfires to developing and implementing community engagement programs. The 1200 or so delegates also had the opportunity to sit in on dozens of individual presentations, many of which were given by world-renowned specialists in their particular field of expertise. Significantly for those unable to attend the Perth event or because presentation timings clashed, all of these presentations can now be viewed online at the AFAC Knowledge Website at http://knowledgeweb.afac.com.au.

In addition to the main conference, the event was preceded by the option of field research trips and followed by a day devoted to a professional development programme. An exhibition ran alongside the conference where over 100 companies from around the world showcased the latest developments from market-leading brands in personnel protection equipment, firefighting vehicles and suppression technology. APF

For more information, go to www. afac.com.au

Emergency Services Show

The EMERGENCY SERVICES SHOW 2012 is being heralded as the key event for anyone involved in fire and rescue, emergency planning, response or recovery, both in the UK and abroad. This year, the event will take place on Wednesday 21st and Thursday 22nd November at Stoneleigh Park, Coventry, UK.

The event is the ideal place to explore new ideas and initiatives to help deliver effective firefighting in a range of environments throughout the world such as refineries, airports and wildfires. Worldwide flooding, and the latest blackout in northern India, have tested the world's emergency services as they battle to implement emergency plans and re-establish order throughout large communities. The Show is an ideal platform for fire and rescue services to share experiences and learn from other emergency professionals. Networking and collaboration with suppliers, colleagues and contemporaries is an essential part of ensuring an emergency is dealt with as efficiently and effectively as possible. Every year chief fire officers, operations managers and emergency planning officers with a role in operations, procurement, training and recruitment attend.

Bristol Uniforms, Devon and Somerset Fire and Rescue Service, Volvo Trucks, Dräger, Angus Fire, Vimpex, Scott Safety, Fire Service College and TEEX will be among 300 exhibitors on hand to demonstrate their latest innovations and developments. The show's Emergency Response Zone will once again feature exhibitors from fire and rescue, police, ambulance, government and voluntary organisations from around the UK. This area demonstrates to visitors the capabilities of partnering agencies and the voluntary sector.

For more information, go to www.emergencyuk.com

Unmanned Wildfire Suppression

WASP MANUFACTURING has launched a new tool to help battle wildfires – the Wildfire Automated Suppression and Protection System or WASP, an automated wildfire protection system. The new equipment helps free up ground crews, can be deployed in the bush, or anywhere there is an urban interface to protect homes and commercial structures. As long as it is hooked up to water, whether it is a lake or a fire hydrant, it can be started from any cell phone or laptop, anywhere on the planet.

Mounted on a trailer, the completely self-contained unit provides a 25,000 watt diesel generator, powerful pumps and over 900 metres of line with 30 sprinkler heads. The Wasp can be towed to a location by most full sized pickup trucks, and be easily deployed by two operators within 45 minutes.

When firefighters are pulled out of an area for safety reasons, the Wasp can be left behind, where it can pump water continuously for up to five days without supervision. The Wasp can also be used to provide emergency lighting and power, and can move extremely large quantities of water great distances in flood situations.

For more information, go to www.waspwildfire.com

UL Compliant Voice Messaging

FIKE has announces that its CyberCat platform with integrated voice messaging is now 100 percent compliant with the UL 2572 Standard for Mass Notification Systems, claiming to be the only fire alarm manufacturer currently listed to this new standard.

The system is said to have several key products and benefits that, along with the listing to UL 2572, make it an ideal foundation for mass notification (MNS) or emergency communication (ECS) systems that are designed to integrate fire, security and communications systems for immediate, responsive and effective notification of fire, weather, intrusion, and many other important emergency situations.

For more information, go to www.fike.com

SOLO TI Tic Gets Personal

The S2 Personal has been designed as a high specification, low cost thermal imager to equip firefighters with intuitive thermal imaging technology. Using the UK designed and manufactured SOLO TI camera core means less restriction and greater control, as SOLO TI manufactures every single part of each S2 Personal. Designed as an ultra-small form camera, small enough to easily clip to firefighters' gear, nomex side hand straps complete the rugged external features.

The S2 Personal is one of the world's smallest, lightest hand-held cameras weighing only 750 grams including battery, yet still manages to utilise a large format, high definition display. This feature of the display offers sharper, brighter image definition than a standard display as found in many hand-held imagers. All S2 Personal cameras have the ability to capture and store in to the on-board memory up to 1000 images with the press of a button and this capability is essential for use as evidential proof or during training exercises. Each camera is also provided free of charge with SOLO TI analysis software, which offers greater detail and colour mapping to be extracted from the downloaded images.

High Resolution/High Definition Imaging

The S2 Personal shell utilises a fire retardant polymer material and includes power pack and locking configuration with further protection offered by the oversized nomex side handles and vulcanised rubber screen shroud. The S2 Personal is offered with our high resolution/high definition sensor, the same SOLO 5200Ti camera core platform as used in the entire SOLO TI camera range and this format offers both greyscale and four colour options as standard.

Fully Loaded Standard Specification

Although the S2 Personal FIRE is a low cost unit, it most definitely has a high end specification. Each S2 Personal FIRE comes as standard in an IP67 hard shell carry case, with four rechargeable batteries with charger and all leads, replaceable display window, direct spot temperature and digital read out with temperature scale running along the right hand of the display, battery gauge, four colour maps, SOLO TI Scene Capture with SOLO TI software – all as standard features. User preference start up screen with on screen menu offered in various languages and a choice of shell colours complete the standard issue specification. Optional extras include a neck strap and retractable lanyard; the S2 Personal can also be specified with either one or two button operation.

Low Cost Maintenance, High Level Warranty

In keeping with the client cost save policy at SOLO TI, we have maintained low price replacement parts and an example of this is the battery replacement cost of only £40 and a complete charger the same. The S2 PERSONAL comes with the standard SOLO TI life time manufacturer warranty with a standard two-year electronic components warranty. APF

For more information, go to www.solo-ti.co.uk

New Warning Signal Towers

Warning signal manufacturer, E2S, has developed the IP66 sealed STA and the STB user-configurable warning towers. The construction is modular, comprising a separate termination enclosure fitted with two M20 cable entries and up to five unpopulated housings.

The assembly is available in grey, red or white. A STA audible-visual unit consists of up to four high performance L101 beacons and a 100dB(A) SONF1 10-tone sounder; the STB version has up to four beacons without the sounder. A pre-configured wiring loom interconnects the housings, enabling the units to be populated easily and configured as they are installed on site. The units are designed for use in fire and gas systems and any application where a loud audible or audible-visual warning signal is required. The sounder generates the three UKOOA/PFEER standard tones, allowing it to be installed in non-hazardous areas such as accommodation modules and canteens in onshore and offshore facilities.

The beacons are available as either 200cd Xenon strobe units or 120cd high intensity LED units, both with a choice of amber, blue, clear, green, magenta, opal, red or yellow lenses. The two-stage sounder has an effective range of 30 metres at 1kHz. Nominal operating voltages are 12VDC and 24VDC and 115VAC and 230VAC. The units can be wall or bulkhead-mounted using external lugs, or secured directly to a standard conduit box through the rear face of any of the housings.

For more information, go to www.e2s.com

New Lanyard Option

MSA's Workman self-retracting lanyard is now available in new 15-metre length for the added mobility. It has a lightweight, durable thermoplastic housing for years of dependable service, and RFID-enabled product simplifies product tracking and inspection. The Workman boasts an ergonomic carrying handle and 180kg working capacity

It is also available in a nine-metre length with galvanized or stainless steel lifeline, certified to ANSI Z359.14 2012, CSA Z259.2.2 and meets all OSHA requirements.

For more information, go to www.MSAsafety.com/WorkmanSRL

New Engineered Total Flooding System

FIRETRACE INTERNATIONAL has unveiled its new Engineered Systems, which it predicts will redefine the global total-flooding gaseous fire suppression market.

In addition to incorporating a number of innovative engineering developments, the new Engineered Systems from Firetrace are said to offer system installers greater flexibility, speedier installation, significantly lower overall installed cost and a measurable competitive edge. End user benefits come in the form of a lower financial outlay when compared with other systems on the market, significantly improved design freedom, and a swift, least-cost transition from an existing Halon system to the latest clean agent technology and delivery solution.

Firetrace's Engineered Systems offer 500 psi (34.5 bar) high pressure efficiency while utilising low pressure hardware. The system is designed to slash the amount of piping used, with savings on distribution network alone being quoted as typically between 25 percent and 40 percent. At the same time, the bugbear of having to accurately equally balance the amount of agent at Bull T and Side T connections has been overcome, plus extra pipe lengths between tees is either minimal or completely unnecessary. With Engineered Systems, the Bull T split can be up to an 85/15 split, while the Side T can be as much as a 95/5 split.

The actuation system has been designed to be stackable, and the cylinder storage problems often associated with gaseous total flooding systems have been overcome. With the new Firetrace offering, the distance between the agent storage cylinder and the discharge nozzle is claimed to be more than three times longer than old-technology systems on the market, significantly increasing the vertical distance capability. The liquid agent to pipe volumes are up by 500 percent; and higher fill density means more agent in the same hardware. All of this is achieved without the need to incorporate expensive Nitrogen driver systems, so installing the largest possible networks without having to resort to incorporating extra equipment.

Firetrace believes that as many as 75 percent of existing Halon distribution networks can be easily and cost-effectively refitted with its Engineered Systems utilising the existing piping. Its Engineered Systems fully comply with every aspect of NFPA 2001: 2012, the standard on clean agent fire extinguishing systems.

For more information, go to www.firetrace.com

2012 IWMA Conference Goes to Barcelona

The past 15 years have been distinguished by significant advancement in the commercial application of water mist fire suppression technology throughout the world, so the 2012 IWMA conference in Barcelona, Spain in November has much to offer.

The Montreal Protocol opened the way for water mist technology as replacement for Halon. More than a decade of research and development on water mist systems has revealed a broad variety of applications where this technology can replace not only ozone depleting chemical agents; it also represents a measure equivalent to standard sprinklers. The undisputed environmental advantages embodied in water mist systems combined with efficient firefighting characteristics will certainly contribute to its continued success in the future.

The IWMA

Some years ago a logical conclusion of the continuous development of water mist technology throughout the world was the creation of the IWMA – the International Water Mist Association. For more than ten years the IWMA has supported research, development and the use of water mist technology worldwide. Until then the IWMA provides a platform and a forum for all interested parties active in this field; manufacturers, distributors, insurers and approval bodies, research bodies and private individuals.

The on-going success of water mist systems will strongly depend on reliable codes and standards. IMO has been the driving force that developed guidelines and test protocols for the use of water mist on ships. NFPA, UL, FM, CEN have developed guidelines and test protocols for land-based applications, but there are still gaps to close. It is currently the major task of the IWMA to support the further development of a European Standard for water mist systems.

The revision process of Technical Specification 14972 is not finished yet, so has not yet been transformed into a European Standard. This transformation, however, is urgently needed to serve the market with mandatory rules all market players can rely on. Basically, this missing standard currently prevents water mist technology from further spreading throughout Europe. Potential users are hesitant because of the lack of a binding document.

As IWMA had proposed, the first step should be the finishing of the general design and installation standard. The second task should be to add step-by-step test protocols for certain applications.

IWMA Conference 2012

This topic will be certainly discussed in depth during the next IWMA conference in the World Trade Centre in Barcelona on 14th and 15th November.

Many experts and researchers from around the world will present the latest findings on water mist technology, will define the current state-of-the-art of this fire protection technique and will, using case studies, describe the latest applications. The current situation on standards and test protocols will also be discussed. The conference language will be English and Spanish, so Spanish-speaking delegates may take advantage of the English-Spanish translation.

This will be a truly international event; delegates from more than twenty countries will make it once more a worldwide come together. Save the date and join this excellent networking opportunity to meet all major researchers, manufacturers, distributors and others interested in the field. Meet the number-one experts in water mist technology from around the world at the World Trade Centre Barcelona; a very special conference location where you might even get the chance to see a cruise liner equipped with a water mist system just few steps away from the conference centre. APF

For more information, go to www.iwma.net

New Structural Fire Fighting Helmet Standard

Following eight years of committee deliberation and public comment, the latest edition of the Australia/New Zealand Structural Fire Fighting Standard, AS/NZS 4067: 2012, is now up and running. This new edition will incorporate the introduction of increased minimum requirements for structural fire fighting helmets in Australia and New Zealand.

The SF049 committee responsible for drafting this Standard comprised representatives from numerous Australian and New Zealand fire brigades, the Australasian Fire and Emergency Service Authorities Council (AFAC), New Zealand's United Fire Brigades Association (UFBA) representatives, and industry specialists with international standards experience. While the focus of the new edition remains on providing the highest levels of safety, it also adds three new requirements, and three changes to existing requirements.

New Requirements

1. Helmet shock impact resistance: impact energy transferred must be less than 15kN of all five test sites.
2. Mechanical rigidity (lateral shell crushing test), both transverse and longitudinal.
3. Contact with liquid chemicals on face shield that comprises acid, alkaline, alcohol and organic solvent.

Changes to Existing Requirements

1. The face shield ballistic test speed has been increased from 76 metres per second to 120 metres per second to be in line with EN443.
2. Ease of ignition on ear and neck protector. This has been revised to ISO 15025 method – procedure A, surface ignition, and procedure B, bottom-edge ignition, to be in line with international practices.
3. Revised peripheral vision involving a change of clearance from ≥120° to ≥105°.

Advantages of the Multiple Certification Approach

These changes make the AS/NZS 4067 Standard one of the toughest helmet standards in the world today. Currently, Pacific Helmets is the only helmet manufacturer that makes helmets that are certified to all three major international structural fire-fighting helmet standards (AS/NZS, EN and NFPA). Consequently, conforming to these changes presents no difficulties for the company as its current helmets fall well inside the requirements of any standard and we welcome changes that bring increased safety to the wearers of our helmets.

The key advantage of achieving certification to multiple standards lies in the varied nature of the standards requirements across the three regions.

Some tests that are specific to one region may be intended to simulate a particular situation. As an example, the impact energy attenuation test found in AS/NZS 4067 simulates a firefighter falling from height. It also simulates the somewhat neglected but highly significant danger of impact that may result when involved in an accident in an emergency services vehicle.

Helmets Certified to AS/NZS4067: 2012

Pacific Helmets will be both updating existing models and launching new models to the new edition of the Standard. The latest model to be released that will be certified to AS/NZS 4067: 2012 is the F10 Mk III that will also be known as the "Battler". This is a jet-style helmet that features Pacific Helmet's patented One-Touch™ automatic deploying eye protector. Also available in this model is the option of an ultra-high temperature resistant face shield. The company's popular F3D and F4C models will also be certified to the updated edition of the Standard. A version of the high temperature face shield will also be available on these models. The One-Touch™ eye protector will also be incorporated into these two models in the coming months. APF

For more information, go to www.pacifichelmets.com

All new Pacific F10 MkIII

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- **AFC™ oriented design**
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Certifications:
- **AS/NZS 4067: 2012**
- **EN 443: 2008; EN 14458: 2004**
- **NFPA 1971: 2013**

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Model	dia (mm)	Max length
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Supporting the Team for a Safe Rescue

Bob Grieve

Delta Fire Australasia

The scale and complexity of natural disasters and man-made incidents, coupled with the population's growing expectation of swift and safe extrication, has in recent years witnessed major strides in the provision of structural collapse and confined space rescue equipment.

All too often our TV screens are filled with chaotic images of frightened and panic-stricken people tearing with their bare hands at collapsed rubble, frantically trying to rescue the victims of buildings, tunnels and bridges demolished by earthquakes, volcanic eruptions and cyclones. Sometimes these scenes are even more harrowing following terrorist activity when the devastation is the result of man's own merciless inhumanity.

Speed of extrication is a key life-saving issue; the faster medical aid can be given to injured victims, the better their chances of survival. It may also be the case that the trapped victim is at additional risk due to oxygen depletion, a fractured water main or gas main or toxic emissions.

So, the equation is simple – the sooner the victims are rescued, the more lives are likely to be saved. However, speed alone is not the only life or death deciding factor. The extrication must be conducted with extreme care if the very endeavour to rescue a trapped victim is not to result in further injury or place the rescuers in even greater peril. To revert back to those scenes on television, it is possible to only speculate how many trapped victims perish as a result of wholly well-intentioned but misguided rescuers trampling over the rubble in their evident distress, further compressing the tonnes of rubble onto those entombed below. One of the major threats to those trapped in collapsed and confined spaces is secondary injury brought about by movement and the dislodging of rubble during the rescue operation.

Training is, of course, absolutely essential to ensure that panic and the risk of further injury to trapped victims and rescue personnel alike are replaced with understanding, expertise, planned response and control of the scene. But to achieve this it is equally important to have at hand the right equipment for the particular rescue challenge being faced – tools such as hydraulic extrication equipment, personal safety and support equipment,

emergency ventilation equipment and, most importantly, tools such as lifting and stabilisation equipment.

Safe Lifting

Lifting a heavy object such as a large section of collapsed masonry or a concrete or steel beam either to free a trapped victim or gain access to a casualty invariably has to take place in very restricted spaces. While the weight of the object to be lifted frequently demands ultra-high capacity equipment, the limited available space through which it can be accessed and in which it can be utilised means that the chosen equipment must also be sturdy, compact and be man-handled and positioned as easily as possible.

Lifting bags used in conjunction with stabilisation blocks are often the only workable option for structural collapse and confined space rescue operations. They have a large stroke, the essential load lifting capacity and can be deployed quickly; they also offer the ultimate in control.

In many collapse situations it is essential that the lifting bag has the ability to raise a point load without any loss of capacity. This is achievable with, for example, the RESQTEC NT-Series lifting bag due to the availability of a connectable load plate. The oval design retains a large surface area, the metal top provides a large contact area throughout the lift, plus bags can be stacked to increase height. Additionally they require no blocking and can cope with an "arc" movement using a pivot point. They are available in three variants: light, medium and heavy duty and, when compared with the high pressure pillow bags on the market, provide as much as 800 percent more power at full height.

Another factor in this particular bag's favour is that, in addition to a safety factor of more than four, it is resistant to puncturing. This is an important consideration as exposed reinforcement bar and broken edges of bricks and concrete sections are a frequently present hazard with which to contend.

Conventional lifting bags are an option that are sometimes considered, but these have certain drawbacks, including an inability to provide an "arc" lift. This is often an important consideration when selecting a lifting system as reliance on just vertical lifting can result in an unstable and dangerous floating load, putting both the victim and rescuer at serious risk of injury if the load topples over during extrication. They do however have a

Out of the ordinary environments demand beyond the ordinary protection

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role to play when lifting lighter obstructions or when there is a need to form a small gap, for example to release a trapped limb.

Secure Stabilisation

In the vast majority of instances, the use of some form of shoring is absolutely essential, as it is invariably extremely difficult, even for a qualified structural engineer, to judge how an unstable structure is likely to perform when large sections of the structure are moved to access a trapped casualty. To prevent movement of the supported structure while extricating a victim it is vital to effectively crib and securely stabilise the structure. This is best achieved in one of three possible ways: by using stabilisation blocks in conjunction with appropriate lifting bags; utilising support props; or, as is most frequently the best option, implementing a solution that is a combination of both stabilising blocks and support struts.

