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fourth quarter 2016 issue 104

FIRE & RESCUE

INTERNATIONAL INDEPENDENT INTELLIGENCE

At one with fire dynamics

Science-based training project to prevent firefighters' loss of lives

Airport Fire Officers Association
Annual Conference
January 18-19, 2017
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London UK

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January 22 – 24, 2017

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"SEAC considers that fluorine-free foams can be taken into account on a long-term basis but cannot be relied on for the coming years for such a critical use."

Committee for Socio-economic Analysis (SEAC), Draft Opinion, on an Annex XV dossier proposing restriction on PFOA, its salts and PFOA-related substances, 10 September 2015, p14.

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Published Quarterly by

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www.hemmingfire.com

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Fire & Rescue (ISSN 0964-9727)

Annual Subscription:
Europe £40.00 or €60 (incl. p&p); rest of world £50.00 or US$80.00 (incl. p&p). Subscriptions queries to: m.spillane@hgluk.com

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FIRE & RESCUE JOURNAL (ISSN No: 0964-972719, USPS No: 003-930) is published quarterly by Hemming Information Services and distributed in the US by Asendia USA, 17B S Middlesex Ave, Monroe NJ. Periodicals postage paid at New Brunswick, NJ and additional mailing offices. POSTMASTER: send address changes to Fire & Rescue Journal, 17B S Middlesex Ave, Monroe NJ 08831.

Artwork by
Graphic Examples Ltd, Sherborne

Printed in England by
Latimer Trend & Co Ltd, Plymouth

DISCLAIMER: The views and opinions expressed in FIRE & RESCUE are not necessarily those of Hemming Information Services. F&R is in no way responsible or legally liable for any statements, picture captions, reports or technical anomalies made by authors in their commissioned articles.

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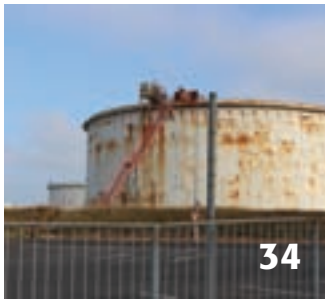

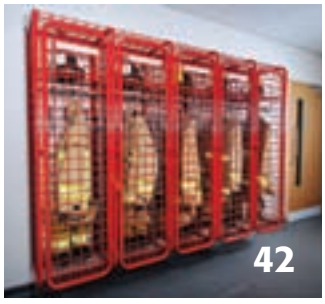

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Front cover artwork by: Darren Small, www.facebook.com/darrensmallphotography/

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EDITOR'S COMMENT

Let's face it, most of us are addicted to our smartphones and tablets. I am no exception. We expect Google to answer any question within seconds, if we are lost we rely on digital maps and GPS appllications to get us to our location, and we trawl reviews to find hotels and restaurants. In hard fact, not only are we hooked on technology, but we have become reliant on it as well.

It's not just us as consumers who are guilty of this, but firefighters as well. In this issue, firefighter and data architect Bart van Leeuwen confronts this addiction head on. In his keynote address at the NFPA Conference in Las Vegas this year, he pointed to what he believes is a 'dumbing down effect' that technology is having on today's fire service. To combat this issue he has developed a new approach to operational information delivery that takes advantage of what technology has to offer – access to an abundance of information, for example – and delivers it in a way that enables firefighters to make sense of the 'noise', regain critical situational awareness and improve safety and incident response (P16). Bart's sentiment has strong parallels with Canadian initiative 'From Knowledge to Practice' (P10), which sees fire services come together to develop scientific training methods for recognising fire dynamics in order to create 'thinking firefighters'; and the European IGNIS project (P18), which is developing simulation-based training approaches for wildfires.

All in all, there is plenty of food for 'critical' thought in this issue.

Ann-Marie Knegt, Editor

IAFC GUIDE TO FILL GAP IN FIREFIGHTER PHYSICALS

The International Association of Fire Chiefs (IAFC) has released *'A healthcare provider's guide to firefighter physicals'* to assist healthcare providers in the evaluation and treatment of the health and wellness of firefighters.

The guide also serves as an important new tool for firefighters to manage their own healthcare.

The research-supported, experience-driven guide, spearheaded by the IAFC's Safety Heath and Survival Section, features a systematic approach to the physical examination of firefighters, addressing cardiovascular health and fitness, cancer, musculoskeletal injuries, behavioural health, lung disease, sleep disorders and infectious diseases.

Recent studies and surveys suggest there is a serious gap in the provision of healthcare of firefighters in the US. According to the National Fire Protection Association, sudden cardiac deaths account for a majority (51%) of on-duty firefighter deaths. Research by Denise Smith, PhD, Skidmore College, found for every line-of-duty death there are an estimated 17 non-fatal cardiac events on duty among firefighters in the US. However, an IAFC survey found that only 45% of volunteer firefighter respondents and up to 80% of career firefighter respondents receive annual firefighter physicals.

'Firefighters need healthcare that is tailored to the inherent risks of their dangerous jobs,' said Chief John Sinclair, IAFC president and chairman of the board. 'The guide provides doctors and firefighters with clear information about the clinical care needed to address these risks. The IAFC encourages all firefighters to be strong advocates for their own health and wellness by making sure their doctor examines them for the many health risks they face.'

This guide is an important new tool designed to explain the risks presented by firefighting to healthcare providers, whether or not a fire department offers NFPA 1582 physicals. It addresses the physiological demands, hazards, exposures, diseases, illnesses and injuries firefighters are most prone to suffer. Through research and experience-driven clinical recommendations, it focuses a healthcare provider's examination on the key issues.

'Ramp-up' alert tones can help reduce stress on firefighters

New research that examines the long-term health effects suffered by emergency responders indicates that the way firefighters are alerted to emergencies can impact on their health.

The recently published research suggests that fire departments can reduce stress levels by signalling emergencies with alarms that gradually increase in intensity instead of sudden, full-volume alerts. The article, *Effect of station-specific alerting and ramp-up tones on firefighters' alarm time heart rates,* was published on the eve of the Annual National Fallen Firefighters Memorial Weekend, which honours firefighters who died during the previous year.

Authors James MacNeal, David Cone, and Christopher Wistrom note that of the 97 firefighters killed on duty in 2013, 32 died from overexertion, stress, and related medical issues. During the last five years, heart attacks accounted for two-fifths of on-duty deaths. Previous studies have established that firefighters are more susceptible to heart attacks when responding to emergencies.

This study was conducted over three months and involved 42 firefighters at an urban three-station fire department. Firefighters participating in the study wore devices on their wrists that measured their heart rates.

Researchers analysed participants' heart-rate increases in response to standard alerting – the sudden, high-volume alarms – and to alerts that gradually increase in volume. Results showed that standard alerting caused a median increase in heart rate of seven beats per minute, while the ramp-up tones caused a median increase of five bpm. In a post-study survey, participating firefighters indicated a strong preference for the ramp-up tones.

'Ramp-up tones were also perceived as the best alerting method to reduce stress during both the day and overnight,' the authors write. 'This study suggests that the manner in which firefighters are alerted does have an influence on their physiological response to the alarm.'

BRONTO SKYLIFT LAUNCHES UPDATED CONTROL PANEL

Bronto Skylift, the Finnish manufacturer of aerial platforms, has introduced the latest generation of its control system, Bronto 5+.

Bronto control systems have been designed based on calculations and stability parameters, so the aerial ladder platform can safely guarantee maximum outreach and is not sensitive to changes in ambient or oil temperature. The new generation system features resistive touch screen control panels that can be operated with gloves on, with an intuitive interface designed to make the system easy to navigate.

The Bronto+ system allows for variable jacking and enables the operator to select the rescue cage load that is suitable for the operational conditions. The system automatically calculates the maximum allowed outreach in every direction, so the operator can focus on the boom movements while the system takes control of the other functions.

The company has also announced that it will be introducing device-independent communication over WLAN in 2017, which will enable operators to access the control system from mobile devices or a laptop.

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PELI INTRODUCES ATEX TORCH FOR HAZARDOUS INDUSTRIES

Advanced lighting systems manufacturer Peli Products has introduced a new ATEX safety-certified multifunctional LED torch designed for use by fire and rescue services as well as oil, gas and other hazardous industries.

The new Peli 3325Z0 combines a number of useful features. It is compact, ATEX Zone 0 certified, and designed with a button back switch for one-hand activation. Other features include the back-mounted switch, which makes the 3325Z0 suitable for any helmet-mounted application; a photo luminescent shroud that ensures that the torch can be located in the darkest conditions; and an IPX7 ingress-protection level that highlights how the 3325Z0 can perform in the most severe weather conditions.