A widely adopted option is the use of Cribblock interlocking stabilisation blocks. However, it is important when selecting such a stabilisation system to ensure that it offers the essential support integrity, load capacity and modular flexibility to enable it to be used in a myriad of shape and size spaces – confined spaces within collapsed buildings are never flat surfaces at right angles to each other. The Cribblock system, for example, incorporates interlocking devices that ensure that blocks are secured in position and cannot slip apart when under load in the way in which wooden wedges can dislodge. The larger of

the blocks measure 60cm by 20cm by 8cm and weigh 7.5kg; they have integral carrying handles making them easier and quicker to carry, locate and secure in position. Blocks come in a variety of shapes and sizes to offer the greatest in-use flexibility: rectangular blocks, wedges and saddle wedges, together with connectors.

While props tend to be most widely used in road traffic accidents and for vehicle stabilisation, they do have a useful function to perform in supporting building structures and shoring and supporting walls that are at risk of collapsing.

The Profix PX-Series from RESQTEC is a good example of a supporting and stabilisation prop system. It comes in an extensive range of sizes – from 55cm to 373cm – and load capacities spanning from 9.6 tons (94.4kN) to 10.5 tons (102.9kN) with a 2:1 safety factor. Profix PX is available with a number of head attachments to ensure a good grip on concrete or support a beam, plus a three-strut gantry for enhanced load capacity. The extending cylinder can be operated manually or pneumatically in combination with the NT lifting bag described earlier.

These load capacities are increased to 14 tons (139kN) with a 4:1 safety factor in the Profix Max Series air strut, while the sizes span from 60cm to 400cm. A number of extension pieces are available to increase these lengths; it incorporates a quick-fit pull-and-place automatic locking device and one or more struts can be safely operated remotely.

Controlled Procedure

Following the correct procedure is every bit as important as the quality and versatility of the equipment if the rescue is to be carried out swiftly and safely.

While every rescue is unique, there are essentially eight steps that should be taken in the following order when using the equipment described briefly earlier:

- Pivot points should be blocked and crib blocks should be placed on the lifting edge of the obstruction.
- The obstruction should be stabilised using shoring props.
- Hoses, the controller and regulator for the lifting bags should be set up.
- Lifting bags should be connected for the required lift height and capacity.
- Position the lifting bags.
- The rescue team should be coordinated to raise the obstruction.
- Crib blocks should be added as the lift proceeds on a "follow the load" principle.
- The elevated obstruction should then be secured with crib blocks and props, prior to commencing extrication.

This underpins the ever-present need for training and for undertaking regular exercises in conditions that are as near as possible to those likely to be experienced in a real rescue. Teamwork is, of course, absolutely vital, and no amount of the best available equipment will turn a poorly trained, inexperienced crew into an effective structural collapse or confined space rescue team. APF

Bob Grieve is Managing Director of Delta Fire Australasia

For further information, go to www.deltafire.com.au

Combating Heat Stress on the Frontline

Tom Hainsworth

Hainsworth

Significant advances have been made not only in the personal protective equipment (PPE) used by firefighters around the world but also in terms of the thinking that goes into today's turnout gear. While there was a time, not too long ago, when the only real consideration was thermal protection, the issue of heat stress management is now increasingly regarded as just as important.

Growing awareness of the problem – considered to be the biggest threat to the safety of firefighters – can be seen in the introduction of various standards in recent years. These include the incorporation of water vapour resistance testing into EN469:2005, the introduction of a physiological Annex F into the latest revision of EN469 and the development of the sweating articulated manikin test method ISO 15831:2004.

Total heat loss requirements were introduced into NFPA 1971 in 2000 with the level of stringency being stepped up five years ago from 130W/m^2 to 205W/m^2. A further nod to the importance of heat stress management could be seen with the changing of NFPA 1584 *Recommended Practice on the Rehabilitation of Members Operating at Incident Scene Operations and Training Exercises,* 2003 edition to a standard in 2008 to provide guidance for job specific, safe working procedures for the prevention of heat related disorders.

Heat stress, if not managed and monitored effectively, can not only imperil the life of a firefighter but, on a more day to day basis, can seriously harm someone's decision-making ability which, in turn, then potentially puts the lives of colleagues on the line.

To understand why the issue of heat stress is so important, there is a need to appreciate how the human body reacts to heat. The body's internal core temperature is closely regulated and remains within a very tightly defined range from approximately 36°C to 38°C. This temperature range is maintained by controlling the equilibrium between the amount of heat the body produces through physical activity, the amount of heat stored by the body, and the amount of heat lost to the surroundings through sweat evaporation and heat radiation, convection and conduction aided by vasodilation (the widening of blood vessels that results from relaxation of the muscular walls of the vessels).

When the ambient temperature of the surroundings rises to above 35°C, heat loss through radiation, convection and conduction stops and the only way left for the body to cool itself is through sweat evaporation. This will also stop if the heat and humidity becomes excessive, causing the body to store the excess heat produced and produce a rise in the core body temperature.

The first symptoms of heat stress are thirst and muscle cramps caused by dehydration. Dehydration levels as low as 2% of body weight can cause slower reaction times and loss of concentration, both of which can put a firefighter in great danger. Ensuring that the firefighter is well hydrated can mitigate the effects of heat stress and dehydration is easier to prevent than treat.

If the core body temperature continues to rise, it can lead to heat exhaustion (symptoms of which include fatigue, dizziness and nausea) and finally heat stroke (core body temperature in excess of 40°C), symptoms of which include seizures, unconsciousness and, potentially, death. A serious side effect throughout this process is mental confusion and irrational behaviour, which can affect the decision making process of the individual and pose a high risk to the wellbeing and safety not only of that individual, but also of all members of his or her team.

Managing heat stress is as much about protecting physical health as it is about protecting mental health and the decision making capability of the individual and the team at large.

There are a number of factors which play a key role in the management and elimination of heat stress. Two of the most important are enhanced personal and operational discipline. The former

includes the maintenance and monitoring of fitness and hydration levels, good diet and avoidance of alcohol and caffeine prior to being on duty. The latter concerns crew rotation, rest and recuperation, active cooling and regular employee health checks.

Increasingly, those responsible for the procurement of PPE are looking for a holistic approach from companies such as Hainsworth, which designs its fabrics with a complete understanding of how they interact with the various layers in the system. Serious consideration is given to each layer to offer the best possible performance, which encourages effective moisture movement through the system and, with it, the best possible heat stress management.

In these tough financial times, there is also an acute awareness that by managing heat stress effectively, there is a significant financial saving to be made in terms of loss of productivity caused by ill health and down days. Mark Jones, one of the UK's most experienced chief fire officers, says: "The importance of heat stress management is now widely recognised and it is a subject in which we are also more knowledgeable and technically efficient than we have ever been. He continues: "Today's firefighters are far more educated about the personal and operational issues surrounding heat stress management and, through their growing knowledge of equipment used by other services, about the PPE available on the market."

"We work with our fire crews to help them understand the issues of heat stress and how they can avoid or mitigate the symptoms. For example, we talk a lot about the importance of personal hydration and of opening their tunics to enhance breathability and accelerate cooling during recovery periods. Our firefighters may be better protected than ever before with today's PPE, which is of a far higher specification, but it important that their awareness and knowledge of the dangers they face remain high." Mark concludes: "In an ideal world, someone would develop PPE with a single directional flow of heat or kit that is totally heat resistant, but this is unlikely to be viable."

The nature of the job means that, when firefighting, firefighters are already operating in a far more stressful environment than virtually every other occupation. By continuing to make advances in heat stress management technology, we can not only help them continue to perform to the highest possible standards operationally but also save lives. APF

Tom Hainsworth is Managing Director of Hainsworth

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Opening Up the Debate on Fire Detection Protocols

Paul Pope

Apollo Detectors

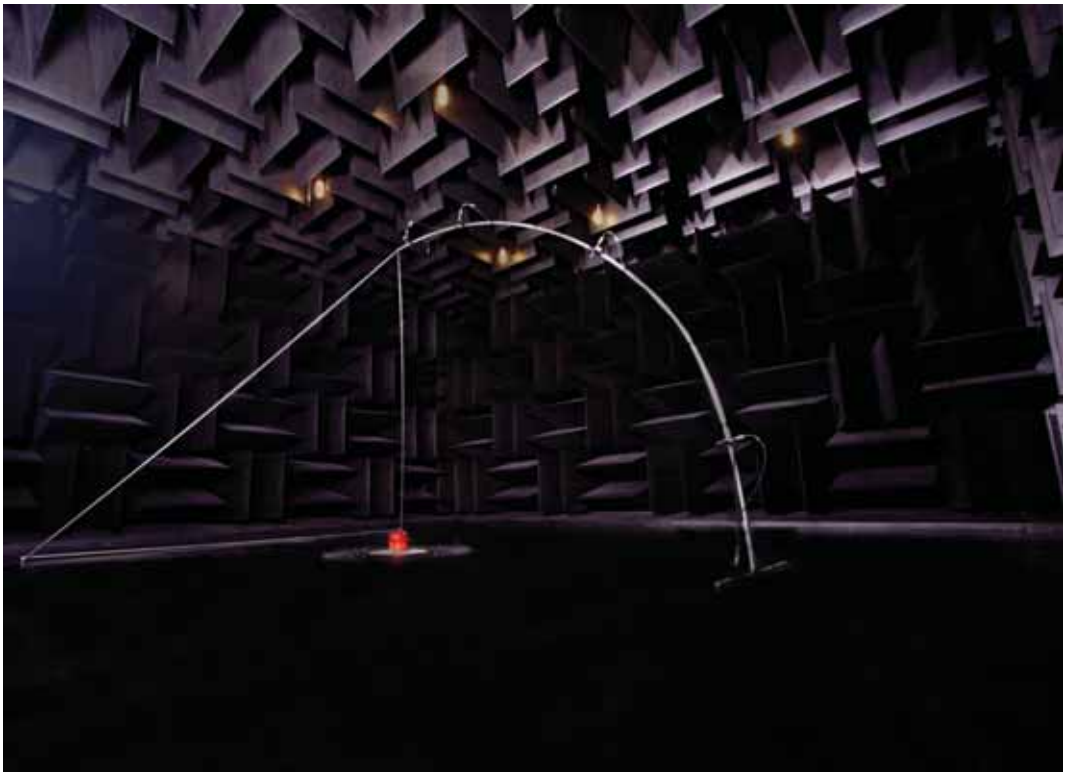
Every year we see more unique buildings appear across the region, each one demanding the highest level of fire protection. At the same time detection technology is moving on a pace with new intelligent systems delivering exceptional service. But, despite all of this, the industry still seems to be dragging its heels on one particular issue – protocol.

You can understand how for many companies producing 'one-stop shop' ranges makes perfect business sense, but in an industry that is supposed to pride itself in doing its upmost to protect life and property how can restricting choice be a good thing? Surely, giving installers freedom of choice when it comes to choosing fire detection systems is the only way forward for the industry.

Protocol is not complicated but some do their best to make it seem so. What it really boils down to is choice and whether you have any.

Protocol is the language devices use to communicate with each other. In the case of fire alarm systems, this usually means the field devices such as manual call points, detectors and interfaces communicating with the fire control panel. Modern fire detection systems constantly monitor the air and temperature around each smoke or heat detector, gathering information that is processed in the detectors and control panels to decide whether a fire is developing. Protocol is the way in which the control panels request and receive this information from detectors in order to ensure that abnormally high levels of smoke or heat are reported without delay. Fairly straight forward so far, but difficulties start to arise when installers may want to use a mix of panels and detectors from different suppliers. Depending on the protocol used, this may not be feasible.

Today's end users of fire detection systems face an increasingly diverse and often complex choice



of solutions, so it has never been more critical that everyone involved in the purchasing decision understands the difference between the two types of system and the potential implications of this decision in years to come.

Closed Protocol

Manufacturers offering both panels and field devices – effectively all the elements needed to provide an intelligent system – have no need to disclose the nature of their protocol to any other parties and as such, equipment supplied by other manufacturers is not expected to be compat ible with these systems. The protocol used is said to be 'closed'.

Manufacturers of equipment using closed protocols claim that all elements of their equip ment (control panels, detectors, panels, call points, interfaces and special detectors such as beam detectors) will work harmoniously with each other, since it is all designed and made by the same company. The implication is that a system comprising detectors and interfaces from one manufacturer and control panels from another cannot work as well together as when everything comes from one manufacturer.

Those promoting closed protocol would argue that by sourcing products from a 'one-stop shop', the purchasing process is simplified, with customers potentially able to make cost savings and having greater negotiating power because they are placing a single large order with one supplier. In today's economic climate, it is easy to see why companies will take a short-term view to their purchasing decision and be lured into this attractive, cost-saving option.

It is vital, however, that those responsible for purchasing a fire detection system understand that by specifying closed protocol systems, they will be tied to a single manufacturer throughout the lifetime of the fire system. Consideration needs to be given to who will have the negotiating power when the system needs to be extended. Similarly, if the products or services fail to meet expectations, the customer or engineer is not at liberty to try another manufacturer's detectors as a means of eliminating the problem because they will not be compatible with the rest of the system.

Compatibility is without doubt the fundamental problem with closed protocol systems. There is no compatibility between equipment produced by different manufacturers; this restricts the system, resulting in only the original manufacturer or its agents being able to maintain it, and customers being entirely dependent on one supplier for spares, servicing, modification and upgrades of their systems.

It is also important to consider the longer-term implications of opting for a closed protocol system – when an upgrade or extension to the system is required in the future, customers will have only a limited choice and it cannot be assumed that products from the original closed protocol will still be available. In this situation, the cost of upgrading or extending will drastically increase as the only option is to replace the entire fire system and start again.

Open Protocol

A number of device manufacturers, including Apollo Fire Detectors, do not make all the fire system components themselves and have instead built up partnerships with independent fire control panel manufacturers and, in some cases, companies that offer other synergistic products, such as aspirating smoke detectors. It is the field device manufacturer that normally determines the protocol used. In order to encourage independent manufacturers to design and develop control panels that are fully compatible, they publish and share information including technical data, enabling panel manufacturers and other companies to design compatible controlling equipment.

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As all the details of the protocol are disclosed to associated partners, it is referred to as an 'open' protocol.

An open protocol system avoids many of the potential pitfalls of being tied to a single manufacturer. The benefits offered by open protocol systems include:

- Choice – An open protocol system makes products interchangeable across a wide range of manufacturers and offers freedom of choice in terms of product, installer and maintainer. The customer is free to choose between different companies to service the system.
- Expertise – Different suppliers could be used for the components according to their specific area of expertise. Open protocol manufacturers can concentrate their core specialist skills and maintain flexibility in an integrated systems approach.
- No Restrictions – Upgrades, maintenance or replacement of products can be undertaken by any competent installer.
- Availability – Compatible products are available from a greater range of suppliers.
- Competition – Multiple providers create greater price competition and drive providers to keep customers because they give the best value and service.
- Innovation – Open protocol offers customers greater choice as it drives manufacturers to innovate and create better products that people select because of their performance.

One criticism sometimes directed at open protocol is that combining products from different manufacturers inevitably means that the system will not work as well as one where all the components are sourced from a single manufacturer. However, this is a false assumption as the certification and testing for all the components of the fire detection system remains the same.

To use a sporting analogy, most Formula 1 racing cars are a combination of components from various specialist high technology manufacturers and are extremely successful. In this highly competitive sport it is an advantage to use the best in-class specialist manufacturers that can concentrate on their own skill areas. This is also true in the fire detection industry.

Basing fire system development on partnering rather than excluding other manufacturers encourages longevity. Manufacturers may come in or occasionally drop out of the partnership, but products compatible with the shared, open protocol will always remain. The digital protocol that Apollo detectors use, for example, has been available since 1980, and has since been extended twice to ensure that Apollo technology is always the latest and most up to date in the industry. Although the protocol has been extended, it still ensures forwards and backwards compatibility between products, simplifying extensions of systems or replacement of detectors to accommodate changes of building use and making upgrades logistically easier because work can be carried out in phases over time.

Key Considerations

There are pros and cons for both closed and open protocol and the decision as to which type of fire detection system to be installed needs to be made on a case-by-case basis. There are, however, some key questions that should be asked and the following checklist is a useful starting point when beginning the process of purchasing a new fire detection system, whether open or closed protocol:

- Is the manufacturer a well-established company?
- What after-sales service is offered by the manufacturer?
- How long will the product range be supported?
- What is the manufacturer's upgrade policy?
- Will the manufacturer maintain product backwards and forwards compatibility?
- Can the system maintenance be carried out by any competent third party? If yes, what knowledge, protocols, equipment, software passwords etc are required?
- What is the cost of maintenance for the life of the system?
- What is the cost of replacement parts (such as detectors) for the life of the system?
- What are the labour rates for service and call outs and the rates for software upgrades?

A criticism sometimes directed at open protocol is that combining products from different manufacturers inevitably means that the system will not work as well as one where all the components are sourced from a single manufacturer. This is a false assumption as the certification and testing for all the components of the fire detection system remains the same.

Conclusion

The objective of this checklist is to make decision makers consider the total cost of ownership (TCO) rather than just the purchase price when making a financial comparison between fire detection systems.

The TCO includes all of the additional costs required to support and maintain the system purchased for its lifetime. The protocol of a fire detection system must be considered at the purchasing stage in order to help determine the total lifetime costs. Even where one option seems to offer an initial cost saving, it is the whole life cost of the fire system – and how easy it will be to maintain to a standard that meets both current and future requirements – that must be the priority of the fire safety professional.

Apollo acknowledges the importance of life safety and system integrity and recommends the routine replacement of detectors after ten years. Apollo's Product Lifetime Guarantee supports the recommended working life of a detector and provides a warranty on all products, which for detectors is ten years and for CO detectors is five years. APF

Paul Pope is Business Innovation Manager at Apollo Detectors

For further information, go to www.apollo-fire.co.uk

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Typical ICAO Level B performance of tested F3s at one-minute

Independent Evaluation of Fluorine Free Foams (F3)

A Summary of ICAO Level B & EN 1568 Fire Test Results

Mitch Hubert

Chang Jho

Eduard K. Kleiner

Dynax Corporation

Dynax Corporation is a major producer of C6-telomer-based fluorosurfactants and fluorochemical foam stabilisers for use in AFFF, AR-AFFF, FP, FFFP and AR-FFFP agents, and a founding member of the Fire Fighting Foam Coalition (FFFC). In the past, Dynax has received from customers and other sources conflicting information regarding the fire performance levels of Fluorine Free Foam (F3) agents, particularly against the ICAO Level B foam standard. Despite individual attempts by some foam manufacturers in the past, F3 agents have rarely been subjected to an independent and comparative evaluation under the same test conditions.