The new torch uses 3 AA alkaline batteries, produces 155 lumens of powerful light, weighs 173g (including batteries), and is just 15.4cm long. As it is certified to ATEX Zone 0 (Cat. 1), the torch can be used in the most hazardous work environments where even a small switch spark could cause an explosion.

Personal radiation monitor with Bluetooth connectivity

Flir Systems has launched the Identifinder R100 personal radiation detector, the latest addition to its Identifinder R-Series handheld radiation security solutions.

The belt-worn R100 integrates networking capabilities to safeguard firefighters, law enforcement, military and security personnel by delivering immediate radiation threat alarms. It also provides automatically-generated radiation dose rate reports to offer increased situational awareness to central command personnel.

The Identifinder R100 is an IP67-certified and American National Standards Institute drop test-compliant personal radiation detector. The device meets the 1.5m drop criteria required by ANSI N42.32, one of the key performance standards for alarming PRDs in Homeland Security.

The R100 is protected against dust and immersion in up to one metre of water. The unit features integrated Bluetooth smart wireless technology, which facilitates recording and sending real-time dose rates and geotag information via a companion mobile app.

The R100 joins the Identifinder product family in offering a range of radiation security solutions, from threat detection to threat identification. All Identifinder models, including the Identifinder R100, share the same user interface, which enables coordinated emergency response between law enforcement, firefighters, and Hazmat teams using any identifinder product. 'As the only ANSI drop test-compliant and IP67-certified personal radiation detector, the R100 is the industry's most rugged personal radiation detector for first responders,' said Dennis Barket, vice president and general manager of Flir Detection. 'When deployed across teams, the R100 provides a primary detection net that protects the frontline against radiological threats, while the integrated networking features eliminate communication blind spots for central command.'

AFOA and the IFE create new aviation working group

The inaugural meeting of the Airport Fire Officers Association and the Institution of Fire Engineers Aviation took place at Gatwick Airport Fire Station in October with the aim of creating the first Special Interest Group for Aviation.

The concept of creating a link between the two organisations was discussed prior to the 2016 AFOA conference by Graeme Day of Heathrow Airport Fire Service, Simon Petts of Gatwick Airport Fire Service and Chairman of AFOA, and Andy James of the IFE.

The Special Interest Group for Aviation will share information and build on future educational programmes for firefighting professionals with an interest in aircraft and aerodrome response. The group will include members of the wider aviation fire and rescue community with experience in developing information conduits.

Graeme Day chaired the initial meeting, leading the first discussions around the groups' aims and ambitions.

The Special Interest Group for Aviation will meet again at the AFOA conference 18-19 January, 2017.

Magirus supports Kressbronn fire brigade after storage fire

Following a blaze in July at the equipment store of the Kressbronn fire brigade in Germany the fire department received help from Magirus in the form of a loaned vehicle.

After the fire in the equipment storage facility had been extinguished it was established that the ensuing damage amounted to several million Euros. The majority of the storage facility was destroyed; three of the brigade's eight trucks were severely damaged; and four were completely burnt out. Only one vehicle escaped the blaze undamaged.

Only four days after the incident the fire brigade was offered an M32L-AT turntable ladder by Magirus to help restore the fire brigade's capabilities. Several delegates from the fire brigade visited the Magirus Excellence Centre in Ulm to pick up the new turntable ladder.

The M32L-AT is an articulated ladder truck with a three-axle chassis. The steerable third axle and smaller turning radius provides effective manoeuvrability with a reduction of load on the rear axles.

The M32L-AT is also currently the only series vehicle to feature a Euro VI engine, according to Magirus marketing manager Tobias Knebel. It was first revealed to the world during Interschutz 2015.

NEW PANTHER 6X6 ROARS FOR THE US MARKET

The Rosenbauer Panther was recently introduced to the US at the annual conference of the ARFF Working Group in Texas, which was held 18-20 September 2016.

The Panther is a high-tech truck with totally integrated vehicle and fire extinguishing systems. It has been designed so that the crew is protected in a newly-designed, crash-tested cabin that exceeds the world's most stringent safety requirements. The fire extinguishing technology is designed for high-performance, precision firefighting, and the panorama deep-set windshield offers improved vision and safety. The environmentally-friendly engine power system also meets worldwide engine emission requirements.

The Panther is Rosenbauer's flagship ARFF vehicle and is one of the world's most popular airport fire trucks. It is manufactured at facilities located in Wyoming, MN and Leonding, Austria. The rollout for the US-made Panther is scheduled for 2017.

The ARFF vehicle features a Rosenbauer 39-700-6x6 chassis, a Volvo D16, 700hp, Tier IV final engine (US version), and has a twin disc transmission with a six-speed power shift.

The Panther can hold 13,400 litres of water, 1,818 litres of foam, and 230kg of dry chemical with an optional 208kg clean agent system. The pump is a Rosenbauer N80 with a capacity of up to 10,683 litres per minute at 180psi. It also has a 16.5m high-reach extendable turret with a capacity of up to 6,819 lpm, and a high-volume low-attack turret with a capacity of up to 5,682 lpm. The gross vehicle weight rating of the Rosenbauer Panther is 4,000kg.

HONEYWELL INTRODUCES SAFETY FOOTWEAR FOR RESCUE OPERATIONS

The new Airfire footwear range uses full-grain premium leather to provide resistance to flame, fluid, oil, and abrasion, while innovative lining materials ensure breathability and freedom of movement.

Airfire has a technical insole to provide maximum shock absorption and comfort. The footwear's tough, protective toe-shield, anti-puncture steel plate insole, and non-metallic toecap provide added protection as well as lightness and thermal insulation.

The footwear has a specially-designed lightweight outsole made from injected polyurethane and nitrile rubber. It features multi-directional cleats for grip, particularly on ladders, and is resistant to temperatures up to 300°C. In addition it offers slip protection against oil, hydrocarbons, fat and chemicals; enhanced stability; and heel shock absorption.

The range includes the Firepro and Firestorm boots with a waterproof and breathable Sympatex membrane. The multipurpose Firefast and Firetrail boots have a Poromax lining with a Eucalyptus treatment to enhance moisture management. Firetrail includes a soft-toe resistant to the force of 500 Newtons.

Distress signal unit for the fire ground doesn't require SCBA

A new personal alert safety system from Grace Industries has been developed that does not require an SCBA – the device can simply be transferred from one piece of protective clothing to another.

The Superpass 5, Superpass 5X and Tpass 5 are NFPA-compliant, which means that firefighters can comply with NFPA 1500, the standard that defines how the technology should be used operationally.

The new technology complies with the latest PASS device standard NFPA1982-2013, and aims to solve the common situation where firefighters remove their SCBA and then continue to work on the fire ground. As most PASS and RF PASS systems are integrated into the SCBA, once the SCBA is removed firefighters are potentially in danger and do not comply with NFPA standards.

Grace Industries' RF PASS and Incommand accountability systems also aim to reduce congestion of radio voice channels on the fire ground, which can cause confusion and put firefighters at risk if critical messages are not heard. The wireless personnel accountability report (PAR) check significantly reduces radio voice traffic at the scene while keeping the incident commander informed of acknowledgements from the crew.

Grace Industries' president Bob Campman explained: 'Radio voice PAR check traffic creates congestion that competes with fire ground voice radio traffic. Our proprietary and patented Automated PAR check replaces the traditional manual PAR check performed on the radio voice channel. The Automated PAR check is now part of our affordable, Automated RF PASS Accountability System, designed to fit the operational needs of both large and small fire departments.

'A standalone PASS or RF PASS solves the problem of limited protection given to only those firefighters inside the hot zone with SCBA integrated PASS. As required by NFPA1500, all fire personnel, both inside and outside the hot zone are protected by wearing a standalone Superpass 5, Superpass 5X, or Tpass 5 that does not require SCBA.'

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18-19 JANUARY 2017, AIRPORT FIRE OFFICERS ASSOCIATION ANNUAL CONFERENCE, GATWICK, HILTON, LONDON, UK

Senior airport fire officers, local authority fire officers and anyone involved with air crash and aerodrome response should attend the Airport Fire Officers (AFOA) Annual Conference.

Attendees can gain 11 hours of continuous professional development from the Institution of Fire Engineers while hearing real-life case studies involving major international incidents.