As a member of the Fire Fighting Foam Coalition (FFFC) Dynax is involved in the evaluation of the proposed ICAO Level C standard that has recently raised some serious issues, such as extending the extinguishment time requirements by permitting flicker fires from 60 seconds to 120 seconds. If adopted, this change of extinguishment time requirements would also apply to the existing ICAO Level A and B standards.

In an effort to obtain independent and comparative fire performance data on F3 agents under the same test conditions, Dynax, as the sponsor of this project, commissioned Resource Protection International (RPI) to provide an independent third-party witnessing service for the fire tests according to ICAO Level B and EN 1568 (Part 3 and 4). RPI is uniquely qualified to witness such tests as it has sitting members on the NFPA and EN Foam Technical Committees, as well as being LASTFIRE testing coordinators and LASTFIRE steering committee members. Dafo Fomtec and Falk Nutec provided logistical support. The test data presented in this article is taken directly from the full report prepared by RPI.

TABLE 1 – ICAO LEVEL B TEST RESULTS

Test Configuration: ICAO Level B
Test Fuel: Jet A1 / Premix: in Fresh water

Test Product	Nozzle	FXR	QDT	CT (90%)	CT (99%)	EXT	BB (25%)	Pass/Fail
Product A-F3-6%	UNI 86	9.6	18:26	0:35	0:45	None	N/A	Fail
	MMS	4.8	10:56	0:30	0:45	1:58	(6:45)	Fail
Product B-F3-3%/6%	UNI 86	10.2	15:07	0:40	0:45	1:24	(7:50)	Fail
	MMS	4.9	5:35	0:35	0:55	None	N/A	Fail
Product C-F3-3%	UNI 86	9.6	16:16	0:50	1:05	2:00	(8:30)	Fail
	MMS	4.5	18:38	0:50	1:45	None	N/A	Fail
Product D-F3-3%/3%	UNI 86	8.5	22:57	0:55	1:05	1:40	(9:50)	Fail
Product E-F3-3%/6%	UNI 86	7.4	17:00	0:40	0:55	1:50	(8:05)	Fail

MMS (Modified Militatry Specification); FXR (Foam Expansion Ratio); QDT (Quarter Drain Time); CT (Control Time); EXT (Extinguishment Time); BB (Burnback Time)

TABLE 2 – EN 1568-3 TEST RESULTS (FORCEFUL APPLICATION)

Test Configuration: EN 1568-3 / FORCEFUL Application
Test Fuel: Heptane / Premix: in Fresh water

Test Product	Nozzle	FXR	QDT	CT (90%)	CT (99%)	EXT	BB (25%)	Class
Product A-F3-6%	UNI 86	9.3	25:16	0:45	1:25	None	N/A	Fail
	UNI 86	8.8	18:25	0:25	1:00	None	N/A	Fail
	MMS	4.6	10:25	0:45	1:20	None	N/A	Fail
	MMS	5.0	9:33	0:40	2:50	None	N/A	Fail
Product B-F3-3%/6%	UNI 86	9.3	16:57	0:50	1:10	None	N/A	Fail
	MMS	4.5	6:04	0:55	DNA	None	N/A	Fail
Product C-F3-3%	UNI 86	8.5	21:32	0:45	1:20	1:49	6:00	→
	MMS	4.2	18:28	0:40	3:00	None	N/A	→
Product D-F3-3%/3%	UNI 86	8.7	19:11	0:40	1:15	2:09	5:55	→
	MMS	5.1	15:34	0:50	DNA	None	N/A	→

MMS (Modified Militatry Specification); FXR (Foam Expansion Ratio); QDT (Quarter Drain Time); CT (Control Time); EXT (Extinguishment Time); BB (Burnback Time); DNA (Did Not Achieve); → (Followed by Gentle application test)

TABLE 3 – EN 1568-3 TEST RESULTS (GENTLE APPLICATION)

Test Configuration: EN 1568-3 / GENTLE Application
Test Fuel: Heptane / Premix: in Fresh water

Test Product	Nozzle	FXR	QDT	CT (90%)	CT (99%)	EXT	BB (25%)	Class
Product A-F3-6%	UNI 86	9.3	25:16	0:35	1:00	None	N/A	Fail
	UNI 86	8.8	18:25	0:35	1:00	None	N/A	Fail
	MMS	4.6	10:25	1:00	1:40	None	N/A	Fail
	MMS	5.0	9:33	0:55	1:15	3:40	13:00	IIIC
Product B-F3-3%/6%	UNI 86	9.3	16:57	0:40	1:20	None	N/A	Fail
	MMS	4.5	6:04	1:00	1:45	None	N/A	Fail
Product C-F3-3%	UNI 86	8.5	21:32	0:35	1:20	2:17	24:30	IB
	MMS	4.2	18:28	0:45	1:55	4:05	23:30	IIIB
Product D-F3-3%/3%	UNI 86	8.7	19:11	0:35	1:05	1:40	21:50	IB
	MMS	5.1	15:34	0:45	1:30	2:50	12:45	IIIC
Product E-F3-3%/6%	UNI 86	8.7	18:04	0:45	1:25	2:08	17:00	IIIB
	MMS	4.4	5:58	1:25	2:10	None	(10:40)	Fail

MMS (Modified Militatry Specification); FXR (Foam Expansion Ratio); QDT (Quarter Drain Time); CT (Control Time); EXT (Extinguishment Time); BB (Burnback Time);

ICAO Level B & EN 1568 Fire Test Program

In May of 2012, a series of 38 fire tests were carried out with five different Fluorine Free Foam (F3) agents by the Danish Fire Laboratories (DFL) at the outdoor fire testing and training facilities of Falk Nutec in Esbjerg, Denmark. ICAO Level B and EN 1568 tests were conducted in fresh water. Although the ICAO Level B Standard allows nozzle movement in a horizontal plane during the test, all tests in this program were run with the nozzle in a fixed position to improve the reproducibility in comparing the performance of the F3 agents.

The main objectives of this extensive fire test program were to:

- Confirm if the selected group of F3 agents meet, under the same test conditions, the requirements of ICAO Level B and EN 1568 (Part 3 and 4).
- Compare the above test results obtained with the UNI 86 nozzle (the nozzle specified in ICAO and EN 1568 Parts 3&4) with results obtained with a modified air-aspirating US Mil-Spec (MMS) nozzle providing the same nominal flow rate as the UNI 86 nozzle but approximately half the foam expansion and drain time values. The results of these comparative fire tests are considered important, because many commercial air-aspirating foam discharge devices, such as hand-line nozzles, branch-pipes and high flow turrets, generate foams with considerably lower expansion and drain time characteristics than those obtained with the UNI 86 nozzle.
- Determine if all the F3 agents included in this study are free of fluorine.

Test Samples

With one exception, the test samples were all commercial products purchased on the open market just prior to the test program. These products represent sampling of the major F3 agents currently available on the market. The F3 agents tested are coded as follows:

- Product A-F3-6%.
- Product B-F3-3%/6%.
- Product C-F3-3%.
- Product D-F3-3%/3% (a developmental product).
- Product E-F3-3%/6%

Results

As expected, test results showed variability between manufacturers. In general, the foams tested showed reasonable fire control but suffered persistent edge flicker fires so they failed to extinguish at all, or only extinguished with considerable difficulty.

Of particular interest were the results obtained from the ICAO Level B testing (Table 1), because a few airports and aerodromes have recently started using F3 agents in lieu of AFFF or FFFP agents.

When the nozzle was maintained in a fixed position, these tests showed that none of the F3 agents extinguished the fire within the maximum 60-second time limit specified in the ICAO Standard. Contrary to the expectation that the sloppier foam obtained from the MMS nozzle might provide a faster knockdown and extinguishment on aviation kerosene (Jet A1), control times actually got longer with the MMS nozzle in two out of the three tests, and in both of these cases extinguishment was not achieved.

EN 1568-3 test results summarised in Table 2

and 3 also show variability in performance between agents.

These sets of data have shown that only three of the five agents tested were able to gain an EN 1568-3 class rating. In all cases, the control and extinguishment times extended considerably as the UNI 86 nozzle was switched to the MMS nozzle. It is noted that none of the agents in this test program achieved an IA forceful application rating (Table 2). Even under the gentle application conditions (Table 3), some F3 foams failed to extinguish the fire when the MMS nozzle was used.

For EN 1568-4 testing (Table 4), only the three agents claiming polar solvent performance were tested. Only the developmental F3 agent passed these fire tests using both acetone and isopropyl alcohol (IPA). In general, all F3 agents did quite well on the acetone fire but poorly on the IPA fire.

All of the test results are summarised in Table 5.

TABLE 4 – EN 1568-4 TEST RESULTS

Test Configuration: EN 1568-4 / GENTLE Application
Test Fuel: IPA / Premix: in Fresh water

Test Product	Nozzle	FXR	QDT	CT (90%)	CT (99%)	EXT	BB (25%)	Class
Product B-F3-3%/6%	UNI 86	9.1	45:30	DNA	DNA	40% at 5 min	N/A	Fail
Product D-F3-3%/3%	UNI 86	8.2	19:22	1:25	1:55	2:06	15:15	IA
	MMS	5.0	16:15	1:45	2:10	2:57	15:30	IA
Product E-F3-3%/6%	UNI 86	8.1	44:27	1:50	2:25	3:00	8:45	IC
	MMS	4.9	21:57	DNA	DNA	50% at 5 min	N/A	Fail

Test Fuel: Acetone / Premix: in Fresh water

Test Product	Nozzle	FXR	QDT	CT (90%)	CT (99%)	EXT	BB (25%)	Class
Product B-F3-3%/6%	UNI 86	9.1	45:30	1:15	1:35	2:15	12:15	IB
Product D-F3-3%/3%	UNI 86	8.2	19:22	0:25	0:45	1:04	16:55	IA
Product E-F3-3%/6%	UNI 86	0:30	44:27	0:30	0:45	1:12	19:00	IA

MMS (Modified Militatry Specification); FXR (Foam Expansion Ratio); QDT (Quarter Drain Time); CT (Control Time); EXT (Extinguishment Time); BB (Burnback Time); DNA (Did Not Achieve)

Discussion

The F3 agents tested showed differences in fire performance between manufacturers and fuel types. Most agents during this test program suffered from persistent edge flicker fires causing problems meeting the extinguishment requirements. The results of these tests with a higher foam expansion UNI 86 nozzle and a lower foam expansion MMS nozzle show that firefighting effectiveness decreases with the foam quality.

The foam expansion and drain time values from the MMS nozzle are more realistic of the foam quality typically obtainable from real-world air-aspirated discharge devices. This drop-off in performance should be of major concern to any users of F3 agents. Many municipal and industrial fire brigades have switched away from air-aspirated discharge devices in favour of variable pattern non-aspirating nozzles. While these non-aspirating devices work effectively with fluorine-containing foams, the use of such devices with F3 agents seems to be questionable. Likewise, some ARFF vehicles have gone away from air-aspirating turrets and hand-lines in favour of non-aspirating devices in order to achieve greater reach of the foam from the turret and hand-lines and faster knockdown of the fire.

Surprisingly, all of the F3 agents tested failed to pass ICAO Level B performance requirements. A few airports and aerodromes have recently converted away from the conventional fluorine-containing foam agents such as AFFF and FFFP to F3 agents.

The failure of F3 foams to perform under forceful application conditions in both ICAO Level B and EN 1568-3 appears to be related to fuel contamination effects that are expected to be more pronounced under direct, forceful application conditions. Foams generated from the MMS nozzle are heavier and therefore expected to pick up more fuel than the lighter but unrealistic foams produced by the UNI 86 nozzle.

TABLE 5 – SUMMARY OF TEST RESULTS

Test Fuel / Mode of Application	Nozzle	ICAO Level B Jet A1	EN 1568-3 Heptane Forceful	EN 1568-3 Heptane Gentle	EN 1568-4 IPA Gentle	EN 1568-4 Acetone Gentle
Product A-F3-6%	UNI 86	Fail	Fail	Fail	–	–
	MMS	Fail	Fail	Fail / IIIC	–	–
Product B-F3-3%/6%	UNI 86	Fail	Fail	Fail	Fail	IB
	MMS	Fail	Fail	Fail	–	–
Product C-F3-3%	UNI 86	Fail	→	IB	–	–
	MMS	Fail	→	IIIB	–	–
Product D-F3-3%/3%	UNI 86	Fail	→	IB	IA	IA
	MMS	–	→	IIIC	IA	–
Product E-F3-3%/6%	UNI 86	Fail	–	IIIB	IC	IA
	MMS	–	–	Fail	–	–

ICAO: Fail – No extnguishment within 1 minute
EN 1568-3 (Forceful): Fail – No extinguishment within 3 minutes
EN 1568-3 (Gentle): Fail – No extinguishment within 5 minutes
EN 1568-4: Fail – No extinguishment within 5 minutes
→ : Indicates the test was repeated with Gentle Application

Conclusions

Five F3 agents were independently evaluated and compared under the same test conditions against the fire performance standards of ICAO Level B and EN 1568. In this test program, all failed to meet the ICAO Level B test requirements. Against EN 1568-3, none of the products met the IA class ratings under direct, forceful application conditions; some achieved the ratings only with indirect, gentle applications. Significant deterioration of firefighting performance was observed when the MMS test nozzle was used delivering foams with quality more realistic of widely used foam turrets and hand-lines.

Laboratory analysis of all F3 foams tested confirmed that they are fluorine free. APF

Mitch Hubert is Vice President of Marketing, **Chang Jho** is Vice President of R & D and **Eduard K. Kleiner** is President & CEO of Dynax Corporation

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Popular Style 366 Nozzle delivering protective fog pattern. Photograph courtesy of Protek

Mike Willson

Selecting Hoses and Nozzles

All fire-fighters work in a dangerous environment, but those tackling the flames are most at risk. The fire hose is a vitally important "lifeline" for firefighters, who rely on them to carry out an effective, efficient and above all a safe job.

The chosen fire hoses must be durable, reliable and flexible to deliver water or firefighting foam agents consistently. Nozzles play a key part in delivering more choices to the firefighter in the "hot seat", providing the versatility needed to get the job done swiftly and efficiently. Several fire teams found out `the hard way, that using hoses beyond their design limits can lead to sudden failure – a false economy that has put firefighters' lives suddenly, and unexpectedly, at risk.

Three key factors are critical when choosing fire hoses – abrasion, kinking, and liquid pick-up. Keeping these in mind can help avoid this happening to your fire teams, and understand how they should influence your purchasing decisions. Perhaps use it to check whether your existing hoses are really as trustworthy as you think?

Common Hose Requirements

Let us think about how and where we use our fire hoses; what they need to be doing for us; and then review hose design and materials to see what is likely to deliver those requirements. Whether you are an industrial, municipal, aviation, marine or military firefighter, your fire hoses are likely to:

- Be regularly dragged across and through abrasive materials.
- Come into contact with a range of liquids from water and fuels to more aggressive chemical spillages that can quickly affect or attack unprotected jacket fibres, even in some covered type hoses.
- Be often used in confined spaces and complex layouts including high rise buildings.

The ideal firefighter's hose needs to provide a reliable, consistent water flow even at lower pressures, whenever and wherever the firefighter needs it, reliably time after time. To do this it needs to be particularly durable, flexible and long lasting.

How well do Hoses Stand up to Abrasion?

Dragging hoses weighed down with water through grit, over tarmac, rubble, broken glass and other debris is common place, but the design of your hose will have a significant bearing on how long it will stand up to this rough treatment.

The jacket fibres are vital to containing the water pressure and delivering it effectively to the firefighter's nozzle. Damage here will cause the quickest premature failure. In the USA, alternative "double jacket" hoses are often used to try and overcome this problem. The hose jacket fibres are protected by an extra jacket, designed to be worn away and protect the inner jacket from damage. It can work well, but makes the hose much heavier and harder to use, particularly when both jackets are wet. It also provides little protection from liquid contaminants that can attack or weaken key internal fibres. They also need extra time spent washing and drying after each use, requiring increased stock levels to ensure sufficient hoses are ready for action.

In many countries "canvas" or "double jacket" types have largely been replaced by wipe-dry rubber "covered" type fire hoses. The main exception is bush firefighting, where controlled percolation hoses are still widely used, to intentionally leak a film of water to protect the hose from burning.

The variety of "covered" fire hoses comprise essentially two basic types, each having jacket fibres with internal rubber lining and external rubber cover, to reduce abrasion damage and chemical attack. The answer lies in selecting those that deliver on your stringent requirements. It is all about construction methods and materials used, delivering firefighters the reliability, long term durability, and value for money they need and deserve.

Often heavier and cheaper, are the "sandwich" type construction covered hoses. These are literally glued together in a sandwich of lining, textile jacket

and outer cover. In theory this is a good solution, but the rubber mix usually has high levels of PVC that are not as flexible or resistant to abrasion, heat and sunlight as nitrile. Any slight damage to the cover will allow water and contaminant absorption by the jacket fibres, acting like blotting paper. When the hose is next pressurised, this liquid tries to get out, but both impervious outer cover and inner lining force it along the line of least resistance – the glue. These forces can often strip the cover or lining from the jacket in seconds along its whole length, often causing premature failures. The hose becomes suddenly useless, the system must be de-pressurised, the length replaced before continuing, but firefighter safety can be severely compromised.

This sudden and often unpredictable failure, can be avoided by choosing the more resilient "through the weave" type covered hose. As the term suggests, during manufacture the inner lining and outer cover are produced under pressure and squeezed through the jacket weave in a single operation, making it very strong with solid pillars of rubber linking cover to lining through the jacket, without glues. Tiny pinholes made in the cover release volatile gases from the lining during its steam vulcanisation process, to prevent internal blistering and potential lining damage.

Leading brands such as Angus Duraline have developed special nylon textile jacket fibres that flex more easily, accompanied by unique optimised PVC/nitrile rubber formulations. Additional chemical bonding takes place between jacket and rubber during this curing process. Solid plugs of natural latex rubber fill these tiny pin-holes under vacuum to completely seal the hose and provide the levels of flexibility and durability required to protect the firefighter, deliver exceptional firefighting performance and good value for money. Each length is pressure tested to 22.5 bar g. before leaving the factory to ensure its durability, and long life. I have seen these Duraline fire hoses after many years of constant use by municipal fire brigades and industrial fire departments, outperforming other newer covered hoses already giving problems at less than half their age and usage.

How is Kinking Important?

Many firefighters seem to overlook the critical importance of kinking, or lack of it, in their fire hoses. Kinking or folding of fire hoses during use is commonplace, but causes two important things to happen. It can put lives at risk when the kink restricts or ceases water flow to the nozzle operator tackling the fire. The kink also causes a high point on the hose that leads to excessive abrasion at that point when dragged, causing early hose failure.

This can easily happen if hoses become twisted, are moving through confined spaces like doorways, upstairs, in high rise buildings or operating at lower pressures. Kinking also results from dragging unpressurised but partly full hoses, or sudden drops in pump pressure, allowing the hose to relax and cause a kink. This dramatically reduces water flow and increases the risk of bursting. If kinked against an obstacle, the only answer is to find the offending obstruction, wasting valuable time and potentially putting colleagues at risk. Most hoses will kink quite easily at pressures around 5 bar g, but how do you know whether your hoses will kink easily or not?

A Simple Kink Test

You can conduct a simple test, similar to that used by the UK Navy before accepting any fire hose for use on board ships:

1. Lay the hose out in a straight line.
2. Fill a 45 gallon drum with water, and place next to the hose.
3. Bring the hose tight round the drum, in a smooth curve.
4. Connect the hose to a nozzle in the 'off' position, and pressurise the hose to 5 bar.

Are there any kinks? If so, your hose is prone to kinking and could not only cause unnecessary operational problems, but also cause sudden and premature bursting from abrasion at the kink point, placing firefighters at risk.

Many hoses that fail this simple test have cheaper polyester jacket fibres, which do not extend in the same way as nylon's ability to minimise kinking. The best "through the weave" performers are those with special nylon textile yarns that maintain their profile and resist kinking at pressures as low as 3 bar, again such as, Angus Duraline. Such low kinking hoses are best suited for the Cleveland coil stowing method, increasingly used for high rise buildings. This lessens the burden on firefighters working in restricted environments, yet ensures speed of deployment with maximum water flow at the nozzle, delivering both optimum firefighter protection and fire impact.

Increasing numbers of firefighters are recognising that kinking exposes them to unnecessary risks, and causes premature damage reducing hose life. Many are now specifying a kink test, in addition to BS 6391 Kitemark specifications for their hose (the world's best performance fire hose specification) to prolong hose life, increase value for money and increase firefighter safety.

What Else Causes Fire Hoses to Commonly Fail?

The next most important factor is the amount of liquid absorbed into the jacket. Operationally this could be firewater run-off, hydrocarbon fuels, or a variety of industrial chemicals, like polar solvents, acids or alkalis, all of which can attack or weaken the crucial jacket fibres that are retaining and delivering consistent pressurised water flow to the firefighter. "Through the weave" hoses with optimum PVC/nitrile rubber and plugged pinholes are the best answer to reducing liquid ingress to the jacket fibres, and prolonging the safety and life of your fire hose.

There are many other reasons and causes for failure including lining damage causing water to enter the hose, commonly delaminating "sandwich" type hoses; damage from radiant heat and burning embers that can melt and burst the hose, unless adequate levels of nitrile are included in the formulation; attack from sunlight causing deep cracks in the cover where high PVC levels are used.

Which Diameter is Best?

Having selected a "through the weave" fire hose with nylon jacket fibres and high nitrile to PVC content cover and lining to meet your stringent needs, we need to consider the suitable hose diameter and its impact on pressure as we move further away from the water pumping source.

For long distances, 64mm is common for industrial locations, and even larger diameter 125mm or 150mm layflat "through the weave" hoses are being used by many industrial and larger municipal fire departments to help speed up hose deployment and deliver more efficient configurations, particularly where large water or foam flows are needed. Smaller diameters are preferred where only one or two lengths are used from the pumped supply to maximise flexibility, but they will increase the frictional pressure losses. Using a smaller diameter at the end of the hose lay is a good way to gain flexibility while minimising pressure losses.

Increasingly municipal fire departments are looking at smaller diameters of 52mm, 45mm or 38mm at the nozzle to increase manoeuvrability, reduce

weight and save water. Smaller diameters make better use of limited water resources and lower pressure availability, particularly in regional and remote areas, where vehicles may be reliant on their water tank for some time, until back-up supplies can be relayed and connected.

Which is the Most Appropriate Nozzle to Choose?

Despite a bewildering array of styles, there are several key factors to consider. Firstly the likely flow rates that can be supplied by the fire pump(s), hose diameters and layout configurations, which need to be calculated and will determine the usable flow range of the nozzle selected and the inlet connection to attach to your fire hoses.

The materials of construction, whether aluminium alloy for drinking water quality, or the more durable corrosion resistant but heavier brass construction, where borehole or salt water is frequently being used, consider a shut-off option, so you can save water while changing your position of attack, or during mopping up. A jet-spray facility helps cover larger areas more quickly and provides some operator protection, while spinning or fixed teeth can vary the spray pattern. Selectable flow variation helps minimise water damage, reduce usage during damping-down duties and increases flexibility for smaller fires.

Past preferences will also inform your decision, but a pistol grip is very popular as it helps control and better direct the water stream from the nozzle. Colour coding of shut-off handles and pistol grips could be useful for larger users with a wide range of nozzles to identify specific roles. A stainless filter mesh at the inlet is also advisable to prevent sudden blockage or damage caused by debris in the water. You may decide that a constant flow rate is necessary irrespective of whether the nozzle is set on straight stream, spray or full fog. Alternatively, if you have fluctuating water flows an automatic nozzle will maintain an effective pressure and consistent stream for the firefighter. A new dual pressure capability allows switching between 5 bar and 7 bar at the nozzle to better control your application.

A Multi-Purpose nozzle may be ideal, providing a solid bore, fog spray or combination of both to meet your requirements. Alternatively a shock-less nozzle that goes to fog first before jet, to reduce the sudden reaction forces could be appropriate, particularly for training rooky firefighters. Many of these nozzle styles are NFPA 1964 compliant or FM approved. Some exceed both criteria like Protek's popular 366.

More Specialised Applications

You may decide a more specialised nozzle is required for your application, perhaps for wild-land, forest firefighting, high pressure use, play-pipes for multi firefighter applications needing high flow rates, flammable liquid control with a foam nozzle, or marine use. You may be looking for an adaptor to make better use of your existing nozzle with a clip-on foam tube, piercing adaptor for inaccessible areas, or dual agent AFFF foam and dry powder nozzle, used separately or together, for controlling pressurised liquid fires.

Selection of the appropriate nozzle and fire hose design will provide your best answer to deliver reliable, fast, efficient and effective fire control, firefighter safety, durability and long life, plus excellent value for money. Keep safe. APF

Mike Willson is a Consultant in areas of specialised Fire Protection

For further information, go to www.angusfire.co.uk

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Building Bushfire Resilience:

Protecting Vulnerable Communities

Gerry Quinn

Aurecon

The 2009 Black Saturday bushfires in Victoria, Australia were a tragic illustration of the vulnerability and risk many communities face in the event of an uncontrolled wildfire occurring on a large scale. Having lived through a natural disaster of such magnitude, the Victorian government, and Victorians themselves, recognised the necessity and urgency of protecting the lives of at-risk communities.

Following Black Saturday, the Victorian Department of Education and Early Childhood Development (DEECD) initiated a substantial and wide ranging review of bushfire and emergency management arrangements. One significant project established by the Department was the School Bushfire Protection Project (SBPP).

Through this project the Department engaged a consortium to manage a site visit and works programme at schools identified as being at high bushfire risk. The primary objective of the project was to improve the bushfire protection of students and staff at schools in high bushfire risk locations in a practical and timely manner. The consortium engaged by the Department included experts in fire risk modelling, threatened species assessments and engineering solutions for bushfire-prone locations. The team were directed by the Department to find solutions that improve safety, reduce bushfire hazards and minimise the impact of bushfire on the school site.

Bushfire Management Plans — Understanding the Need

There have been significant developments in the understanding of bushfire modelling, engineering and incident response planning since the Black Saturday fires, with significant potential for improved planning, prediction and fire protection engineering.

Aurecon, a global engineering, management and specialist technical services business, was chosen to lead this consortium. The project focused on the use of multi-disciplinary teams that included government advisors, botanists, fire engineers (buildings), planners, environmental

Crown scorch adjacent to the playground indicates the flame zone extent

managers, engineers and procurement specialists. The strength of this approach was that it allowed for a systematic approach to risk identification and management, using the best techniques and approaches from government and industry.

Programme delivery involved assessing and managing works at 301 schools in Victoria identified as being particularly bushfire prone. The focus of the project was to identify, at each school deemed to be at bushfire risk, a school-specific shelter in place (SIP) and other mitigation measures that could be implemented to reduce risk from bushfires. A school's SIP is required as part of the school's emergency management planning and is a place of absolute last resort after all other options have failed.

While predicting fire behaviour under Code Red conditions is extremely problematic, a categorisation scheme for bushfire does exist and is based on Australian Standard AS3959-2009, which allowed for the categorisation of at-risk school buildings into one of six bushfire attack levels (BAL). The BAL system is in turn linked to a series of provisions under the Building Code of Australia that relate to protection from radiant heat and embers.

These assessments were undertaken on educational infrastructure and buildings across Victoria, classifying them from low to extreme, commensurate with geographic location and perceived vulnerability. Subsequent to this initial assessment of BAL ratings, the SBPP commenced in September 2010, with a scheduled completion date for those schools where works were required being November 2011.

Delivering the Programme

The programme and methodology was specifically designed through workshops with school principals and representatives of the Department, who had full access to the senior team of project managers, fire safety and fire protection engineers, ecologists and GIS experts. The resulting approach was structured to provide a high level of strategic direction, quality control, technical output and project coordination.

Following initial reviews and site visits, the project team identified the following key issues:

- The level of risk exposure to vulnerable communities, specifically school children and teachers, would have been elevated if the February 2009 bushfires had occurred on a weekday, rather than a weekend.
- The provision of a shelter in place (SIP) at each school would provide, for the first time, an independently assessed building into which students and staff could retreat while awaiting evacuation, or as a shelter in the absolute last resort.
- Investigations to determine the SIP requirements, and the capital investment to construct them, were relatively nominal and ranged from AU$ 10,000 to AU$ 200,000 for each school site.
- The programme had the prospect to reduce the potential for bushfires to impact on schools through targeted and sensitive vegetation management. The blend of bushfire management, environmental and building fire engineering expertise allowed for significant flexibility and innovation in designing solutions for individual schools.

Delivering the Solution

Working with technical partner Ecobiological, the team developed a methodology for delivering the BAL assessment programme in conjunction with the DEECD and other stakeholders.

The methodology followed a process that allowed the field assessment teams to build a bushfire risk profile of individual school sites to provide a powerful decision support tool. The process was cross-disciplined and involved biological sciences, program managers and specialist engineers.

The process was broken down into six key deliverables:

1 Initial Assessment of Bushfire Prone Areas

The first and most basic step was determining if the site was within an area designated as bushfire prone land. Registers of bushfire prone areas are most commonly maintained by state and local agencies, and this designation was checked and confirmed by an in-house planning team. All sites within bushfire prone areas are required to consider bushfire risks in accordance with AS3959 *Building in Bushfire Prone Areas* when building or modifying existing buildings.

2 Classification of Vegetation into Fuel Types

Most areas of Australia have some form of vegetation mapping, but this is normally done on






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Case Study – Chum Creek Primary School

For higher risks sites, sprinkler systems provide additional protection

Chum Creek Primary school is located 50km north east of Melbourne in Victoria. The school has around 50 students.

Chum Creek represented a school with very high fire risk, and was one of the first schools completed. The school is surrounded on all sides by tall open foothill forest, which places significant portions of the school in the flame zone. The site had crown fires on the grounds during the 2009 Black Saturday fires and the playground areas suffered significant damage. The pine plantation directly to the north of the site was destroyed in the fires and has now been completely removed. This removed a major source of fuel, but the remaining forest still represents a significant risk during high fire danger periods. Road access to the site is also heavily forested, and as a result a dedicated Shelter in Place was an important risk mitigation measure.

The site had an existing shelter that was put in place after the Ash Wednesday fires in February 1983 but significant issues remained with this building, including:

- Sprinkler/drencher was a pull-start motor that female staff were unable to operate.
- Window shutters were heavy and could not be closed from within the building.
- Significant areas of exposed wooden beams.

Works completed at the school include the removal of all eucalypts and acacias, removal of all trees with a diameter greater than 50cm, the application of fire retardant paint to external timber building elements, new fire shutters, new fire doors and the provision of an automatic start pump to the existing sprinkler system.

While the school is still in a high risk category, the vegetation management works and improvements to the Shelter in Place Building at the school have dramatically reduced the risk of loss of life in the event of a fire.

an ecological basis. As bushfire fuel classifications are slightly different, this initial mapping of vegetation was taken as a starting point, and then re-classified into the relevant fuel type under AS3959. This is both the single most important input into the modelling process, and the area in which the most common mistakes are made by inexperienced assessors.

The project fire management experts were

backed by senior ecologists with extensive fire management experience to manage this process and provide the highest quality input data to the bushfire modelling.

Ecologically-based mapping was still valuable as this allowed the field assessment teams to identify potential environmental constraints, particularly habitat for threatened species. This is critical as the vegetation management needs to be sensitive to the environmental requirements of surrounding bushland, both now and into the future.

3 Calculation of Slopes

Slope has a dramatic influence on fire behaviour, with the rate of spread (speed) of a fire roughly doubling for every ten degree increase in upslope (steepness). The Geographic Information Systems (GIS) specialists were able to provide an initial calculation of slopes across the site, which was later checked in the field.

4 Production of Initial Heat Contour Maps

The methodology for delivering the BAL assessment involved fine scale, GIS modelling of fire causal factors (such as fuel load, aspect and topography) to create heat contour maps and determine the specific fire risk exposure for each school. Once the fuel and slope affecting the site have been determined, modelling of bushfire risk zones was undertaken and plotted onto a modelled fire extent across the entire site, and was categorised into the following zones:

- **Flame zone** — representing the area of direct flame contact and is the most hazardous area. Buildings within this zone need to be specifically engineered if they are to survive and there is extreme hazard to people.
- **Building safety line** — representing the zone where 10kW/m^2 of heat energy will be generated. Provided that they are secured against ember attack, buildings have a high chance of survival outside of this zone and it is also the limit of safe firefighter operations, effectively defining the defendable space around a building.
- **Personal safety line** — representing the zone where 2kW/m^2 of heat energy will be radiated from the fire front. This is the zone where people in normal clothing can be expected to survive with minimal risk of injury.

5 Field Checking

Modelling is an effective decision support system, but requires careful checking against on-ground conditions. Site visits were used to check for environmental and heritage constraints, and as an opportunity for consultation with school principals and senior staff. The heat contour maps allowed for genuine consultation with affected stakeholders. The visual mapping of risk zones facilitated a discussion on what could be done to address the risk.

The team's senior fire management specialists for the project included highly experienced ecologists, and these staff have previous experience in designing asset protection zones that are sensitive to the ecological and aesthetic values of the surrounding bushland. Once all practical approaches to reducing the fuel hazard have been developed, the modelled exposure to buildings is re-calculated for the application of engineering upgrades.

6 Engineering a Solution – Effective, Sustainable and Consultative

Drawing upon expertise in building engineering, the building fire management teams modelled heat intensity to design a range of building upgrades to meet AS3959.

The level of building upgrades were specific to each situation, but commonly included the following elements:

- Ember screening on all potential entry points (such as windows, weep-holes and roof vents).
- Upgrades to window glass to increase resistance to breakage under higher heat loads.
- Changes to exterior building materials, including decking, walls and roof materials.
- Bushfire shutters on windows and doors.
- Sprinkler systems to 'wet down' the building and surrounds.

Significant among the breadth of the SBPP projects was the establishment of a programme of work in high bushfire risk locations. APF

Gerry Quinn is an Executive with Aurecon

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DST-3P4	5.5	14885	18", 4-Blade	81 lbs.	23" X 23" X 21.5"
DDST-3P4	5.5	14885	18", 4-Blade	82 lbs.	23" X 23" X 21.5"
DST-3P4-L*	5.5	14885	18", 4-Blade	85 lbs.	23" X 23" X 21.5"
DST-3P4-6.5	6.5	17000	18", 4-Blade	91 lbs.	23" X 23" X 21.5"
DST-9P4	9	17500	20", 4-Blade	115 lbs.	26" X 23" X 21"
DST-13	13	22000	24", 4-Blade	136 lbs.	30" X 28" X 24"

ELECTRIC MODELS

Model	HP	Output (CFM)	Prop Size	Weight	Dimensions
E18SP	2	12000	18", 2-Blade	85 lbs.	21" X 21" X 18"
E18P4	5	22000	18", 4-Blade	88 lbs.	23" X 23" X 16"
EB18SP	1.25	12000	18", 2-Blade	90 lbs.	21" X 21" X 19"
EX18SP	2	12000	18", 2-Blade	110 lbs.	21" X 21" X 18"

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Evaluating and Implementing PPV

Leroy Coffman

Tempest Technology Corporation

Positive Pressure Ventilation (PPV) is a firefighting tactic that involves the use of high-powered ventilation fans to remove smoke, heat and gases from burning structures, thereby enhancing safety for first responders. There are many considerations when deciding whether PPV is right for your fire brigade and how it will be integrated into existing tactical operations.

Positive Pressure Ventilation works on the principle that air will always flow from an area of high pressure towards an area of low pressure. To apply PPV, a gasoline or electric powered fan is positioned in front of the firefighters' access point in order to force fresh air into the structure (the high pressure point). At the same time, an exhaust opening is created where the smoke and heat are to be exhausted (the low pressure point). The air pressure created by the fan forces the air in the structure towards the exhaust opening, taking smoke and heat with it. The resulting improved visibility and reduced interior temperature make it easier and safer for firefighters to enter the structure. PPV is most often applied after the fire has been extinguished, but it can also be applied prior to extinguishment with a technique called Positive Pressure Attack (PPA).

PPV and Firefighter Safety

Positive pressure ventilation is first and foremost a tool to enhance safety for firefighters and other first responders. It gives firefighting personnel a greater level of control over a hazardous or dangerous interior environment. During fire suppression activities, PPV can dramatically improve visibility inside the structure, making it easier for firefighters to conduct search and rescue operations and locate the seat of the fire. PPV can also dramatically reduce interior temperatures, making it easier for firefighters to move within the structure and reduce the chance of flashover. Opponents of positive pressure ventilation will claim that PPV can intensify a fire by introducing fresh air, thereby making the situation more hazardous. In fact, PPV is not adding any more 21% oxygen than already exists in the interior environment and it rapidly reduces the interior temperature while removing the unburned particles of combustion. Smoke will become fuel when the temperature is high enough and PPV limits the fire's ability to reach the temperature at which smoke will ignite.

One of the most significant benefits that PPV offers firefighters is added protection from the

carcinogens in smoke. Many of the contents in a modern structure fire are made of synthetic and petroleum-based materials. The gases that are emitted when these materials burn pose serious health risks to firefighters over the course of their careers. By applying positive pressure ventilation after the fire has been extinguished and during the overhaul phase, firefighters can achieve an added layer of protection from the gases that linger after the fire has been extinguished.

Availability of Positive Pressure Training

For positive pressure ventilation to be implemented safely and effectively, every person on the fire ground must understand how PPV will be implemented and the role that they will play in the operation. Without a coordinated ventilation operation, PPV cannot be applied safely and effectively. To accomplish this, all personnel should go through a positive pressure ventilation training course that includes hands-on experience with a PPV blower. It is important that this training course includes some type of live fire exercise. The best way for a student to clearly understand the positive impact that PPV can have is to experience it during a live fire training exercise. Many firefighter training academies offer a section on positive pressure ventilation. It will involve a day of classroom training on PPV concepts and hands-on training in a burn tower or fire simulator.