Ronald Dom, head of fire and emergency services at Brussels Airport, Belgium will discuss how the airport fire service responded to the terrible events of 22 March 2016 when three coordinated suicide bombings occurred in Belgium.

Another highlight of the conference programme is the opportunity to hear retired BA Captain Chris Henkey recount his experience of having to evacuate his entire plane when an engine fire broke out during the run out of Las Vegas McCarran Airport last year. Henkey made world news due to his admirable performance during his penultimate flight, just three weeks before his final retirement as airline captain.

The keynote speaker at the event is Carl Daniels, deputy senior responsible officer for the Joint Emergency Services Interoperability Programme. He will be explaining what has been achieved by JESIP so far, what more there is to be done, and what the impact on other Category 1 and 2 organisations has been.

Chairman of AFOA, Simon Petts commented: 'We are very excited about the upcoming conference and we have strived to create a programme full of world class speakers who bring first-hand incident case studies.

'Our hope is that the conference further supports the development of the rescue and firefighting arena. The UK regulating body, the Civil Aviation Authority, now has a regular slot on the programme, through which it gains an additional mechanism for engaging with the industry as a group. This year the CAP 699 workshop will be of prime interest to the delegates.'

Sponsored by Rosenbauer UK, the conference also features an exhibition which will showcase a range of highly relevant products and services from key providers to the ARFF industry. Exhibitors already signed up to attend include Draeger, Angus, Simulation, IFTC, Geargrid, Newcastle International Airport Training Academy, Falck, Bristol Uniforms, Simply Training, Terberg, Respirex, ERDT, and Fireblast

There will also be plenty of opportunities for networking with peers, as there will be a gala dinner with entertainment on the evening of 18 January and a buffet dinner on the evening of 17 January.

In addition two workshops relevant to ARFF responders have been planned for the afternoon of 17 January. The first will be held by JESIP and will focus on ways of increasing interoperability. The second, organised by the CAA, will focus on the draft of the revision of CAP 699, the standard for the competence of rescue and firefighting service. Places for these workshops are limited and will be allocated on a first-come, first-served basis. Delegates will have to indicate if they are interested in attending these workshops during the sign-up process.

For more information about the 2017 conference visit www.afoa.co.uk/2017conference.

22-24 JANUARY 2017, INTERSEC, DUBAI INTERNATIONAL CONVENTION AND EXHIBITION CENTRE, DUBAI, UAE

In its 19th edition, Intersec 2017 will feature more than 1,300 exhibitors from 54 countries spanning over 55,000m^2 of exhibition space. This represents a 10% growth over the previous year.

Fire and Rescue is one of seven show sections at Intersec 2017, and has nearly doubled in size over the last four years. The section, which attracted 350 exhibitors in 2016, is expected to continue its growth trend in 2017, having attracted the likes of Apollo, BSI, Bristol, Chemours, Fike, Hochiki, Grupo Komtes, LPCB, NAFFCO, Oshkosh, Rapidrop, Scott Safety, Securiton, SFFECO, Siemens, UL, and Velox.

'Ongoing investments in the commercial, retail, industrial, hospitality, and healthcare sectors, combined with upcoming high profile international events, means growth is the buzzword across all sectors in the GCC, and this also applies to the fire safety market,' said Ahmed Pauwels, CEO of Messe Frankfurt Middle East, the organiser of Intersec.

'Improvements in the enforcement of fire codes in the construction sector, and the constant need for fire protection and life safety means the GCC's fire safety market is estimated to grow annually by 14-16% to reach US$3.15 billion by 2020.

'This robust demand for the latest equipment, fire protection and firefighting systems is reflected in the strong growth in the Fire and Rescue section at Intersec.'

Intersec's other core sections include commercial security, homeland security and policing, safety and health, information security, smart home and physical and perimeter security.

More information about the event is available at: www.intersecexpo.com.

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The 'thinking' firefighter

F.I.R.E. FROM KNOWLEDGE TO PRACTICE

'From Knowledge to Practice' is an international project that aims to develop training based on a scientific approach to fire dynamics in order to promote operational best practice and develop 'thinking' firefighters, write Katherine Lamb and Peter McBride.

Historically, many firefighting procedures have been based more on tradition within a particular fire service organisation rather than on validated research into fire dynamics. While a firefighter's professionalism, skill, and experience may often mitigate this situation, a lack of scientific understanding of fire behaviour can place firefighters, the public, property, and critical infrastructure at significant risk during fire service operations.

Furthermore, changes in building construction, building height and complexity, building use, occupancy levels, and increased fuel loads have altered the modern fire environment, resulting in faster fire propagation, unanticipated events and more rapidly occurring dynamic fire situations.

When combined with a decrease in the overall number of fires from which firefighters can gain experience, and global firefighter retirement demographics, these factors have resulted in the loss of considerable experiential knowledge. This, in turn, indicates that the tradition-based approach to firefighter professional development has now become obsolete.

From Knowledge to Practice aims to create evidence-based firefighting training programmes.

Within the past six years, several notable incidents have occurred in Canada during firefighting operations that have highlighted these challenges. These include the death of a captain with Montréal fire service in January 2006, the deaths of two captains with Winnipeg Fire Paramedic Service in February 2007, and the deaths of two volunteer firefighters in Listowel, Ontario, in March 2011.

In addition, in January 2007, five Ottawa firefighters were injured, three of them critically, after being forced to jump from fourth-storey windows during a structure fire. Post-incident investigations of these and other near-misses or critical fire incidents have consistently identified inadequate incident size-up, poor assessment of risk, inaccurate evaluation of the evolving fire dynamics, inappropriate tactics, and insufficient live fire training opportunities as the major contributing factors to the injuries, deaths, and property losses recorded.

During 2007 alone, the financial cost of fires in Canada exceeded US$1.12 billion (CAD$1.5 billion). This is an amount that excludes cascading economic effects, the operational costs of responding agencies, and any

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The project promotes the concept of the 'thinking firefighter' and aims to embed scientific knowledge of fire dynamics into firefighting operations.

rehabilitation expenses associated with injured responders.

Using economic forecasting models, researchers at Arizona State University have demonstrated the significant impacts that successful firefighting operations have on economic sustainability. This includes the ripple effect that fire 'saves' have on averting job and production losses, which impact nationally, regionally and, especially, locally. It has become clear, through these examples and others, that there exists a need to increase firefighting safety and efficacy through a better understanding of fire dynamics and associated mitigation strategies.

The City of Ottawa Fire Service is leading the development of an evidence-based fire dynamics training (FDT) curriculum, focused on closing current critical knowledge and capability gaps. This curriculum and the associated training programme will be incorporated into Canadian firefighting training certification standards for adoption and use by all fire services throughout Canada. Ottawa Fire Service has partnered with the Calgary Fire Department, the Service de Sécurité Incendie de Montréal, and Halifax Regional Fire and Emergency for the duration of this project.

Defence Research and Development Canada (DRDC)'s Canadian Safety and Security Programme (CSSP) has funded the project with a grant of US$0.89 million (CAD$1.2 million). An additional US$1.86 million (CAD$2.5 million) of in-kind funding has been provided by participants and industry partners. The DRDC-CSSP mandate is to strengthen Canada's ability to anticipate, prevent/mitigate, prepare for, respond to, and recover from acts of terrorism, crime, natural disasters, and serious accidents through the convergence of science and technology with policy, operations, and intelligence.

This innovative project is called '*From Knowledge to Practice*' and it aims to embed scientific knowledge of fire dynamics into firefighting operations.

The project mission patch reflects an overarching goal of broadening what the word 'firefighter' means to include firefighting (which encompasses anticipate, prevent, intervene and recover); instruction; research; and engineering. All four disciplines are needed to manage today's complex response environment and are reflected throughout the project design.

The project goals are to reduce social, economic, environmental, legal and life-safety risks, and their impacts due to fire, through the development of a collaborative, evidence-based fire dynamics curriculum, and safe, realistic live fire training tools. The project will confirm theory and make it accessible to front-line workers, thereby confronting a wide range of existing, inaccurate and potentially dangerous assumptions and replacing them with complex and often non-intuitive research findings in a valid and reliable way, and linking them to appropriate mitigation techniques.

Project transition to the operational level will occur through new industry standards, an endorsed curriculum, and validated technologies. These outcomes will inform fire service investment decisions, policies, procedures and practices, both nationally and internationally, and present innovative commercial development opportunities for industry.