Demand for PPV training has prompted a number of instructor groups to begin conducting on-site training for a fee. These instructors will travel to the fire brigade's training facility to conduct both classroom and hands-on training for all incident commanders and firefighters. Once they have concluded their classroom training, every student will have the opportunity to practice implementing positive pressure ventilation in a highly realistic environment. One training group in the United States will even provide the construction plans for a 150 square meter burn building that simulates a typical American single-family dwelling.

PPV Equipment

There are numerous manufacturers of PPV equipment and all offer products that have similar features, functions and performance. A typical positive pressure ventilation fan (also referred to as a blower) consists of a 450mm diameter fan blade, a gasoline or electric motor, and a fan shroud to protect personnel from the spinning fan blade. All of these components are mounted to a metal cart that allows the PPV fan to be rolled by one firefighter to the appropriate ventilation point.

Most PPV fans are small enough to fit inside a standard vehicle compartment. Other tools for PPV include large vehicle-mounted fans that are used to ventilate very large structures. These large fans have 1250mm or 1500mm diameter fan blades and can generate up to 255,000 cubic meters of air an hour. When evaluating which positive pressure ventilation tool to purchase, it is important to consider the compartment size of your vehicle, the types of structures you will be ventilating, and whether you prefer gasoline or electric powered blowers.

Compartment Size

Compartment size can be one of the most important considerations when purchasing a PPV blower. Today's fire brigades are called on to perform services far beyond basic firefighting. The equipment that is required for fire suppression, EMS, rescue and Hazmat response makes compartment space on a fire apparatus valuable and scarce. This issue encourages fire departments to purchase the smallest PPV blower they can find. While a 400mm blower might meet a fire brigade's compartment space limitations, it can put limitations on the effectiveness of PPV due to the smaller air pattern and reduced CFM relative to a 450mm or 530mm blower. A good rule of thumb is to purchase the largest blower that will fit into your available compartment space. Most fire departments will try to make space on their apparatus for a 530mm blower and will settle for a 450mm size when necessary.

Type of Structure

It is important consider the types of structures you will be ventilating and choose the type of PPV blower that is best suited to your environment. If your community has many smaller single-family residences of 100 to 200 square meters, a 450mm or 530mm blower will be adequate. If your fire brigade protects commercial structures that range from 300 to 700 square meters, a larger PPV blower such as a 600mm or 680mm will be more desirable. If your fire brigade encounters incidents involving large commercial structures or high-rise buildings, it may be beneficial to have a large mobile fan of 1250mm or 1500mm diameter. In situations where a large structure must be ventilated with smaller PPV blowers, it is possible to use multiple blowers to achieve greater air volume and therefore adequate ventilation of smoke, heat and gases.

Gasoline or Electric Power

When deciding whether to purchase gasoline or electric powered blowers, the user should consider how they will implement PPV and their access to electric power. If a blower is being used for fire attack (before fire extinguishment), a gasoline blower can be setup in much less time and will provide better airflow performance. If a blower is being use during fire overhaul (after fire extinguishment), an electric blower will introduce less carbon monoxide into the building and will generate less noise on the fire ground.

A note on the performance of electric PPV blowers. The first positive pressure ventilation blowers were gasoline powered due to the amount of air volume required for PPV to work effectively. In recent years, new developments in electric motor technology have greatly improved the power and performance of electric PPV blowers. Inverter drives allow motors up to 1.5kW to operate on a 20amp circuit and generate airflow performance that is 60% to 70% of a comparably sized gasoline powered blower. When purchasing an electric blower, it is important to consider the

generator power required to operate the PPV blower in addition to all the other equipment on your vehicle.

PPV Airflow Ratings

The airflow performance of a positive pressure ventilation fan is an important consideration for users of PPV. Blower performance is measured in cubic meters per hour (m^3/hr.) or cubic feet per minute (CFM) and there are many methods for measuring the performance of a PPV fan. It is common to see the performance ratings for a 400mm PPV fan vary widely from one manufacturer to the next. For example, one manufacturer may claim that its 400mm blower with 4.1kW engine generates 43,100 m^3/hr. (25,350 CFM) and another claims that its blower with the same sized engine and blade generates 26,300 m^3/hr. (15,500 CFM). All 400mm fans with 4.2kW engines will move approximately the same amount of air. It is the way that the airflow performance is measured that will result in wide differences between the published numbers. It is important to compare airflow performance using the same test method. Many manufacturers are using a performance standard established by the Air Movement Control Association (www.amca.org) and this has proven to be a good relative measure of PPV fan performance. Some manufacturers claim that their products are AMCA tested and certified but they have no affiliation with AMCA. It is important to verify a manufacturer's association with AMCA before accepting its AMCA airflow numbers.

Positive Pressure Attack

Positive pressure ventilation began as a tool to assist with removing smoke and gases after the fire has been extinguished. As the understanding of the physics of positive pressure ventilation has evolved, it is being applied in new ways and for new purposes. The most dramatic development in PPV tactics has been its use for positive pressure attack (PPA), which refers to the use of PPV blowers during the initial phase of fire attack.

After size-up, firefighters will determine whether PPA is an appropriate tactic to use. A PPV blower is positioned at the point where firefighters will enter the structure and a firefighter is stationed at the point where the internal gases will be exhausted. When firefighters are ready to begin PPA, the exhaust opening is created by opening or breaking a window or opening a door. As soon as the exhaust opening is created, the PPV blower is started and the air pattern is aimed into the entrance opening. Once positive pressure ventilation has started, the firefighters wait up to 30 seconds for conditions inside the structure to being improving.

The most obvious indication of improving conditions is improved visibility inside the structure. Almost immediately after the PPV blower is started, visibility inside the structure will improve, allowing firefighters to see a clear path of access to the interior of the structure. Positive pressure attack allows firefighters to begin controlling the environment inside the structure before they enter it and allows them to begin reducing the interior temperature and improving visibility at the moment they begin their fire attack.

Final Words

Positive pressure ventilation (PPV) and positive pressure attack (PPA) are not for every firefighting situation and should never be attempted until all personnel on the fire ground have been trained on proper tactics and techniques. Access to PPV training materials and resources can be sourced via www.positivepressureattack.com and www.positivepressureventilation.com. APF

Leroy Coffman is President of Tempest Technology Corporation

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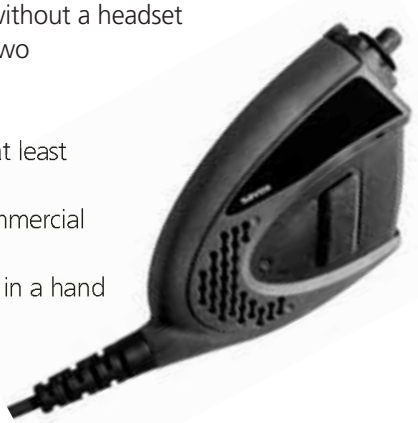

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Firefighting & Rescue Communication

Andy Ibbetson

Lauren Girdler

Savox Communications

The role of the modern fire departments is ever changing. No longer responsible for just fire suppression, most departments routinely respond to incidents involving specialised rescue disciplines such as HazMat, vehicle extrication, confined space, water rescue and urban search and rescue (USAR) to name a few. Within these diverse rescue situations the need for appropriate personal communications gear is particularly important. However, deciding what type of communications gear is needed is not always cut and dry.

Considering the type of communications gear that is needed for a department is an important decision, therefore it is important to consider the types of situations a department may become involved with. Traditional radio accessories such as remote speaker microphones (RSMs) used by fire departments might not be appropriate, or even functional, in other rescue situations

CRBNE & HazMat

Portable hand-held two-way radios are the most common type of communications equipment used during CBRNE and HazMat situations. That is because they can be used effectively in many environments and can handle an unlimited number of users. Some drawbacks to portable radios are that they work best when out in the open – in confined spaces they are much less reliable. In addition, radio transmissions can be broken up or even monitored by outside sources. In situations where a victim's intimate details are being broadcast it is important to remember that those outside of a decontamination area may be listening.

With portable radio communications use being

Large surface PTT with standard headset and boom microphone

so prevalent, there are special considerations that should be made for CBRNE and HazMat situations that require protective equipment. Items such as fully encapsulated suits, facemasks and other breathing apparatuses can all lead to problems with communication among personnel. In this case the very equipment designed to protect responders can also lead to a potentially dangerous situation if communication is not possible. There are a variety of portable radio accessories that can be utilised during CBRNE and HazMat situations that allow protective equipment to be worn, while also ensuring localised and command communication functions. Listed here are some examples of solutions that are readily available, as well as a brief summary of common potential benefits and drawbacks to each.

- **Remote Speaker Microphones**

Remote speaker microphones (RSMs) will be familiar to all public safety professionals using radios and in some cases portable Tetra terminals. They typically are supplied by manufacturers as part of the communication system. RSMs work best when speaking directly into the face of the unit. When external factors such as PPE, facemasks, HazMat and CBRN suits are introduced their effectiveness is diminished. Some RSMs have the ability to plug in to external devices such as microphones, speakers and headsets.

- **Push-to-Talk (PTT) vs Voice Operated (Vox)**

In HazMat situations – where bulky suits and gloves make it challenging to access the PTT switches to initiate communication over a radio or terminal – users are quick to look for a voice activated solution.

However, careful testing needs to be done before committing to a Vox system. External factors such as environmental or background noise, respirator noise and noise levels inside the suit can negatively impact Vox effectiveness. Additionally, if a user gets hurt and screams out in pain this can lock a system at the exact moment when it is needed most. Push-to-talk solutions, while appearing to be more low-tech than their Vox counterparts, tend to be more reliable in general HazMat or high noise applications. PTT switches come in a variety of shapes and sizes that can be positioned and reliably activated underneath protective suits and clothing or in high noise environments. Some products have the option for a wireless remote PTT switch to be placed externally on equipment, for example vehicle controls, so that the hands do not have to leave their position to initiate communication.

- **Throat Microphones**

Throat microphones pick up the vibrations from the throat and therefore must be worn around the neck. They are usually secured in place with a strap or neckband to ensure contact between the microphone and the voice box or Adam's apple of the user. Proper position of the throat microphone is key; if the unit is not worn properly it can lead to poor communication and discomfort of the neck. Some throat microphones include an integrated PTT button as well. When worn and used correctly, throat microphones are especially useful in high noise environments.

- **Boom Microphones**

The boom microphone is typically part of standard headsets and is best suited to situations where breathing apparatus is not needed. There is a wide variety of headsets on the market that include hearing protection both passive and active. The key to clear transmissions is in the microphone, particularly in high noise areas. Manufacturers use a variety of technologies, some acoustic and some digital, to try to minimise background noise.

- **Ear Microphones**

Worn inside the ear, the ear microphone picks up voice vibrations from the ear and surrounding bone. However, this type of microphone will only work properly if it fits snuggly within the ear canal so that all other outside noise is blocked. If an ear microphone does not fit properly it is more likely to fall out – something that is particularly difficult to deal with when wearing a fully encapsulated suit. When using ear microphones for communication during a CBRNE situation having a custom ear mould made should be a serious consideration. One often overlooked drawback of this type of microphone is the "time on station" and the ambient temperature in the work environment that can cause discomfort.

- **Bone Microphones**

The bone microphone is worn either on top of the skull or around the ear. These are most likely to be attached to a helmet suspension or strapped to the head itself. They function by picking up the voice vibrations of the skull and a key to their

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Wired RSM PTT with headset connector

correct performance is good bone contact in order to function properly. Therefore, an assessment of other protective equipment that requires wearing hoods or large straps that traverse the head will likely affect the quality of bone microphone communication.

- **Voice Amplifiers**

Voice amplifiers are simple yet effective devices that either attach to the face mask or are worn on the body; the main function of these products being to amplify the voice.

The source of sound can be either a microphone embedded in a facemask or an off mask solution such as a throat or bone microphone. These types of voice amplifiers are particularly beneficial because they can work with any make, model or style of face mask providing a cost effective and versatile solution. More complex voice amplifiers are available that can bridge the gap between both face masks and communication devices such as portable radios or terminals. These products provide communication over a communications network while also providing localised voice amplification. A voice amplifier is particularly useful during a decontamination event where communicating with the general public and keeping people calm is so important. With clear and direct communication it is much easier for medical personnel to properly direct victims through the decontamination process while minimising panic.

Urban Search & Rescue/Confined Space Rescue

When rescuers enter a confined space or an underground location, maintaining voice contact with the outside world is extremely important. Feelings of claustrophobia, stress or panic can be experienced by even seasoned responders and while these feelings can be controlled, they can surface very quickly if a problem occurs.

In confined space and collapsed rescue situations the preferred communication tool is a full duplex hard wired intercom system as they are a much more trustworthy option over two-way radio communications. That is because in confined space environments wireless radio communication is subject to dead spots, fading and weak signals. During confined space rescue operations where a supplied air breathing apparatus is required the hardwired communication cable can be "piggybacked" onto a breathing airline, making a single umbilical that is easily managed by the entrant.

With the previously addressed shortcomings of many wireless radio communications systems, a hardwired communications system is the best investment for any department involved with confined space rescue. A fully duplex hardwired system that is completely hands-free will provide a dedicated and private network for first responders as they are working. Ideally, a hardwired system will meet the following requirements: electrically shielded, resistant to chemicals, IP rated, intrinsically safe, hands free and extremely rugged.

The key drawback of a hardwired communications system is the communication cable itself. The major issue being that there is a limitation in terms of length of the cable. In addition, the cable can snag or become caught on debris in a collapsed structure. However, it is still more beneficial to have a guaranteed, constant line of continuous communication between the responder and the safety attendant above ground – without the worry of interference or dead spots.

Mobile Phone Technology

Mobile phone usage has increased dramatically over the past decade and its use as a communications tool within fire services should not be overlooked. Department members may utilise their mobile phones for a variety of functions including connecting with other team members or utilising the Internet or specialised software applications (apps) to access relevant information. Future interoperable systems that utilise a mobile phone type network backbone will no doubt work their way into regular use over time, perhaps even surpassing radio systems in the future. Keep a look out for ruggedised handsets and accessories that will operate in a professional work environment. These include wireless push over cellular remote speaker microphones and a variety of Bluetooth enabled wireless PTT's and ruggedised accessories for harsh work environments.

Conclusion

The role of fire rescue services around the world is ever changing and in these days of shrinking budgets and economic hardship it is more important than ever to choose equipment that is not only suitable for the task but will survive the work environment as well. Doing more with less is a dilemma that faces commanding officers and fire chiefs on a daily basis. Many manufacturers offer to loan demonstration equipment for trial by potential users, a program that more departments should take advantage of. Communication equipment, when correctly selected and applied, can produce real results by increasing productivity, efficiency and safety. APF

Andy Ibbetson is Senior Vice President of Marketing and **Lauren Girdler** is Marketing Manager at Savox Communications

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Are you ready for BS EN54-23?

Normal hearing is taken for granted by most of us, but there are estimated to be nearly nine million people who are deaf or hard of hearing in the UK alone, equivalent to one person in every seven.

Leanne Danby

Cooper Fulleon

For the deaf or hard of hearing, reliance on audible alarms in the event of a fire is ineffective. In addition, increased concerns over health and safety are encouraging the greater use of ear defenders in the work place and so there is a sizeable contingent of people who work in environments where alarm sounders are unlikely to be heard.

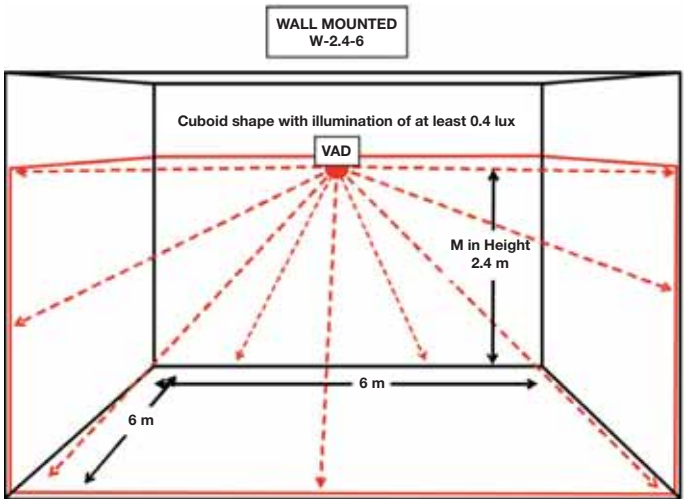
To overcome these issues, signalling needs to be broadened to stimulate senses other than hearing. Supplementing audible alarms with visual alarm devices (VADs) is an effective way to warn people in or around a building of the occurrence of a fire emergency so they can take appropriate action. Over recent years, the installation of VADs has experienced considerable growth and this trend continues due to the influence of the equality legislation and their suitability for various applications including staff-restricted warning systems, (such as nursing homes and public assembly buildings), broadcast studios and hospital operating theatres.

Current UK building regulations and BS 8300, *Design of buildings and their approaches to meet the needs of disabled people,* recommends that a VAD is sited in any area where a deaf or hard of hearing person may be left alone, for example, toilets or bedrooms. This, alongside the rising awareness of equality legislation highlights the increasing importance of the industry being vigilant in designing fire systems with the deaf and hard of hearing in mind.

BS EN54-23

Up until May 2010, there was no fire industry standard in the UK that determined the light output performance criteria and installation requirements of visual alarm devices. This gave rise to manufacturers specifying the performance of their products in an inconsistent, confusing and often misleading way. The use of Joules, Watts and Candela to specify a VADs performance are all largely meaningless, as they do not take into account the effectiveness of the light signal over a given area. Now this has been rectified with the release of standard BS EN54-23: *Fire alarm devices – Visual alarm devices.*

BS EN54-23 specifies the requirements, test



methods and performance criteria for VADs in fire detection and fire alarm systems. Manufacturers must now present the products performance data in a uniform manner so they can be directly compared and their suitability assessed for particular applications. All VADs sold for fire use in EU countries must be manufactured and certified to these requirements by 1st March 2013. For countries such as the UK, which do not currently require CE marking to the CPD, compliance will be enforced from July 1st 2013 when the Construction Products Directive (CPD) is replaced by the Construction Products Regulation (CPR).

The Fire Industry Association (FIA) and the Loss Prevention Certification Board (LPCB) have jointly published *COP0001 Code of Practice for Visual Alarm Devices used for Fire Warning*, which directly compliments BS EN54-23 and BS 5839-1. It provides guidance and recommendations on the planning, design, installation, commissioning and maintenance of VADs in and around buildings, other than single-family dwellings.

Coverage Volume

VADs will now be classified into three categories based on their intended application, namely ceiling-mounted devices, wall-mounted devices and an open class category. Each of these categories has specific targets for light distribution patterns in order to be compliant with EN54-23. Manufacturers should now ensure products are tested and assessed by an EU notified body to determine its coverage volume, based on the distance at which the required illumination of 0.4 lux or 0.4lm/m^2 is met. The manufacturer must specify the coverage volume with the device; either on the product or with supporting documentation. Therefore, specifiers should always look for the coverage volume specification code. Note – the flash rate of a VAD should be between 0.5Hz and 2Hz and should emit either a red or white flash (only red or white in EN54-23).

Different light dispersion characteristics are required according to the VADs intended mounting position. Wall-mounted VADs will be effective in a wide range of applications, but the manufacturer will be required to state a mounting height; which is a minimum 2.4 metres, followed by the width of a square room over which the VAD will provide coverage. Therefore, the specification code with a VAD suitable for a wall application could read W-2.4-6; that is, mounted at a height of 2.4 metres the VAD will cover a room six metres square. The VAD will therefore be required to cover the volume below its mounting height. Any light going upwards will be wasted as far as this categorisation is concerned.

Ceiling-mounted VADs are suitable for broad coverage in regular shaped rooms. Ceiling VADs must state the height of the ceiling at which it is designed to operate. This can be three metres, six metres or nine metres. The VAD in this case needs to radiate light in a cylinder below the mounting point. Therefore the specification code could read C-6-6; that is, mounted at a ceiling height of six metres, the VAD will cover cylinder six metres in diameter.

The open class category allows for different light distribution patterns that do not fall within the restrictions of the wall or ceiling. The shape of the pattern and its coverage volume must be determined and stated by the manufacturer; however the minimum illuminance of 0.4 lm/m^2 is still required.

Design

External factors can have a significant impact on the effectiveness of VADs. LPCB COP 0001 advises that when designing systems incorporating VADs, it is important to consider what these influences, such as the level of ambient light, the reflectivity of surfaces, effect of colour, the required field of view and the use of tinted eye protection may have at the onset of the design.

- **Ambient Lighting**

Because of the large variations in ambient light levels that can exist in some locations, it is important that the highest level expected should be considered when selecting VADs. Measures to control the ambient light, such as blinds or curtains may help reduce its impact. A lux meter complying with BS 667 should be used to determine the ambient light levels, although it should be considered that light levels in some rooms with large window areas will vary throughout the day and from season to season.

- **Reflective Surfaces**

It is important to assess and understand the types of surfaces involved as different materials will react differently to the emitted light. The reflection of light may be specular; for example, a glass mirror or diffused reflected light in many directions such as from a granular surface. Many surfaces will exhibit both types of reflections.

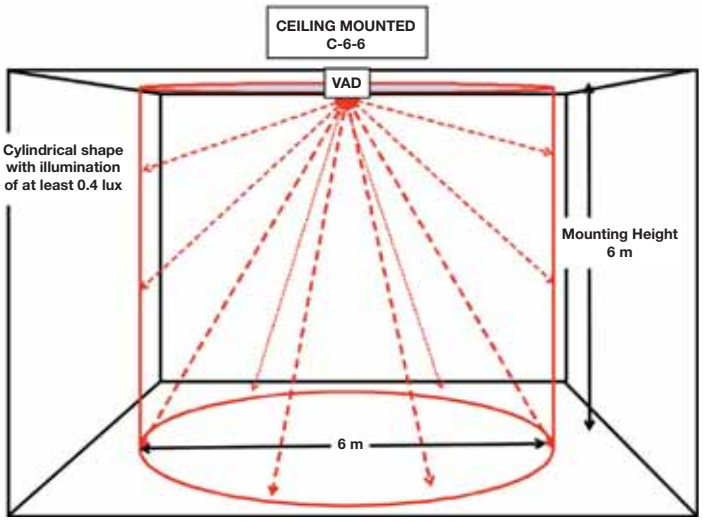
- **Field of View**

Consideration should also be given to the presence of any obstructions in the field of view, such as partitions or furniture, as this could affect the VAD coverage. At any position within a space where a VAD is required, any individual should be able to view its light directly or reflected from adjacent surfaces.

- **Environment**

The selection of VADs should also take into consideration the nature of the environment where it is intended to be installed. Type A VADs require a minimum ingress protection (IP) of IP21C, while Type B require a minimum IP of IP33C for more exposed locations.

When considering the siting and spacing of VADs in a room, it should be ensured that all occupants of the room have a clear line of sight of the device, but there should not be undue dependence on this in applications such as an office, where people predominantly spend their time looking at computer screens or focusing on a specific activity. Reflective surfaces can increase the field of vision by providing multiple paths for the light to attract attention. Where the space to be covered is larger than the specified coverage volume of a device, a sufficient number of devices should be sited to ensure the required illumination levels are satisfied.



Power Consumption

To meet the requirements of BS EN54-23 and cover the practical room size encountered in most situations, VADs will be required to have higher light output levels than those generally used in the market today. Higher illuminace levels will result in a significant increase in current consumption due to the use of higher output devices or to a greater number of less powerful units.

Application of the inverse square law to light radiating from a point implies that: "to double the distance from a light source will require four times the power to achieve the same level of luminosity". LED technology can offer a breakthrough here, offering more efficient production of light, leading to lower power requirements than Xenon tube-based devices. Although the initial cost of LED VADs may be slightly more expensive than Xenon products, the more efficient operation that LEDs offer means the number of devices required on an alarm circuit is reduced, consequently reducing the burden on control panel power supplies and decreasing installation costs by avoiding supplementary power supplies. This should be considered in the design of a system.

A further strain on power consumption can be the flash colour. Across most of Europe a flashing red light denotes a fire alarm signal; however red light consumes more power than white light for the same intensity. To achieve red light, white light, particularly from xenon tubes, has to be filtered by a lens that allows, only the red wavelengths to pass through. This can reduce the light output by up to 80 percent and therefore require more higher-output devices to achieve the require illuminance levels.

The BS EN54-23 requirements of 0.4 lm/m^2 means that using red light requires a big increase in current compared with the same illumination using white light; this is exacerbated when room size is factored in. System designers are presented with a dilemma; should they offer a white flash to save power consumption and move away from the traditional red light associated with fire, or should they factor in the price of additional power supplies and installation costs, significantly increasing the total cost of the system?

Ahead of 1st March 2013 when BS EN54-23 becomes mandatory, it is an opportunity for the industry's leading manufacturers to build on existing expertise and experience to develop innovative solutions to the issues of power consumption and the challenges that light output and flash colour present.

The choice to use red or white VADs may not just be down to cost, the long established use of red for fire in some organisations may require a change in culture and retraining, but it should also be considered that whatever colour is chosen, it should be used consistently across the whole site, so existing beacons may have to be removed or changed.

Ahead of 1st March 2013 when BS EN54-23 becomes mandatory, it is an opportunity for the industry's leading manufacturers to build on existing expertise and experience to develop innovative solutions to the issues of power consumption and the challenges that light output and flash colour present. This should make the transition as easy as possible for those operating in the industry, including risk assessors, installers, system designers and commissioning officers. APF

Leanne Danby is Marketing Executive at Cooper Fulleon

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Jupiri Apou

Fire and Rescue Department of Malaysia

The construction industry is among Malaysia's most hazardous industrial environments, with the rate of reported accidents being high when compared with other industrial sectors. As in many countries, responsibility for rescue operations falls on the fire and rescue service, in this case the Fire and Rescue Department of Malaysia (FRDM).

Typical of the type of search and rescue operations undertaken by the FRDM was the sudden collapse of the five floors of a 38-floor building under construction owned by the Kerjasama Rakyat's Bank in Brickfields, a small to medium-sized town and residential neighbourhood located just outside central Kuala Lumpur. 13 construction workers were trapped; one died at the scene and two were seriously injured. The remaining ten workers were uninjured as they had managed to cling to the building's fifth-floor floor beams, 30 metres above the ground.

The emergency call was received at the State Operation Centre (SOC) Fire and Rescue Department of Kuala Lumpur. The fire and rescue service from the nearby town of Pantai was the first to respond and immediately set about establishing strategies for the search and rescue operation, which was monitored at Fire Forward Command Post (FFCP) that had been established on the site. Meanwhile, additional assistance was received from the Kuala Lumpur Central Fire and Rescue service and the fire and rescue service from Sentul FRS, the main town area of Kuala Lumpur.

Search and rescue operation was successfully performed in which three people were extricated from the collapsed building. The remaining ten workers known to be in the building were successfully moved to safety. A canine search team then conducted a thorough search for other possibly trapped victims. This particular specialist unit comprised seven officers with four trained dogs.

Incident Operations Management

In order to achieve search and rescue operation objectives a management structure called Operations Management System (OMS) was formed at the incident scene. This comprised an operation Commander, and reporting directly to him was a safety officer, a liaison officer, a planning officer,

an operation officer, a logistics officer and a documentation officer. An emergency medical services officer, a communications officer and a canine operations officer in turn reported to the operation officer.

The task of the OMS was to monitor, control and improve the effectiveness and efficiency of the overall management of search and rescue operations at the incident scene as well as to coordinate assistance and promote close cooperation with other agencies. Incident information transmitted via the communication system established in the State Operation Centre gathered information and disseminate it to senior officers around the Federal Territory of Kuala Lumpur and FRDM Head Quarters in Putrajaya, Malaysia.

A two-way communication system was set up between the Fire Forward Command Post (FFCP) and other emergency agencies using telephone lines and fax machines. Communication between the rescue teams, the State Operation Centre and members of the talk group was done using the Kuala Lumpur Government Integrated Radio Network to ensure smooth information delivery during operation.

The search and rescue operation was implemented in two stages. First, the search for victims on the site and second, the extrication of victims trapped in the ruins of the collapsed building. Operations began with a briefing and risk assessment at the scene.

Techniques used in this operation includes to detect victims included using the specially trained dogs to seek victims in confine spaces and areas where it was difficult for the rescue team to enter the rescue team. The first dog performed an initial search for victims; a second was then brought in to verify if there was a victim of ruins at that location. No further victims were found.

Lessons Learned from the Incident

Operations at the collapsed building provided very useful and important experience and lesson learn for each member of the rescue team.

First, each member involved in the operation had the expertise, experience and skills and worked as a team and mutually helped each other. This was an important asset in the successful implementation of the operation. Each person involved understood his duties and responsibilities and his roles, without waiting for further instructions from superior officers. Enthusiasm, commitment and dedication of the team were all very high, which undoubtedly increased the performance of the department.

Second, in this particular operation, the team managed to achieve the target response time with distinction. The first team arrived with a recorded response time of ten minutes from a station where the expected response time was between ten and 20 minutes.

Third, the rescue teams carried out their search and rescue duty professionally, demonstrating a caring attitude and high commitment. This attributes are now being nurtured and strengthened among fire and rescue teams across the country so that the fire services nationally is seen as a highly respected global service.

Finally, coordination and understanding between the fire department and other agencies such as police, civil defence and the local authority was very good throughout the rescue operation. All the agencies demonstrated a high commitment and helped each other. They performed their respective roles based on expertise, experience and skill. Indeed, the strength of the teamwork between the various agencies was a major contributor towards the successful management and conclusion of the incident.

Conclusion

Search and rescue is one of the key roles of the Malaysia Fire and Rescue Department in the event of a disaster. Preparedness, skill, professional attitude and commitment of the rescue team are very important to ensure that every victim is rescued regardless of status, race or citizenship. Hence, each fire and rescue team member follows procedures and operational procedures set out in the directives, orders and regulations established under Malaysia's Fire Services Act 1983.

Fire team's success, along with other agencies in the operation, created a new image of the departments and undoubtedly boosted people's confidence regarding the government's commitment to protect the interests of society as a whole. Professionalism, the spirit of teamwork and the caring attitude shown among members of rescue teams has remarkably improved the fire and rescue department services in line with the slogan of 'Fast and Friendly'. Experiences and lessons from this type of operation has also increased self-motivation and a drive to achieve the highest possible effectiveness, along with the vision of the Fire and Rescue Department of Malaysia to become international class fire and rescue organisation. APF

Jupiri Apou is a Fire Superintendent with the Fire and Rescue Operations Division, Fire and Rescue Department of Malaysia

For further information, go to www.bomba.gov.my

Structural Fire Engineering & Optimisation of Fire Protection

Allan Jowsey

International Paint

Structural fire engineering can bring many advantages to a project including reduced fire resistance ratings and optimised fire protection requirements. Understanding its application together with characteristics of a passive fire protection material can bring cost savings to a project, while maintaining a safe and robust structural design.

Structural codes and guidance documents around the world cover the design of steel structures in fire. Those who use these codes have the opportunity to exploit the properties of structural steel to its maximum capacity in the fire limit state. When used effectively there can be significant benefits to the project, including robust and safe designs, quantified structural performance and cost savings.

The suitability of a member in a structural design is generally governed by serviceability limitations such as deflection. Generally this approach provides a conservative working stress for the steel sections of approximately 50 percent of their overall capacity. Within the UK, this simplified approach led to the development of generic limiting steel temperatures of 550°C for columns and 620°C for beams.

Best-practice industry guidance advises designers to specify a limiting steel temperature together with the fire resistance period as part of the overall steelwork specification. In reality, passive fire protection is generally specified post design-stage at a contractor or applicator level and sometimes very little is known about the limiting steel temperature.

Steel as a Construction Material

Steel is used across many iconic buildings around the globe as the basis of the structural frame or to define certain features. Passive fire protection to steelwork is a very important safety element of any building. If not correctly specified it could have severe consequences in the event of a fire.

An increased understanding of how the performance of steel structures behave at elevated temperatures can provide safer solutions by understanding the steel failure temperature that is required for a given fire scenario by means of a structural assessment.

Steel at Elevated Temperatures

Structural steel starts to lose its yield strength at temperatures around 400°C and at 600°C at which point, approximately 50 percent of its yield

strength will be lost. In order to maintain stability, it is critical to ensure that structural members are fully protected against the high temperatures that are often generated in fires.

There is an increasing paradigm shift in the way of thinking by passive fire protection suppliers towards recognition of structural fire design approaches. Many structural engineers and fabricators are starting to collaborate closely with manufacturers in terms of product performance knowledge.

Many structural design codes and guidance documents include 'fire resistant' design. In the UK the relevant standard is BS 5950 Part 8:2003 and in Europe the relevant codes are EN 1993-1-2:2005 for steel and EN 1994-1-2:2005 for composite steel and concrete design. In BS 5950-8 and the Eurocodes methods are given for determining the thermal and mechanical response of the structure and evaluating the fire protection required, if any, to achieve the specified performance. An important feature of the standards is that they use the concept of a variable steel temperature, that is, the limiting steel temperature before the critical failure temperature is reached.

Defining a Fire Resistance Rating

Typically an architect would stipulate the fire resistance period in accordance with the building codes or regulations that prevail in the country or region where the building is to be constructed. There are a number of international fire safety codes and guidance documents currently in use, including the National Fire Protection Association (NFPA) suite of documents and the International Building Code and BS 9999.

These documents typically indicate a period of fire resistance for the building, which is generally determined based upon the height of the building, the occupancy use and the potential provision of a suppression system. The duration of a fire resistance period can be anywhere up to four hours depending on the associated risk.

In general, the standards do not specifically call for fire protection of individual structural elements, but they do stipulate that the building should remain stable for the fire resistance period. The stability of the structure acts primarily to protect life safety in terms of people to evacuate safely and for attending firefighters.

To realise the many benefits of the structural steel frame and to help maintain stability in the event of fire, it is often necessary to provide passive fire protection to some, or all, of the individual members that make up the steel frame. Unprotected steel can perform poorly in fully developed post-flashover compartment fires, which can lead to full or partial collapse.

Strictly speaking, a fire resistance period is only part of the fire resistance rating for structural steelwork. The performance criteria of a structural member should be defined not only by its fire resistance period, but also by its maximum allowable temperature at that period to maintain stability, termed the limiting steel temperature.

Typically to allow for the correct specification of the fire protection, the following minimum information is required:

- Fire test standard *e.g. EN 13381-8.*
- Fire resistance period *e.g. 90 minutes.*
- Structural section *e.g. I-column.*
- Degree of exposure *e.g. 4-sided.*
- Limiting steel temperature *e.g. 684°C.*

Load Ratio & Limiting Steel Temperatures

The limiting temperature method may be used to assess the structural stability in fire of members including columns and beams. The limiting temperature, which should not be exceeded during the required fire resistance period, is dependent upon a number of factors:

- The ratio of the load carried during the fire to the load capacity at ambient.
- The temperature gradient within the member.
- The dimensions of the section.
- The yield strength of the steel.

At ambient, structural design uses the concept of ultimate and serviceability limit states. Associated partial safety factors to represent these states are applied to the given loads acting on the structure. The resultant loads are used in a structural assessment to generate steel member sizes. At the fire limit state however, the partial safety factors may be different to those for ambient.

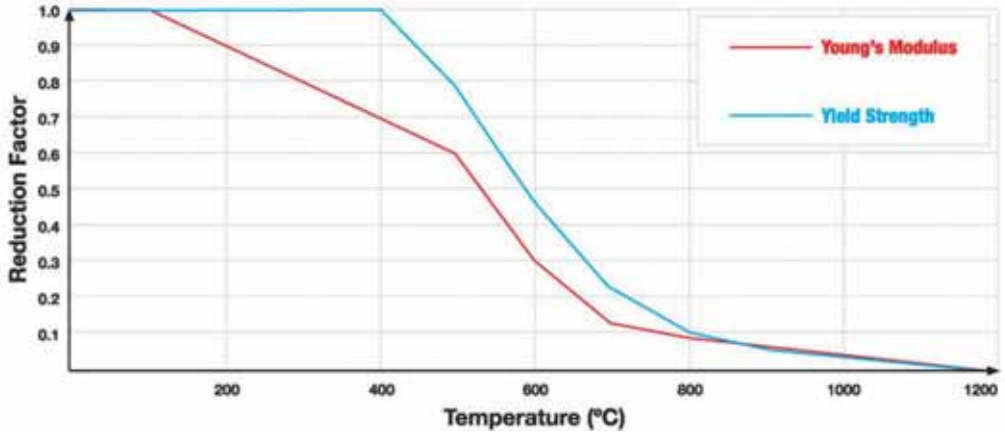
The resulting load in the fire limit state is effectively reduced to account for the probability that in the event of a fire the structure is unlikely to be loaded to its capacity and can be justified using statistical evidence of actual measured imposed floor loading. The ratio of the effective load applied on the member in the event of a fire to the load at ambient is termed the 'load ratio'.

Both BS 5950-8 and the Eurocodes use the concept of load ratio as a measure of the applied load that a member can resist at the time of a fire. In practical designs, the load ratio may vary from 0.45 to 0.55. However it is not uncommon for designs to have a load ratio greater than or less than these values. For a given load ratio, the maximum permitted temperature is termed the limiting temperature. In essence, the steel member will function satisfactorily at the limiting temperature but will fail at higher temperatures.

Lookup tables are defined in BS 5950-8 and EN 1993-1-2 to define the limiting steel temperature for a range of different member types for a range of load ratios.

Industry Temperatures

In the absence of an appraisal of a member's limiting temperature, the UK passive fire protection



industry has adopted limiting temperatures as follows:

- 550°C for typical columns in compression.
- 620°C for non-composite beams supporting concrete slabs or composite slabs.
- 520°C for hollow sections.