The project has received widespread support from the international fire response and research community, including the Canadian Council of Fire Marshals and Fire Commissioners; the Canadian Fire Service Education, Training and Certification Council; the Canadian Association of Fire Chiefs; the International Association of Firefighters; TSWG; UL; NIST; as well as a number of universities in the US and Canada. Support from the ground is also being afforded from fire and rescue services in the US, Canada, Australia, Belgium, Germany, Republic of Ireland, Netherlands, Germany, Poland, Spain and Sweden. Industry partners include 5.11 Tactical, Bullard, Bullex, DQE, Lion, Logistik Unicorp, Mercedes Textiles, MSA, Streamlight, and Task Force Tips.

The project commenced in 2014 and the final test of the curriculum and training strategies is due in May 2017, signalling the completion of the project.

This project has brought together subject matter experts from around the world, with their home services releasing them from operational duties. Thanks to the innovative way the project has been coordinated, the best international ideas and training methodologies have been pooled together to achieve best practice during the development of this operational fire dynamics curriculum.

In order to educate as many firefighters as possible from both the career and volunteer departments, an e-learning component was added to the curriculum in early 2016. This component was funded by the US Department of Defence, as it was deemed an essential link in the education of the predominantly voluntary fire departments in the rural regions of North America.

This funding enabled additional training material to be captured and integrated into the project. The most significant was the phased burning of a property in Mirabel, Quebec, in conjunction with Ottawa Fire Service, Service de Sécurité Incendie de Montréal, University of Waterloo, Flash Formation, and Service de Sécurité Incendie Mirabel. During this phase of the project each of the tactical options

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available to a firefighter were video recorded, with temperature and efficacy of the techniques documented. This material was converted into training materials within both the e-learning and instructor-led segments of the new curriculum.

Professor Beth Weckman from the University of Waterloo, Ontario, Canada has coordinated much of the fire dynamics technical curriculum throughout the project. The challenge here has been to design a curriculum in which the fundamental principles of fire science and recent research findings are blended with existing firefighting strategies and tactics. Since the final curriculum is to be self-delivered by fire service personnel, this must be accomplished in a way that both instructors and students are able to understand, explaining the underlying theory of fire behaviour while applying the new knowledge to confirm or modify the experiences, strategies, and tactics within their own department.

Through a blended e-learning, classroom and hands-on format, it is designed to confront existing, potentially dangerous simplifications and assertions about the phenomena of fire growth, control, and suppression. These are replaced with complex, often non-intuitive research findings, via e-learning, instructor-led theory, self-discovery, and hands-on practical and evaluation components that link the science to appropriate fireground evaluation and mitigation techniques.

Quite how these technical principles are to be taught and applied practically has been determined through the combined efforts of an international team of compartment fire behaviour training (CFBT) experts, coordinated by a team of instructors from Ottawa Fire Service.

Students were introduced to scale models of enclosure fires to inform and confirm the theoretical concepts taught in the fire dynamics curriculum. These sessions, led by experienced instructors, then used peer-to-peer teaching to reinforce and self-discover the theoretical concepts. The scale models are used as a stepping stone for further development within larger scale props (modified shipping containers), wherein safe entry, fire control, water application techniques, extinguishment, and managing controlled retreat are all taught and practised in realistic conditions to confirm understanding and develop competence.

The students are given context that shipping container fires aren't realistic, but do provide a laboratory for self-development and building confidence during the management of the fire environment. The shipping containers and the fuel loads are also being studied as part of a Master's thesis through University of Waterloo. This is to support a key project deliverable to create a reproducible environment for learning outcomes, and to ensure that the learning environment is effective through a philosophy of 'warm to inform' not 'burn to learn'.

Finally, students are challenged with more difficult fire scenarios. These involve approaches from greater distances that require decision making using a novel fire assessment tool, while conducting an overall 360 degree survey of the larger fire complex, and then selecting appropriate tactics to deal with the given situation. Each tactical evolution is then debriefed and recorded so that learning is shared amongst the students to enhance self-discovery and confirm understanding of the tactical options applied.

Through this tremendous international collaborative effort, and the unique way the project has been funded and supported, all project content will be made available free of charge internationally for adoption by interested fire services and standards organisations.

The final product will consist of a collaborative, evidence-based fire dynamics curriculum that has been born out of the need to address existing gaps between the science of fire behaviour and current firefighting strategies and tactics, translating knowledge into practice and resulting in safer and more effective firefighting operations that reflect the modern fire environment.

For more information contact Division Chief Peter McBride, Ottawa Fire Department, Peter.McBride@ottawa.ca or Dr Katherine Lamb, K Lamb Associates, Katherine@klambassociates.com.

This project has been dedicated to the memory of Shawn Mathieson, Ottawa Fire Service.

ABOUT THE AUTHORS

Dr Katherine Lamb MIFireE, MSc (Oxon), BSc (hons) is a respected authority on incident command training and assessment. She worked as a research scientist before joining the fire service in 2004. For the last six years she has specialised in incident command and crisis decision-making. In 2015 she co-founded Effective Command, a charitable organisation that develops the concept of 'the thinking commander'. To find out more about the Effective Command methodology or assessment tools, visit the website www.effectivecommand.org or contact Katherine by email at katherine@effectivecommand.org.

Peter McBride is the Division Chief of Safety and Innovation with the Ottawa Fire Services and serves as the Chair of IAFF Local 162's Research and Innovation Committee. McBride's mandate is to deliver service excellence by building a learning and safety culture for and with the 1,500 members of the Ottawa Fire Service. McBride regularly advocates for advances in health and safety on behalf of the fire service and has a passion for sharing ideas and seeking insights from others. He has been responsible for initiating many partnerships. McBride is currently engaged in 'From Knowledge To Practice', the major CAD$1.2 million (US$889,937) Canadian Safety and Security Programme grant directed at the development of a fire dynamics programme for the Canadian Fire Service.

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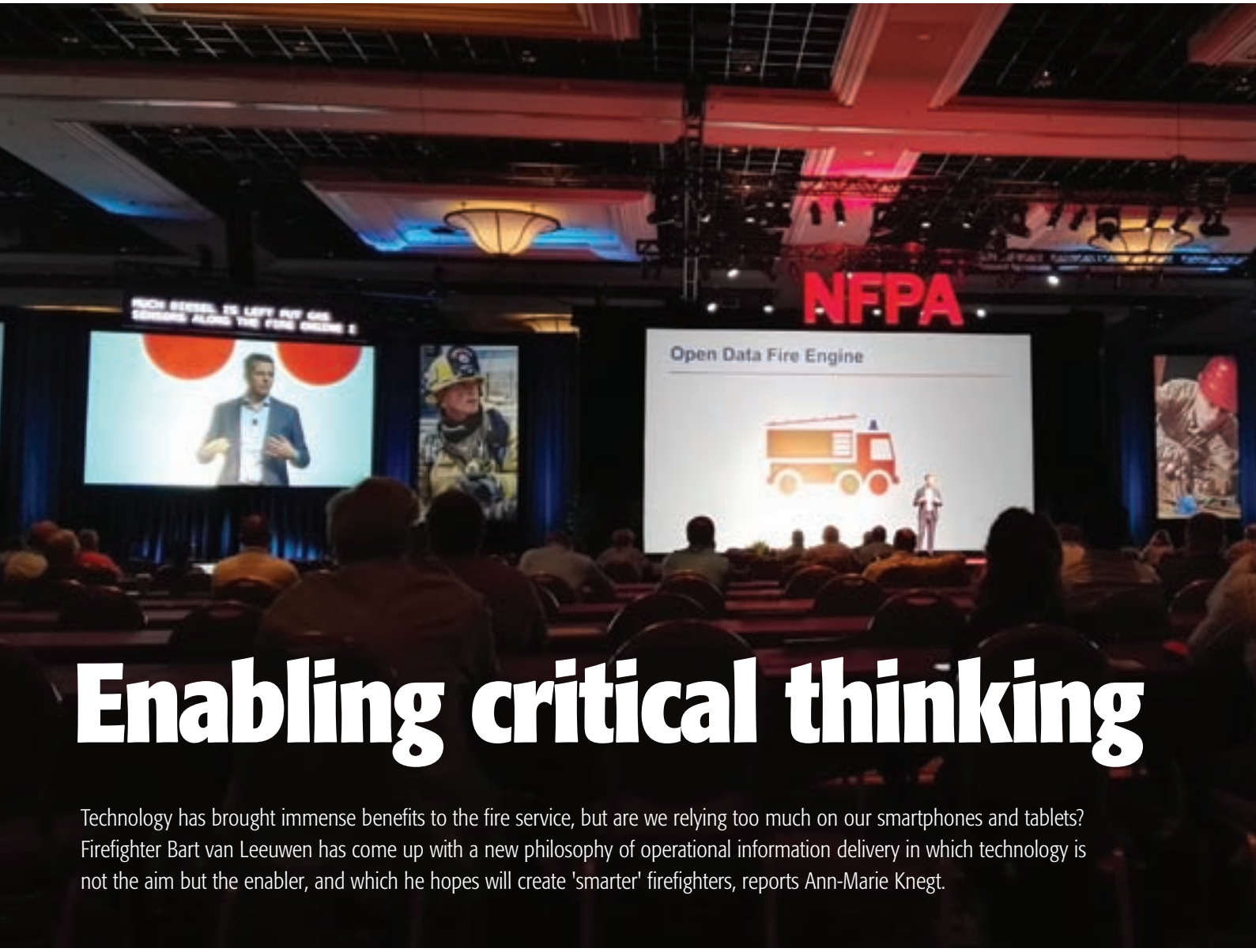


Enabling critical thinking

Technology has brought immense benefits to the fire service, but are we relying too much on our smartphones and tablets? Firefighter Bart van Leeuwen has come up with a new philosophy of operational information delivery in which technology is not the aim but the enabler, and which he hopes will create 'smarter' firefighters, reports Ann-Marie Knegt.

Firefighters have become too reliant on mobile phones and readily accessible information, and technology is having a 'dumbing down' effect, said Bart van Leeuwen, owner of software company Netage and firefighter at Amsterdam/Amsteland Fire Service, during the keynote address at the NFPA conference in Las Vegas this year. As a result of this concern van Leeuwen has come up with a solution that he believes addresses the problem while helping firefighters regain critical situational awareness and enhancing their essential knowledge.

'How many phone numbers do you know by heart these days?' van Leeuwen asks. He predicts that most people will only know their own number, and he emphasises that this has nothing to do with anyone's age or deterioration of memory.

The reason, he asserts, is simple laziness. 'Now we have smartphones, we don't need to remember anyone's number. This reliance on technology is so engrained in our society that technology itself is taken for granted. For firefighters, this can be deadly. There's a tendency to assume that machines are always right. But what if they are not? What if they fail?

'There is an automatic acceptance that whatever you see on your phone or iPad is correct. However, we have to make sure that we create "thinking" firefighters. We need to train people to become sceptical again.'

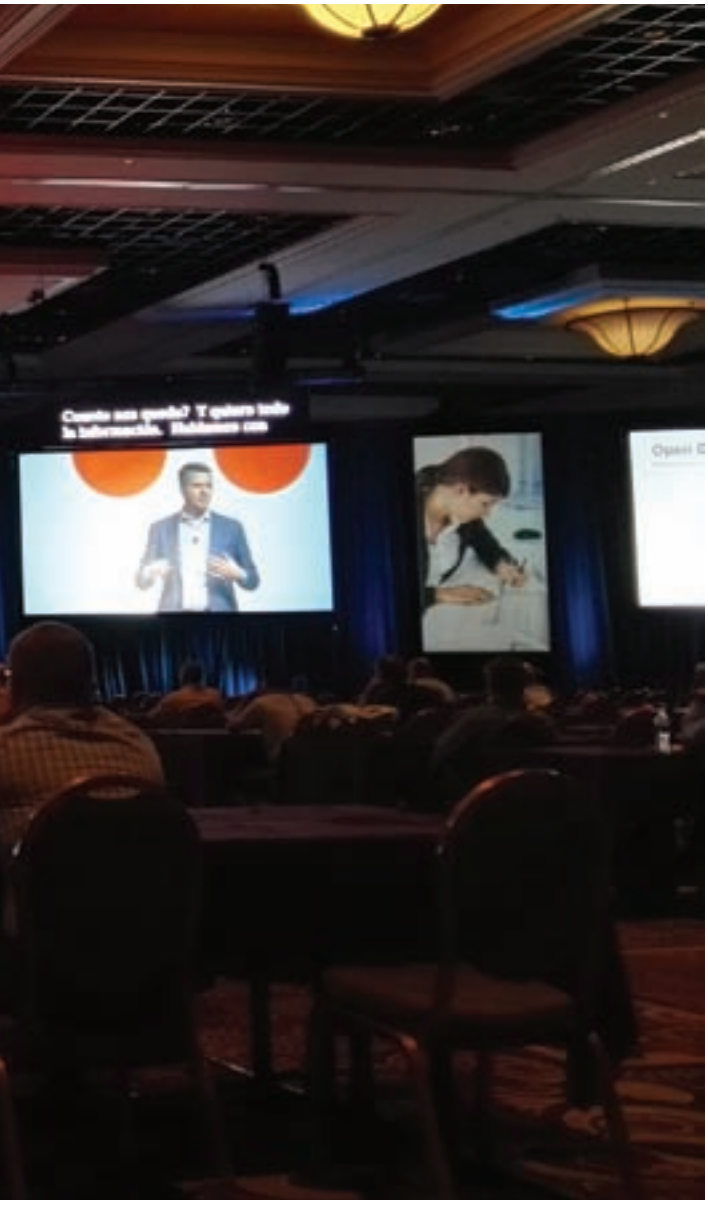
Dutch firefighter Bart van Leeuwen presented the 2016 keynote address at the NFPA conference in Las Vegas.

Firefighters must learn to be critical about the information they receive, he argues, and it is equally essential that the right infrastructure is in place for delivering that information.

'We have to start out with an open mind and begin adopting the standards and technologies that people are using to exchange information. We have to tap into these, instead of saying: ''we are the fire service and we dictate how you share this information with us''. For many policymakers, this is a new concept. Education is required.'

It is an interesting challenge given the way fire services currently work with technology and the prevalence of vendor lock-in. Also known as proprietary or customer lock-in, this makes a customer dependent on a vendor for products and services, unable to use another vendor without substantial switching costs. It happens all the time in the fire service, says van Leeuwen, and it is an obstacle for data sharing.

'With the increasing digitalisation of equipment, vendor lock-in makes much of it rapidly redundant and it slows down innovation. Everybody is developing new telematically-driven systems that provide an enormous amount of data, but as long as every vendor protects this data about the operations of the fire service as their own, we cannot leverage it on a greater scale. What we need to do going forward is make sure we can easily tap into this available data.'



ADVANCED INSIGHTS

Data can be used to help prevent fires as well as assist in responding to them. Another development from Netage is a product called Resc.Info Insight. 'This is a tool developed for the preparation side of firefighting,' says van Leeuwen. 'Open data from various sources is used for risk analysis and management, and the system provides a good approximation of where the next fire will be or the types of fire likely to develop.'

Fire departments now have a lot more insight into the causes of fires in residential areas and therefore the factors likely to contribute to these, and more data about residential populations. Resc.info Insight allows fire departments to combine this resarch with its internal statistical data and publicly available information via a web-based platform. This information can be used to identify areas of higher risk, inform educational campaigns, and assist with decisions on the placement of resources.

Van Leeuwen is hesitant to call this a prediction tool because he says it creates the wrong expectations. 'Fire is unpredictable by nature, so it would be wrong to provide a prediction tool, as you can never be completely sure. This solution instead provides fire services with an approximation of fire type and location.'

Put simply, fire services are not currently using data to its full potential – and this is information that has the potential to save lives, prevent accidents, and change the way firefighters respond to incidents.

'The chances are that if something goes wrong during an incident response, we'll figure out in hindsight that with all the available information in the public arena about the incident, that the accident could have been prevented. We might find out that we sent firefighters into a blaze they should never have gone into, for example. This is a completely new situation compared to 20 years ago when the information that could have prevented these accidents simply wasn't out there.'

In van Leeuwen's NFPA keynote address he highlighted that in order to access and exchange this information, it is necessary to switch to an open platform. 'When I say open platform, many people think that their information will be out in the open and can be modified by everyone. We should really say ''open standard platform''. The next challenge then quickly presents itself. We need to make sure that we can also exchange the meaning of what we are communicating.'

Van Leeuwen explains that the fire service has a common vocabulary, which includes a great deal of jargon and lots of abbreviations. People tend to assume that everyone else uses the same jargon that they do – but this is not necessarily true.