Industry prescriptive temperatures vary across the world in accordance with relevant legislation. For example, UL 263/ASTM E-119 uses a maximum limiting steel temperature of 538°C for columns and 593°C for beams; in parts of Europe, the temperature is commonly 500°C and in China the concept of limiting steel temperature does not exist – this is in place of a single protection thickness to cover all steelwork. In the offshore industry, Classification Societies typically set a limiting steel temperature of 400°C.

The Steel Construction Institute (SCI) in the UK has acknowledged that the temperatures of 550°C and 620°C are acceptable for most circumstances but not always.

In the case of cellular beams, then the above generic temperatures are not applicable due to the fact these beams have additional failure mechanisms as a result of their openings which need to be accounted for. As such, there are no generic temperatures for these beams and their limiting steel temperature must be determined based on a thermal and structural assessment.

Performance-based Design Approach

There are number of approaches available to designer's to establish a limiting steel temperature. These can range from an assessment of the load ratio and simple lookup temperature, to single element checks through to whole frame assessments including advanced finite element methods to account for restrained thermal expansion and load paths within the structure. Often, the greater the level of complexity and interaction consideration, the greater the potential to increase the limiting temperature and make reductions in the passive fire protection costs.

The appraisal of the limiting temperature for structural elements is an exercise that is best carried out once the structural design has been finalised as the section sizes may still be subject to modification at various stages throughout the design, including at a steelwork fabricator level.

A common method of assessment is to assess the degree of utilisation of a structural member in the fire limit state through a single element analysis. This approach considers beams or columns in isolation with conservative boundary support conditions and effectively reproduces the load-bearing scenario of a standard fire test as close as possible by calculation.

Manufacturers of passive fire protection subject their products to a fire test package that comprises unloaded and loaded beams and columns at minimum and maximum product thicknesses. In the UK and Europe, the result of this test package is a dataset that defines the required protection thickness for structural sections over a range of limiting steel temperatures, typically 350°C to 700°C in 50°C intervals. Certified product listings available in the public domain, typically only show the thickness of material required to satisfy the accepted industry standard temperatures. Manufacturers may not typically publish their product-specific multi-temperature assessment (MTA) thicknesses. It is therefore in the interest of engineers concerned with defining limiting steel temperatures for the purpose of setting steelwork specifications to coordinate closely with passive fire protection suppliers to ensure that the potential benefits are understood.

Summary

The use of structural fire engineering techniques to calculate a structural member's limiting steel temperature can result in savings of the required volume for fire protection material for a given project. In the intumescent coating industry this can have further benefits by reducing the dry film thickness required on each member which in turn requires fewer coating applications. This can bring significant time savings to construction schedules and labour costs.

While the use of generic limiting steel temperatures in the absence of a structural assessment may in the majority of cases be conservative, this may lead to an over-application of passive fire protection. It is also acknowledged that in some cases they may not always be conservative, leading to an under-application of fire protection.

Given that the methodologies exist in the design codes to undertake a structural assessment to determine the limiting temperature, qualified engineers within the contract chain should be encouraged to evaluate steel temperatures and to work closely with passive fire protection manufactures to realise the benefits it can bring. Rather than assuming performance criteria, setting steelwork specifications for fire protection in this way can assist to inform robust design based on quantified structural assessment. APF

Dr Allan Jowsey is Fire Engineering Manager for International Paint

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Are "Ex Certifications" to be trusted?

In April this year, a third party commissioned DEKRA Certification B.V in the Netherlands to test six brands of 'intrinsically safe' alkaline (4 x AA) powered hand lamps and to validate not only various performance claims but also to verify if the lights were compliant with the issued ATEX certifications. The results of the study –"Photometric and mechanical testing of six different type of professional torches" – are a cause of concern.

Urs Baeumle

Permalight (Asia)

In brief, the DEKRA test report documented that five of six flashlight samples did not live up to some of the performance claims. For example, grossly overstating lumen ratings, and three samples failed the immersion tests as water leaked into the battery chamber, in non-compliance with the issued ATEX certifications and IP ratings.

What is Intrinsic Safety?

To cause an explosion three elements must be present: Oxygen, flammable compounds and a spark or a flame. As general definition, equipment termed as 'Intrinsically Safe' is incapable of causing electrical sparks or sufficient thermal energy to ignite flammable compounds present in an explosive atmosphere, may they be gases, vapours or dust.

In battery-powered luminaries, three main components might cause a spark or a flame:

- Batteries might leak, gas out or short-circuit.
- Light source – incandescent bulb might break or explode; LED circuits can short-circuit and components may overheat or become faulty.
- Enclosure and material – electrostatic discharge can cause sparks.

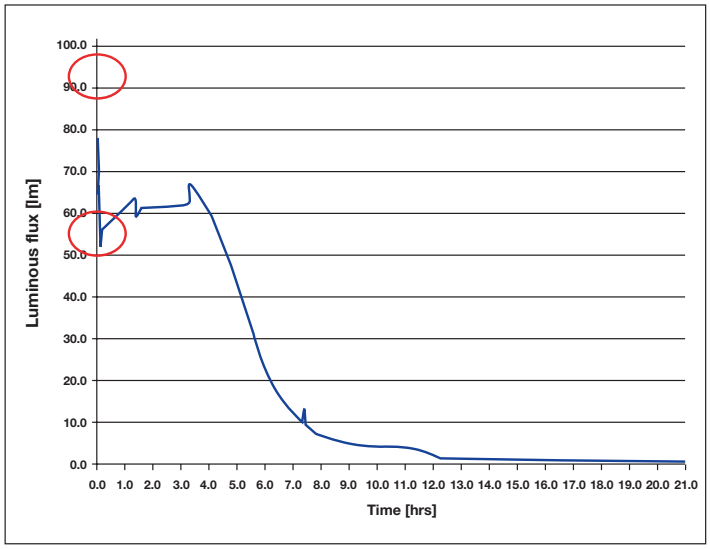
Batteries

Handheld flashlights and headlamps require a power source to operate; these can be rechargeable or non-rechargeable battery cells, for example Li-ion, NiMH, NiCd, alkaline or lithium. Batteries store energy to be released as 'electrical power', and depending on the chemistry, some batteries are more energetic than others.

Yet, batteries may leak over time, gas out or short-circuit damaging the electronics and the enclosure of the luminary. Gassing batteries are of special concern as there are risks that they might explode inside the compartment leading to injuries or, in the worst case, initiating a major explosion. 'Safety gas valves' seem not to offer much protection when batteries start gassing.

Light Source

As light sources, most handheld flashlights and headlamps use either incandescent bulbs such as Xenon, Krypton, or LEDs. Obviously, light bulbs can burnout or break when lit. Also, light bulbs will become very hot during operation – the brighter the hotter – heating up the luminary enclosure (and batteries), sometimes to critical



The graph shows the light performance using a direct driven LED circuit

temperatures sufficient to ignite flammable gases or dust. Therefore, light bulbs have to pass electrical and the housings mechanical and environmental stress tests before the light will be certified as 'Intrinsically Safe'.

Where luminaries include an LED light source, it is mostly ignored that LED chips not only generate considerable heat, they require an electrical circuit and a heat-sink to operate. The Achilles tendon of all LEDs is the electrical circuit that must be designed and manufactured in accordance to approved safety norms and standards in order that neither the circuit nor any of its components will short-circuit and cause electrical sparks.

Circuits

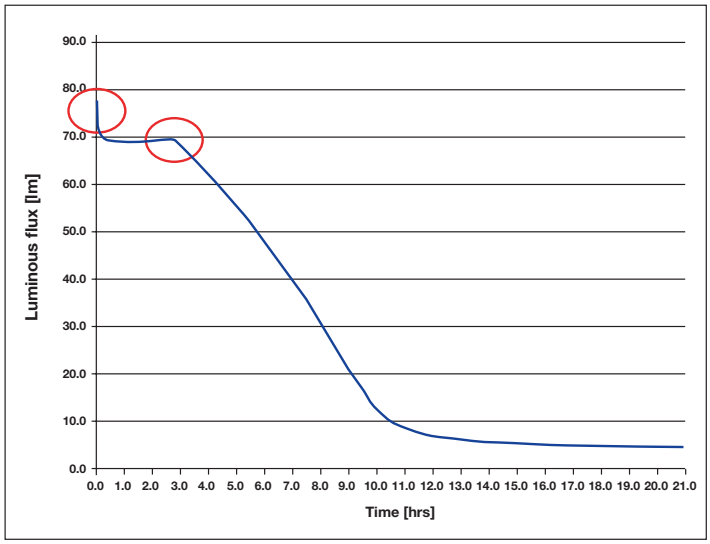
Incandescent light bulbs can be directly connected to batteries without having to take polarity into consideration. Therefore, the electrical circuit is rudimentary, consisting of a bulb, batteries, contacts and likely a switch.

LED emitters are diodes allowing the current to flow in one direction only. In a very simple circuit, LEDs are direct driven, similar to a light bulb. Alternatively and more expensive is to drive the LED with a regulated circuitry. But which of the two is more efficient and safer? Performance wise, the LED with the regulated circuit will fare better than if direct driven; however, electrical safety can only be guaranteed if the regulated circuit includes current limiting resistors, a fuse, and is reverse polarity protected. In addition, all components that might heat up must be insulated, creepage between conductive tracks must be avoided and clean and solid soldering is a prerogative.

Considering the above two circuit types, it is important for the user to know:

Direct-driven LEDs are connected directly to the batteries and will be very bright in the first few minutes but then lose rapidly around 50 percent of the light power. The graph shows the drastic drop in luminous flux from 96 lumens to 53 lumens within a few minutes (it is worth noting that the DEKRA-tested sample is advertised as emitting "200 lumens"). For cost considerations and simplicity of engineering, the majority of "intrinsically safe" lights rely on direct driven LED circuits.

IC-controlled LED circuits regulate the current supply either by pulse modulation (PWM), constant current (CC) or alternatively by applying constant voltage (CV); in other words, a microcontroller constantly senses and optimises the forward current respectively forward voltage applied to the LED, keeping the light output constant and so reducing negative thermal effects. The conclusion is that IC controlled LEDs are safer and show a far better performance than direct driven LEDs.



The graph shows the light performance with a safe IC controlled LED circuit

Enclosures

Enclosures of intrinsically safe lights are predominantly made of plastics; these might have conductive or non-conductive properties. Non-conductive polycarbonate (PC), for example, Lexan, is the most common and cost effective plastic. Conductive anti-static materials like carbon fibres and "XAG" are expensive and preferred if lights are to be certified for safe use in highly explosive atmospheres, such as those with Nitrogen gas. Before a flashlight can be certified as 'Intrinsically Safe', the entire enclosure has to pass various laboratory tests that include impact and drop tests, water and dust immersion (IP rating) and, depending on certification, temperature stress and electrical resistivity tests.

IP ratings indicate the level to which the flashlight is water and dust proof. Water immersion is part of the 'product certification tests'. After the tests, the product will be IP rated, such as IP 67

or IP 68. For example, IP 67 certifies that the product is "Dust Tight" and suitable for "Immersion up to one metre". In the mentioned DEKRA report, three out of the six flashlights failed this one-metre immersion test, despite two vendors are claiming that the affected models are "suitable for diving".

Norms, Certifications & Inconsistencies

The above comments refer predominantly to ATEX, which stands for "Appareils destinés à être utilisés en ATmosphères EXplosives"; ATEX applies mainly to the European Community. However, countries, such as the US, Canada, Australia, Russia and Japan all implement different directives – UL, FM, ETL, IECEx, TIIS, to mention a few. It is outside the scope of this paper to explain the nuances and differences of these directives other than to state that the general product test methods follow and apply schedules similar to ATEX. In accordance to the various certification schemes, 'Intrinsically Safe' products can only be distributed if the facilities of the certified vendor are audited by a Notified Body.

However, vendors that market "Ex certified" lights under their own brand may not necessarily be the original manufacturer, instead employing uncertified subcontractors in third countries. Most subcontractors do not have any 'Ex' quality assurance module in place and the production facilities are not inspected and audited by any Notified Body. In other words, US or European vendors may purchase flashlights either as "complete knocked down" (CKD) kits or as finished products from unnamed and uncertified subcontractors located in different jurisdictions.

In case of CKD kits, the vendor assembles the parts at his facility and sells the products as "intrinsically safe lights" under his own brand certified by a Notified Body in his name. On the other side of the coin, customers purchase, in good faith, a 'branded and Ex certified' flashlight or headlamp that might turn out to be unsafe if used in hazardous areas. For example, an unnamed European "Ex safety" company markets an alkaline battery powered headlamp certified to ATEX "II 2 G Ex ia T4"; "ia" approves the lamp for Gas Zone 0, an area in which explosive gases are continuously present. However, the LED board is made by an "Ex" uncertified subcontractor. The circuit does not include any current limiting resistors or a fuse, components are without insulation and conductive tracks are closer than permitted risking certain current creepage. And yet, the head lamp was approved and certified by a Notified Body in Germany.

Conclusion

The previously mentioned DEKRA report and the cited examples should sound alarm bells to users who operate luminaries in hazardous areas. Flashlights and headlamps branded with Ex certifications are no guarantee that the lights will perform as advertised or will be truly safe for deployment in potentially explosive atmospheres! The reasons are:

- **Notified Body**

To be certified as 'Intrinsically Safe', products must comply with specific norms and standards such as ATEX; nevertheless, it is left to the interpretation of the Notified Body how to implement these. For safety reasons, and in order to avoid ambiguity, it should be made mandatory that only products can be called and marketed as 'Intrinsically Safe' if the entire production chain, including the vendor and the main subcontractor that supplies electronic boards and LED modules, is audited and certified by a Notified Body.

- **Certifications Definitions**

The various definitions, nomenclature and letterings classifying intrinsically safe products are confusing to most users. As example, US and European norms apply different criteria: "classes" versus "zones".

- **Vendors**

For marketing purpose some vendors tend to overemphasise product performance. To be competitive and/or lack of electronic engineering, many 'Ex certified' vendors purchase electronics modules, such as complete LED assemblies or even the entire product, from 'Ex' uncertified subcontractors without having direct control over production, product quality and safety.

- **Users**

Price driven, many customers put a lower priority on safety', as long as the product is branded and carries some kind of 'Ex' certification. However, users are well advised to select only 'Ex' luminaries that are certified by two different organisations such as ATEX and IECEx.

- **Legal Implications**

In the event that an 'Ex' certified luminary causing an accident, fire or an explosion, the above comments lead to the conclusion that the user will, at the end, bear all responsibilities and liabilities. One of the many legal but not hypothetical questions is what will happen if a Notified Body has its accreditation suspended or revoked? Will the products certified by this very organisation have the 'Ex certifications' invalidated so that the products cannot be distributed any longer as "intrinsically safe" luminaries? The answer remains open. APF

Urs Baeumle is Managing Director of Permalight (Asia)

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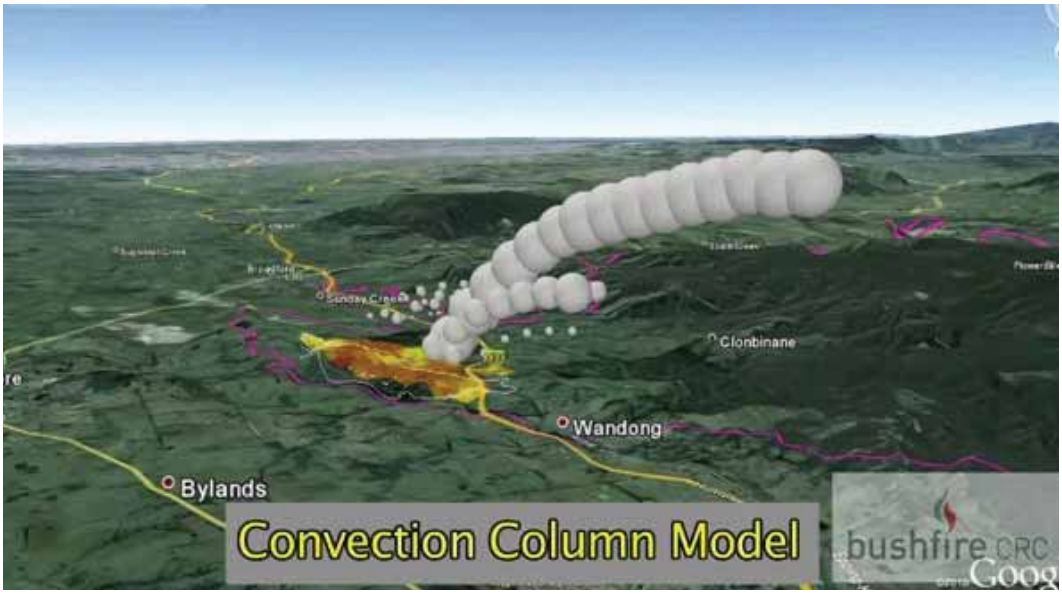


Toolbox Talk

Bob Cechet

Bushfire CRC and
GeoScience Australia

Imagine you are an incident controller sitting in front of a computer screen that is showing you where a fire that has just started is likely to head. Not just that, but also the houses and other structures in the fire's path, and even the number and type of people living in the area – children, adults, and the elderly. In addition, imagine that you can quantify the uncertainty in both the weather affecting the fire, and also the state of the vegetation in the area, so as to deliver a range of options relating to the expected spread of the fire.

Think of the advantages of such a program in making speedy, well-informed decisions about where best to send fire trucks and fire-suppression aircraft; in being able to issue timely, locality-specific warning messages; in judging whether this fire will become so bad that it might warrant recommending not only an early, orderly evacuation of communities in its way, but also identifying the least risky roads for people to get to safety.

A computer program that will not only be able to help with all this and more in a fire, but will also be capable of determining what structures, streets and communities would be at risk should a fire occur, will enable those at risk to undertake remedial work around their properties in advance to make them more fire-ready.