Assuming a common understanding of certain terms can lead to confusion if no definition is provided, as van Leeuwen explains. 'When I talk about my job, I talk about things such as ladders and fire engines, but these expressions mean different things in the US and in Europe. These terms are driven by culture, jobs and organisational patterns, and they are called folksonomies, which is the opposite of a taxonomy.'

A taxonomy consists of a structured set of terminology with definitions attached. A folksonomy is created within an industry or social structure and the definitions are only correct within that context.

This could lead to problems if two communicating parties use the same word for different concepts, without realising they are talking about different things. While two people talking face to face may realise the problem through other cues, it is a greater issue for digital communications. Van Leeuwen underlines this with a recent example he came across while working on a water evacuation plan with the Dutch fire service and Dutch water board.

'Flood evacuation is obviously high on the agenda for the fire service. The water board in The Netherlands has begun to open its data to the emergency services, so people can start looking at the information the water board is collecting about water levels.

'A member of fire service staff started going through the data and found a map of water flows and the dykes along these. One of the dykes was labelled ''critical''. He informed his commander and a preliminary crisis centre was set up. The fire service then approached the water board about the state of the dyke. The staff at the water board didn't understand what the fuss was about. ''Critical'' for the water board meant that they would have to look at it within a few years. ''Critical'' for the fire service meant delivering immediate attention.'

This example underlines the importance of maintaining a clear terminology, especially in multi-agency scenarios where interoperability is a must.

Van Leeuwen explains that terminology needs to be exchanged upfront, and Netage developed a tool for doing so for the Dutch fire service. He calls this a 'fire library' and it is a set of authoritative fire department terms with an electronic dictionary that is employed to communicate the meaning of the terminology used in the data that is communicated between the fire department and the services they work with.

'Using the fire library we are able to exchange terminology automatically when we talk about a crisis command issue or

Resc.Info Monitor is now actively used in the Netherlands by Amsterdam/ Amstelland Fire Service, Twente Fire Service, and three other fire and rescue services in Europe. In Bloomington Indiana, the fire department has also adopted the solution.

during a mass casualty incident. And everything is based on open platform technologies.'

Bringing all this together, Netage has developed a product called Resc.info Monitor. This product is completely based on open standards and aims to provide information to firefighters at the station in a manner that will allow them to assimilate the key facts of a situation quickly. Van Leeuwen explains that the release of only the most critical information at one time means that it can be processed better.

This differs from the current situation, which generally sees fire services deliver information to responders in a variety of formats both at the station and en route to an incident. In his NFPA keynote address, van Leeuwen used an image of the inside of a fire engine to show just how disconnected a firefighter's sources of information can be – tablet computers, radios, mobile phones, even books. In the short time it takes to travel to an incident, it simply isn't feasible that firefighters can read, collate and analyse information from all these sources, he argues. Resc.info Monitor acts as a 'centre of information' for all this data.

The system is device agnostic, meaning that it focusses on the information itself, rather than the mode of delivery. It consists of two components. The central server is at the heart of the system and is called the Resc.Info Base. The second component is the computer screen where the information is displayed, and this is called the Resc.Info Station.

'Resc.info Base collects information from the system at the dispatch centre – the CAD system. The digital incident report provides the address, a code for the intended station or vehicle, the type of incident, comments about the location and a description of the incident itself.

Other information about the incident or the location can be collected from data sources outside the fire service. This type of information differs in each country, region, jurisdiction and even each dispatch centre. Resc.Info Station then collates all the information and transmits it via an open standard, after which it is displayed in a clear and concise way on the computer screens.

The standard maps on the interface are taken from Openstreetmap, but this can be adjusted to the user's requirements. Most of the time information about specific locations is already present, says van Leeuwen, and the ability to view open standard data before the response means that it is easier for firefighters to prepare the right SOP to respond properly and safely to an incident.

Resc.Info Monitor is now actively used in The Netherlands by Amsterdam/Amstelland Fire Service, Twente Fire Service, and three other fire and rescue services in Europe. The fire department in Bloomington, Indiana has also adopted the Netage solution.

'When we deployed the system in Amsterdam, it really improved the locational awareness of firefighters,' says van Leeuwen. 'It all comes back to relying too heavily on mobile phones and satnav – people don't know the streets anymore. The Resc.info Monitor helped firefighters regain an awareness of what their service area actually looks like.'

One unexpected effect was on driver behaviour, adds van Leeuwen. No longer reliant on satnav for directions, drivers began driving more calmly. 'Not following satnav actually takes the surprise out of the driving experience – there are no sudden turns, for example. Drivers can come up with their own route to a location, and if something goes wrong they can use their initiative to come up with an alternative route.'

The additional preparation time the system provides – to develop the correct operating procedure or plan the route to an incident – is one of its major benefits. 'Users are able to grasp the relevant information in the quiet time on the way to an incident and mentally prepare for what it coming,' says van Leeuwen. 'It is why they like the system – it gives them a good idea of what they are going into and what they will be facing when they get there.

'Using this technology in a station-based environment prompted me to start really looking at my environment again, instead of just seeing it,' adds van Leeuwen. 'The problem with situational awareness is that it will start to fade, and people will once again begin to become preoccupied with what they think they see.'

Van Leeuwen believes that his system combats the preoccupation with what we think we know – thanks to our over-reliance on technology – and forces the user to take a deep breath, consider all the options, and then march into action in a more considered way.

BART VAN LEEUWEN

Bart van Leeuwen combines his 18 years of firefighting experience with Amsterdam Amsteland Safety Region in the Netherlands with 20 years of Netage ownership. This enables Van Leeuwen to highlight a new perspective on operational information delivery. With the ever larger volume of available data, and changes in tactical approaches to firefighting, new and fresh thinking is needed. As an 'outside the box' thinker, van Leeuwen helps fire departments to approach their information problems in a different way. In this process, technology is not the answer, rather it's an enabler – and should be treated as such. Currently van Leeuwen leads an innovation project where proven information management technology is combined with new paradigms such as semantic web technology to deal with information flows in a smarter and agile way.

Wildfire simulation

Work has recently begun in Europe on the development of a mobile incident command training system that aims to improve firefighters' response to wildfires, writes Robert Stacey.

The key aim of the Initiative for Global Management of Big Fires through Simulation (IGNIS) is to improve the command and coordination of wildfire incidents through the development of simulation training for incident commanders.

A two-year project co-financed through the EU Civil Protection Financial Instrument, IGNIS brings together the knowledge and experience of emergency service partners from France, Italy, Portugal and the UK. All four partner organisations also currently deliver wildfire training: France's National Training School for Firefighters/Entente pour la Forêt Méditerranéenne; The Italian National Fire Corps (CNVVF); The Portuguese National School for Firefighters (ENB); and Northumberland fire and rescue service in the UK.

The project partners will spend the next two years developing a cost-effective, mobile, and easily accessible simulation tool that can be used by all partner countries and across Europe.

The simulation tool will consist of a network of computers that will run advanced gaming-style software. This will present officers with a realistic virtual environment that is as close to real-life conditions as possible. Commanders receiving the training will see what they would see at a wildfire incident and will need to use their knowledge, skills and experience to gather and process information in order to make informed decisions on how to safely and effectively command the incident, their sector, or team.

To accompany the training tool, the partners will also be jointly developing a robust training and assessment framework as well as a number of training scenarios. The scenarios will be designed to test commanders' abilities to safely and effectively respond to changes that may occur during the course of a wildfire incident, such as changes in rate and the direction of fire spread.

The end result will be a training package that improves and enhances the current training available in many EU countries, including the UK. By jointly developing a simulation tool that can be used across Europe, the IGNIS partners will also enhance the capability for cross-border training involving multiple EU countries, which in turn will help to improve the coordination and response to cross-border wildfire incidents.

Benefits of simulation training for wildfires

A key motivation for developing simulation training for wildfire incident command is that it offers significant benefits compared to traditional training, which usually relies on table-top exercises and large-scale field exercises, including:

- Significant reduction in costs – large-scale field exercises are costly to arrange and implement and are unsuitable for training large numbers of personnel;
- The simulation software can be run in real time, enabling training in both simple and complex wildfire scenarios;
- Simulation tools provide a near endless range of different scenarios and provide instructors with the flexibility to change conditions during each scenario (for example, changing weather conditions such as wind direction), ensuring that incident commanders need to constantly review and adapt their tactics;
- Simulation tools can record the actions taken by the incident commander and provide the necessary capability for reflection, assessment, and improvement within the training environment.