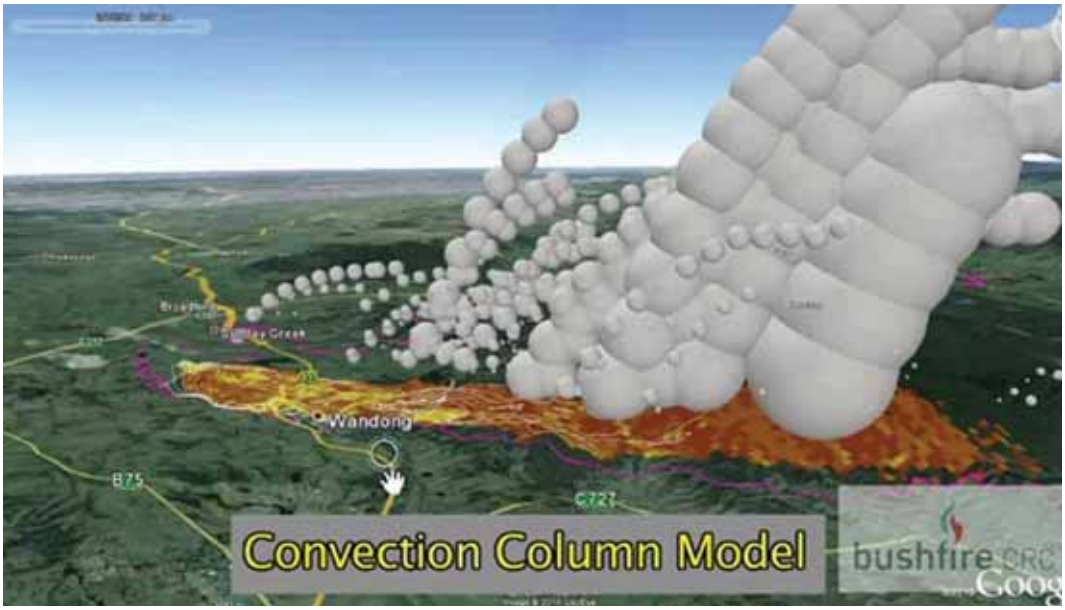
While such a program will not be ready this year or next, it is under development by collaborating teams of the Bushfire Cooperative Research Centre (CRC); researchers from Geoscience Australia, the University of Melbourne, the Bureau of Meteorology and two divisions of the CSIRO. It has the working name *Fire Impact and Risk Evaluation Decision Support Toolbox*, and is one of the Bushfire CRC extension's biggest projects. It links various models and projects developed during the first seven years of the Bushfire CRC, including the Phoenix RapidFire fire prediction model developed by the University of Melbourne's Dr Kevin Tolhurst.

The work of the 2009 Victorian Bushfires Royal Commission (VBRC) highlighted a need for a tool to assess the potential bushfire impacts on rural and rural-urban interface communities responding to an immediate threat, but also to examine scenarios that may pose a threat in the future. Twenty-five recommendations from the VBRC report involved assessing or reducing risk.

When fully developed, the Toolbox will enable fire and land management authorities to develop appropriate fire impact and risk treatment options at local, regional and national levels. This will be achieved by building a library of possible or credible fire impact scenarios, based on historical weather conditions surrounding severe fires, as well as information about the vegetation in certain areas, including the type, the amount and its moisture content.

Phoenix RapidFire will be the Toolbox's engine. Phoenix RapidFire uses geographic and weather information to predict where a fire will go. It is now being used operationally in Victoria and under formal evaluation in New South Wales and South Australia. Dr Tolhurst says that reported Victorian fires are automatically simulated in Phoenix RapidFire to see their potential spread over six hours and the potential assets that might be affected. Additionally, a grid of ignitions across the whole state is run every morning to identify the areas most at risk from fire that day.

"We aim to improve the feed of meteorological data including the development of a third vertical dimension depicting convection, to enable Phoenix



RapidFire to accurately simulate fire-spotting ember attack ahead of the main fire front," says Dr Tolhurst. "In addition, we are also planning to implement a more realistic fire suppression model to capture the ways in which resources are allocated to different sectors of a fire. The resulting fire-spread outcomes will be used by the advanced vulnerability and impact modules within the Fire Toolbox to evaluate realistic impacts such as damage and costs, which can be used to inform cost-benefit analyses for a range of land management options."

The Toolbox is expected to add substantially more information about weather, geography, structures, population and fire behaviour to the already advanced technology of Phoenix RapidFire.

David Youssef, Deputy Chief Officer of Melbourne's Metropolitan Fire and Emergency Services Board (MFB) and one of two lead end users for the project, says the project is about assisting incident controllers in difficult situations, providing a product that is genuinely useful to them and the community. "It will be a tool to allow incident management teams to tell communities where their vulnerabilities are," he says. "I believe the technology will be able to show even how a fire will impact on structures in a particular street. It will add much better information on, and give an incident controller much better information on, what structures are in a community and the demographics of the people living there."

Ian French of Geoscience Australia is bringing various databases and models together into an integrated simulation framework through a geographical information system (GIS) interface. The data includes vegetation, terrain, topography and weather as well as people, buildings and infrastructure. Pre-processed information, such as factors that determine the local and regional wind, and also the typical response of buildings to fire, will be linked with the buildings in the database, along with census-derived social and economic information.

"Large bushfires are complex and unpredictable," says Mr French. "They are greatly influenced by variations in wind and temperature, terrain and vegetation. By varying the circumstances surrounding bushfires and modelling the likely impacts, the Toolbox will have the ability to run a large range of bushfire scenarios, ranging from inconsequential to catastrophic, which will inform the long-term fire risk for communities and be able to provide the bounds of possible consequences for a particular event."

The *Fire Impact and Risk Evaluation Decision Support Toolbox* is expected to add substantially more information about weather, geography, structures, population and fire behaviour to the already advanced technology of Phoenix RapidFire.

Dr Jeff Kepert of the Bureau of Meteorology says the Bureau's new computer-based weather prediction system, ACCESS, uses better technology than its predecessor and is much more accurate and reliable. "Within the Fire Toolbox we have configured ACCESS for very high resolution simulations, and applying it to severe fire weather conditions in rugged terrain. Modelling at this scale will really stretch the computers but is necessary to be able to understand the complex winds, temperatures and humidity that occur during events like Black Saturday. Once we have validated the modelled weather against case study observations, our partners in this project will use it as an input to their fire behaviour models – the aim here is to directly predict the spread, intensity and impact of a fire. We also plan to look at some alternate scenarios, such as what if the wind change arrived an hour earlier or later, or the wind speed was more or less than predicted."

Justin Leonard of CSIRO Ecosystem Science has undertaken considerable research for the Bushfire CRC into the effects of fire on structures such as homes, fences and water tanks, seeking to understand how the physical attributes of buildings interact with their surroundings during bushfires. This work is now being expanded to form part of the Toolbox project.

"We plan to characterise the behaviour of vegetative and non-vegetative elements found within the rural-urban interface zone," he says. "The research focus will be to provide consistent parameters that adequately describe the element properties and spatial relationship with their surroundings, so that simulations of the physical process that occurs during bushfire events can be performed."

The simulations will be validated against actual events and used to profile the vulnerability of existing and future rural-urban interfaces. The simulations will be performed on various two-dimension and three-dimension interface scenes using spatial data: mainly aerial photography and LiDAR (aerial laser scanning).

"We will address the need to combine the broader fuel definition used in bushfire behaviour prediction with the very detailed fuel definition used in house damage and loss research, to come up with a system of defining fuels in rural-urban interface areas that are useful for contributing to the prediction of house loss," Mr Leonard added.

Large bushfires are complex and unpredictable. They are greatly influenced by variations in wind and temperature, terrain and vegetation. By varying the circumstances surrounding bushfires and modelling the likely impacts, the Toolbox will have the ability to run a large range of bushfire scenarios.

Another thread to the Toolbox is the effect of smoke and heat on people. Dr Mick Meyer of the CSIRO Marine and Atmospheric Research is investigating the impacts of the fire's plume on regional health from severe bushfires and prescribed burning programs, as well as the risk of reduced visibility caused by ground-level smoke. His work

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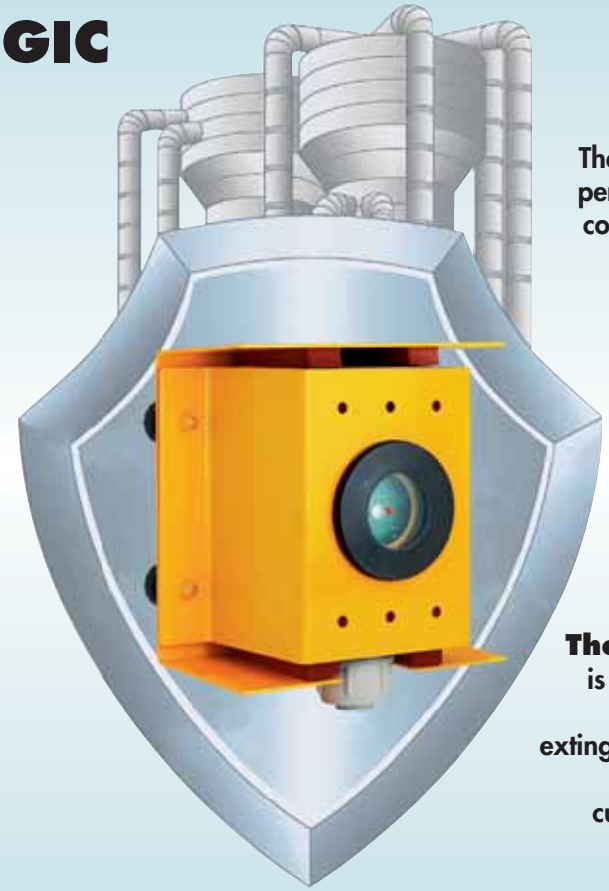

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involves the development of spatial smoke and chemical emissions estimates for major and extensive fire events in southern Australia, and the application of these estimates to several atmospheric transport models to predict tracer concentrations and surface impacts.

"Through comparison of the predictions against observations, we plan to assess the sensitivity of the predictions to parameter values in the emissions model," says Dr Meyer. "We think that the most significant areas of uncertainty will be plume rise and the dependence of emission factors on combustion properties."

Dr Meyer is working with the Bushfire CRC fire behaviour project led by the CSIRO's Dr Andrew Sullivan, undertaking experimental burns in the CSIRO Pyrotron, a fire wind tunnel used to measure emission factors for methane, nitrous oxide, particulates and relevant air toxins covering a range of fuels and fire intensities.

limited range of case study regions.

The focus of this current project is to construct, develop and validate a prototype bushfire simulation system with the long-term aim to create a fully operational tool in association with the project's end user advisory group. The immediate research and development focus is on the estimation of the consequences of extreme fires based on the characteristics of vegetation, extreme fire weather, fire-spread, heat stress and smoke production and dispersion, considering three case study scenarios.

The next step will be evaluation by end users, including land management and fire agencies. Following acceptance by agencies, it is planned to implement robust computer software and hardware practices with the aim to make the Toolbox operational so that it can address potential bushfire response in near real-time.

The MFB's David Youssef is confident the project will produce a model to run as a trial. "Fire managers need to make quick decisions under extremely complex conditions," he says. "They need to know where to direct firefighting resources and how best to protect the community. As more people move into the rural-urban interface, we need to continually update the way we approach fire safety. The Toolbox will allow us to keep our communities safer. The success of the planned research is likely to trigger the development of an operational tool and a roll-out of the Fire Decision Support Toolbox to Australian fire and emergency service agencies." A short video about the research and what it means for the future of fire management is available on the Bushfire CRC website. APF

All these strands of the Toolbox project need to be brought together in a single prototype working model in the second half of 2013. The work is so technologically ahead of almost anything else like it that the computer power to make it work in real time is not yet available.

All these strands of the Toolbox project need to be brought together in a single prototype working model in the second half of 2013. The work is so technologically ahead of almost anything else like it that the computer power to make it work in real time is not yet available, but the expectation is that this will be overcome as computer speeds and technology continue their rapid evolution.

It could be some years before computers are powerful enough to perform the full range of simulations in both high-resolution and in near real time. In the meantime the focus will be on building up the underpinning datasets over large regions of Australia, while using available data and simulations to better understand and interpret the impact and risk to people and buildings in a

Bob Cechet is Bushfire CRC Project Leader and Climatologist GeoScience Australia

For further information, go to www.bushfirecrc.com/category/projectgroup/2-risk-assessment-and-decision-making

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OTB PRODUCTS PTY, LTD
6 Cromwell Court, Tallia, QLD 4213, Australia
Tel: 617-5525-2523
Email: otb@bigpond.net.au
Dealer/Distributor

CHINA

ANCOM SYSTEMS INC
Building 5, Courtyard 10, Beijing
Contact: Wang, Jacinta F
Tel: 86-10-6202-2792
Email: jwang@ancom.cn
Dealer/Distributor

BEIJING CBT MACHINE & ELECTRIC EQUIPMENT INC
Room 503, Building H, Timecourt, No. 6 yard, Beijing
Contact: Chou, Yu
Tel: 010-84440107/8
Email: hillcity1@yahoo.com
Dealer/Distributor

OCEANS SAFETY EQUIP CO LTD
Rm19A 10 & 11, Jazz Mansion, Shenzhen
Contact: Zhang, Echo
Tel: 86-755-8328-0633
Email: andy_oceans@hotmail.com
Dealer/Distributor

WUXI NEW FIRETRE SAFETECH LTD
Block 3 Long Shan Wen Bo Industrial Park
Wuxi, Jiang Su PRC
Contact: Wang, Chad
Tel: 86 510 139 0619 8090
Email: chwang1001@hotmail.com
Website: www.wfs.com.cn
Dealer/Distributor

HONG KONG

EASTERN FORUM FE CO LTD
Unit A2, 1/F No 1123 Canton Road, Mong Kok
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Tel: 852-278-734-64
Email: efung@rescue.com.hk
Website: www.rescue.com.hk
Dealer/Distributor

SUPREME CO
Room 1812, Park-In Commercial Center, Mong Kok
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Email: info@supremeco.com.hk
Website: www.supremeco.com.hk
Dealer/Distributor

INDIA

UNI(CARE) EMERGENCY EQUIPMENT PVT LTD
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Prof. V.S. Agashe Road, Mumbai 400028, India
Tel: 91-22-24221878
Fax: 91-22-24306044
Email: wlp@unicaremail.com
Dealer/Distributor

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P.T. MITRA TEKNIKATAMA
Jl Ekor Kuning No: 1, Jakarta
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Dealer/Distributor

JAPAN

TEISEN – TEIKOKU SERI-I CO LTD
103-0027, Tokyo
Contact: Katano, Yasu
Tel: 81 3 3281 3033
Email: yasuhide.katano@teisen.co.jp
Website: www.teisen.co.jp
Dealer/Distributor

KOREA

KEO WHA R & F CO LTD
RM 1, FL 1, Jiwoo Building, Seoul
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Tel: 82 02 335 0145 7
Email: jfckenneth@yahoo.co.kr
Dealer/Distributor

MACAO

GOLDEN BLOSSOM TRADING CO LTD
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Email: gbtrade@macau.ctm.net
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Email: sp@sp-associates.co.th
Dealer/Distributor

SEA AIR THAI CO LTD
98 Soi Ramintra 49, Bangkok
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Website: www.seaairthai.com
Dealer/Distributor

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Ha Noi
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LACVIET TECHNICAL SCIENTIFITIC & ELECTRIC CO LTD
152 Nguyen Hong Dao Str, Ward 14
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Tel: 84 8 8492 734
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Cutters Edge
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Email: tetra@singnet.com.sg
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Ganga Ram Hospital Square, Shankar Road
New Delhi – 110 060 India
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(All India Sales)
Tel: 011 494458800
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Website: www.askagroup.com
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UTC FIRE & SECURITY INDIA LTD

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Representative Office

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Fax: +61 3 9543 9109
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Dealer/Distributor

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MARS SYNDICATE

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CHINA

I-SAFE FIRE EQUIPMENT (TIANJIN) LTD

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Tel: 852 2807 4684
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Website: www.jec.com
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INDIA

NEWAGE FIRE PROTECTION ENGINEERS

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INDONESIA

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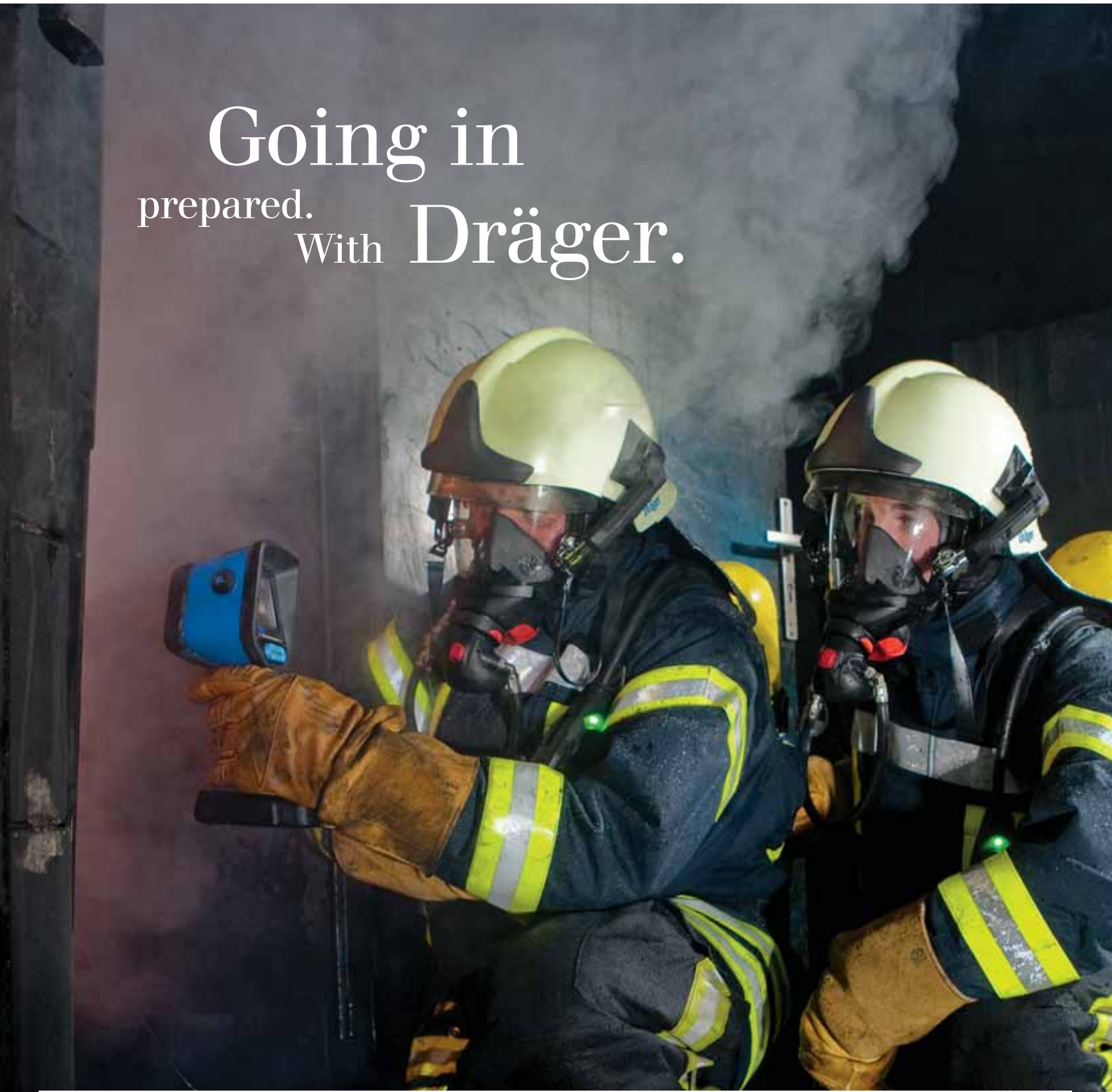

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