As Paul Hedley, Chief Fire Officer at Northumberland Fire and Rescue, notes: 'Due to the risks involved, it is very difficult to provide realistic training for large wildfires, but with the IGNIS training resource we can provide our officers with the experience they need to confidently command and tackle large fires out in the open.'

Project timescales

February 2016 saw the first meeting of the IGNIS Project Partners in France. This took place during a meeting hosted by the lead partner Entente. The meeting was held at CESIR, the Euro-Mediterranean Centre for Risk Simulation.

The meeting included a full tour and demonstration of the new equipment and facilities that are provided at CESIR,

The national exercise in Portugal provided an opportunity for Portuguese incident commanders to train and be assessed on the system.

The virtual reality simulation tool will consist of a network of computers that run advanced gaming-style software. This will present officers with a realistic virtual environment that is as close to real-life conditions as possible.

including the state-of-the-art incident command simulator for wildfire training that will be used as a key foundation for developing the IGNIS simulation tool.

From May to September 2016, the IGNIS partners participated in three training workshops. The first workshop, held in Valabre, France, in May involved the development of the first draft exercise scripts for the large-scale incidents to be designed and used with the simulator.

Two further workshops were held in early September 2016, one in Rome and the other in Cramlington in Northumberland, UK. These were intensive week-long workshops that focused on the simulator software. The partners installed the software and then received training on how to use and design incident command scenarios.

The partners returned to Valabre at the end of September to practise the large-scale exercises on the simulator. The meeting aimed to provide the opportunity to hone and refine the exercises and enabled the partners to receive training on the incident command assessment tool that will be used in conjunction with the simulator to assess the performance and competence of the trainee incident commanders.

This workshop was held in conjunction with the first project advisory board meeting, whose members consist of experts in wildfires and/or incident command from Belgium, Croatia, Denmark, France, Portugal, Spain, Sweden and the UK. The members were invited to assess and critique the IGNIS project activities and outputs. Their remit is to provide an external verification process for the project activities, ensuring that the final outputs of the project are suitable not only for the four partner countries but also for other EU countries.

Elisabettha Bellocchi, policy officer at the EC's Directorate-General for Humanitarian Aid and Civil Protection, which is co-financing the project, was one of the attendees. 'These projects are important for the ECHO Directorate as they create habits and collaborations that can find solutions for crises and provide the means to train skilled teams,' she explained. 'I found IGNIS very interesting and was impressed by the work and contributions of the delegates.'

Looking ahead, the IGNIS partners will meet a number of times throughout the project to collaboratively work on key project tasks. National exercises will be organised and held within the project countries to trial, test and further improve the training being developed.

Following the first national exercise that took place in Portugal in November 2016, further exercises are scheduled for April 2017 in the UK and May 2017 in Italy.

The national exercise in Portugal was designed to provide opportunities for real-life incident commanders from around Portugal to train and be assessed on the system. It included a complex three-day simulation exercise based in Portugal, as well as a shorter exercise designed and based in France. Both exercises involved requests for assistance from another European nation, and required the trainees to implement appropriate procedures for receiving, hosting, briefing and deploying crews from another country.

The exercise also included a dissemination day to promote the project to key stakeholders and the media. The national exercises that will take place in 2017 will follow a similar format but will focus on scenarios that have been developed by the other partner countries.

IGNIS will conclude with an international conference in Belgium in late 2017 at which the project partners will launch an online platform called the IGNIS Fire Simulation Resources Centre. The resources centre will be a key legacy of the project, providing an international reference resource on simulation training for wildfires. The resources centre will also facilitate ongoing networking and collaboration, to ensure the continual development and improvement of this innovative approach to wildfire incident command training.

If you would like further information visit the project website at www.ignis-project.eu or contact Robert Stacey, project officer, Northumberland FRS at robert.stacey@northumberland.gov.uk..

ABOUT THE AUTHOR

Robert Stacey joined Northumberland Fire and Rescue Service in 2007 after training as an academic researcher and is currently project officer in the service's Wildfire Team. He is responsible for developing wildfire policies and procedures and for the design, management, and delivery of local, national, and international wildfire projects. Stacey has managed NFRS's contributions to a number of EU co-financed projects, including the European Forest Fire Networks Project (2010-2012), and was the coordinating author in the development of the European Glossary for Wildfires and Forest Fires (2012). Stacey is also project manager of the Northumberland Collaborative Burning Project, which aims to improve training for retained fire crews and reduce the risk of wildfires in Northumberland.

Helicopter rescue

The US Forest Service has launched the Emergency Medical Short-Haul Programme to rescue critically injured firefighters from remote locations. Michael Davis weighs up the pros and cons of short-haul rescue versus continuous patient care.

Wildland fires rarely occur in convenient locations; they are more likely to be the result of a lightning strike in a remote mountain top or a spot fire in a treacherous, boulder-strewn ravine.

In cases like these, smoke jumpers parachute in from fixed-wing aircraft or are brought in by helicopter to begin the initial attack. They are followed by hotshot crews who hike in, sometimes for 15km or more, to contain the fire.

Hotshots are highly trained, physically fit firefighters. Making the long trek in is not a challenge. But if someone is injured, trying to carry them back out by the same route, while preventing further injury and providing patient care, can be a slow and arduous task. Wildland firefighters have lost their lives in the hours it can take for them to reach medical care.

For decades hotshot crews have been calling for a better method of extricating injured firefighters. The Emergency Medical Short-Haul Programme is the US Forest Service's answer to this long-standing need.

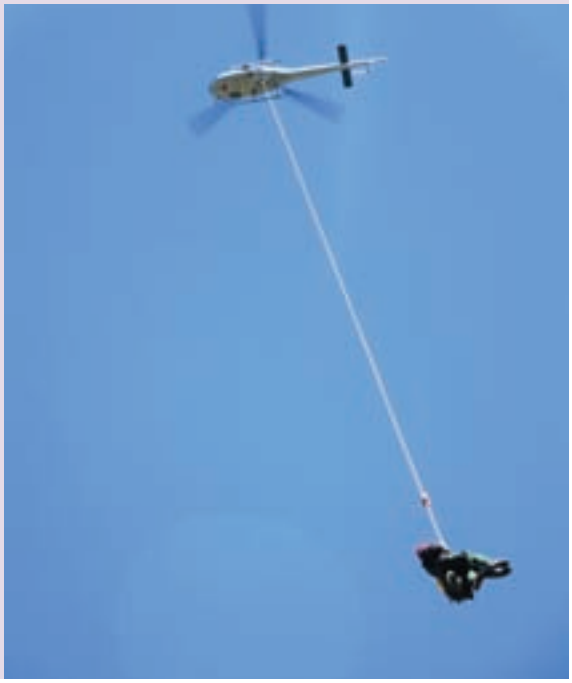
The Forest Service has used helicopters in wildland firefighting since the 1950s. Modern Forest Service helicopter fire attack (Helitack) crews consist of seven to ten members. Their missions include initial attack, crew shuttles, reconnaissance and bucket work – dropping water on fires.

These crews and aircraft are often pre-positioned in regions where high fire activity is predicted. By providing specialised training and a modest amount of additional equipment, existing Helitack crews can become emergency medical short-haul-qualified, thereby adding a life-saving capability to an already indispensable resource.

The use of helicopters to insert or extract personnel in otherwise inaccessible areas isn't new. Parks Canada and European rescue services have a long history of using the short-haul rescue system to retrieve stranded and injured persons from dense forest, snow-covered mountainsides, atop glaciers, and from raging rivers. Law enforcement, including the Forest Service officers and the US military, have used this technique successfully in extremely hostile environments.

The Forest Service's Emergency Medical Short-Haul Programme uses Type 3 light helicopters, such as the Airbus AS350 A Star. The A Star has a proven record of dependability and is widely used by air medical and law enforcement agencies. With a well-trained crew at the ready and a maximum speed of around 250kmph, an A Star can be

The A Star helicopter can be airborne and over the scene of an incident within minutes. (©US Forest Service, picture by Lane Lamoreaux)



The standard haul line length for training and qualification is 76m; this can be lengthened if necessary. (©US Forest Service, picture by Lane Lamoreaux)

airborne and over the scene of an incident within minutes. After emergency medical short-haul teams go through their initial training and become certified, they must undergo proficiency training at least every 21 days. The result of this training and regular testing is that the Forest Service's emergency medical short-haul crews are well prepared to execute their mission.

A typical rescue mission might unfold something like this: a firefighter in a remote area sustains a significant injury or suffers a dire medical emergency. The division superintendent is notified by radio. Information from the incident report or 9-Line Protocol from the National Wildfire Coordination Group Incident Response Pocket Guide is transmitted.

To be a candidate for short-haul rescue, the injured party must have a life-threatening or loss-of-limb injury or an urgent medical condition. The 9-Line Protocol enables field personnel to quickly make this determination. Another consideration is if a conventional rescue would expose the patient or rescuers to an unacceptable degree of risk. If the situation warrants it, the emergency medical short-haul crew is mobilised.

The crew gathers. Typically, this includes the pilot, a spotter, a short-hauler (the person who will be suspended on the line with the patient), an emergency medical technician (EMT) and the ground/support crew. The crewmembers will receive a mission briefing, prepare the aircraft, load their specialised gear, and be ready to embark upon their mission.

The Forest Service's Emergency Medical Short-Haul Programme uses Type 3 light helicopters, such as the Airbus AS350 A Star. (©US Forest Service, picture by Lane Lamoreaux)

The emergency medical short-haul team lifts off and flies to the area of the incident. A reconnaissance flyover is done to confirm the information received in the briefing, and to establish radio contact with ground personnel. Once scene size-up is complete, the short-haul helicopter lands at the nearest available staging area.

The crew completes the rigging, installing a short-haul line from the cargo hook on the belly of the aircraft, which is also connected to a backup-up safety system. This is a built-in, safety-redundant measure to prevent inadvertent release of the personnel. The standard haul line length for training and qualification is 76m (250ft). If necessary, the line can be extended to accommodate special conditions.

Before starting the operation, members of the crew do buddy checks of one another's personal protective equipment and gear. The crew is trained to accomplish the rigging and checks within moments after landing. Once all aircraft and gear checks are complete, the short-hauler and EMT connect to the rescue line, the aircraft lifts off, and the extraction crew is short-hauled to the scene.

Firefighters will move the injured person to a location with the fewest hazards for the aircraft and crew. The short-haul pilot will position the aircraft over the pickup location, and lower the short-hauler and EMT to the ground, where they will begin packaging the patient.

How the patient will be packaged depends on the patient's mechanism of injury and condition. If the patient is ambulatory, he will likely be extracted in a semi-recumbent position using an evacuation harness known as the Screamer Suit. If a spinal injury is suspected, the patient will be secured to a backboard or on a litter. The packaged patient will then be placed inside a Bauman Bag to provide additional protection and lifted in a prone position.

When the patient and short-hauler attendant are secured to the rescue line, they are raised a safe distance above trees or other obstacles. The aircraft then flies to a nearby staging area where the patient and short-hauler can be safely lowered to the ground. Depending on the situation, the insertion and extrication process can be completed in a timely manner.

The greatest risk to the patient and short-hauler during the extrication is entanglement. Should the rescue lines be caught on an obstruction, the flight crew can jettison the lines from inside the helicopter. The short-hauler's gear includes a cutaway knife, and, in the event of an emergency they can cut the rescue lines.

Medical care

Once the patient and short-hauler are on the ground the patient may be transferred to a waiting ambulance or medical transport helicopter. If no other emergency medical care is readily available, the short-haul aircraft can land and load the patient inside the helicopter for an extended transport.

While the crew has at least one member who is an EMT, the short-haul programme is intended for rapid extraction, not pre-hospital care. This is an issue that causes considerable heartache for those in the emergency medical profession.

As EMTs, we are trained that once we render care to someone, they become our patient; we cannot discontinue that care unless we hand the patient off to a provider of equal or greater qualification. Failure to ensure this continuity of care could result in the EMT being charged with abandonment.

When discussing short-haul rescue, people unfamiliar with the programme are usually surprised to learn that the short-hauler is not rendering care to the patient during transport.

But as an EMT who has spent time in an ambulance, I can tell you that delivering patient care in a moving ambulance can be difficult. The chances of rendering effective care while swinging at the end of a 76m-line below a moving helicopter are slim to impossible.

When speaking with medical professionals about this lapse in treatment, their immediate response is that if the patient is in need of constant support, for example, assisting with ventilations or bleeding control, they could not turn the patient over to short-haul rescue because that life-sustaining care would cease for the duration of the short-haul flight.

This is a valid point, but I've assisted on rescues where someone hiked in on a trail wide enough for one person and was subsequently injured. They then needed to be transported out along that same narrow trail in a Stokes Basket, carried by four people, with a paramedic trying to render care as the team moved. This is not a good situation for the patient or the rescuers.

Given that short-haul rescue is intended for use in terrain where carrying a patient out might take hours, and expose both the patient and rescuers to considerable risk, is a three to five-minute flight without care a better alternative?

Well, it depends, since every incident is different. The mechanism of injury, the patient's condition, the terrain, the distance to be covered, the length of the short-haul flight, and the quality of care available at the other end as well as a hundred other factors must be considered. These life-and-death decisions have to be made on the spot by the men and women charged with caring for the injured firefighter.

The possibilities for the short-haul platform are broad, but the decision to use the programme for those purposes will be made only after careful consideration by Forest Service officials. For now, it is a case of continuing to perfect the Forest Service medical short-haul extraction capability with the aim of reducing suffering and saving lives.

A short-haul rescue crew consists of a pilot, a spotter, a short-hauler (the person who will be suspended on the line with the patient), an emergency medical technician and the ground/support crew.

ABOUT THE AUTHOR

Michael Davis is a firefighter and public information officer with the Elk Creek Fire Protection District in Conifer, Colorado. He also serves as lead public information officer for the Colorado Wildland Fire & Incident Management Academy, as well as being part of the Jefferson County Type III Incident Management Team.

Aerial investment

The Russian Ministry of Emergencies' Aviation Division has made a significant investment in its aerial firefighting fleet. David Oliver reports on Emercom's new aircraft and the role these play in emergency operations.

Amphibious aircraft, helicopters and UAVs are just some of the recent purchases by the Russian Federation Ministry of Emergency Situations (Emercom) to enhance the country's emergency response capabilities.

Established by Boris Yeltsin in 1994, Emercom was tasked with managing the civil defence and search and rescue services in the Russian Federation and directing activities aimed at mitigating the consequences of large-scale natural disasters and other civil emergencies. Its roots can be traced back to December 1991 when four helicopter squadrons and civil defence forces were placed under the control of the State Committee for Extraordinary Situations in the Central, Ural, East-Siberian and Far Eastern regional centres.

This formed the nucleus of Emercom's aviation division, which is now responsible for the delivery of relief goods, evacuation from emergency zones and military operations, search and rescue, and aerial firefighting.

Today Emercom has eight aviation centres in the Moscow region located at Zhukovsky, Pulkovo-2 airport near St Petersburg, Rostov-on-Don, Nizhny Novgorod, Yekaterinburg, Mineralnie Vodi, Krasnoyarsk and Khabarovsk. The Yuzhniy aviation centre in Rostov-on-Don is responsible for an area that includes the Crimea.

At present, the ministry operates more than 70 aircraft including Il-76 heavy transport aircraft, An-148 jet airliners for medical evacuations, and Be-200 amphibious firefighting aircraft. Emercom also operates a fleet of Mi-8 and Ka-32 helicopters as well as the world's largest Mi-26 transport rotorcraft, and light Bo-105 and BK-117 rescue helicopters for carrying out search and rescue operations in severe conditions.

In September 2016, the Kazan Helicopter Plant, a subsidiary of Russian Helicopters Group, signed a contract for the delivery of four Mi-8MTV-1 helicopters to Emercom. The helicopters will be used to extinguish fires using underslung buckets, carry out SAR missions, and provide medical assistance day and night in all weather conditions. The helicopters are equipped with a rescue hoist and an external sling with a cargo-carrying capacity of 300kg and four tonnes respectively.

As part of the Emercom 2030 programme, additional indigenous aircraft will be delivered to the ministry. New purchases planned for the next three years include upgraded Ilyushin Il-76 four-jet heavy transport aircraft, Il-114 twin-turboprop transport aircraft for regional centres, Kamov Ka-226 medevac helicopters, Mil Mi-26 heavy lift helicopters, and the latest Mil Mi-8 multirole helicopters.

By the end of 2016, Emercom will purchase and supply more than 750 quad-rotor mini unmanned aerial vehicles (UAV), including 650 Phantom 3s equipped with cameras from the Hong Kong-based DJI company, and 107 Russian-made Unmanned Systems Arnega-DTM UAVs with HD cameras and infrared imagers. The first batch of 250 UAVs has been delivered and is being deployed to Emercom's aviation divisions. In all, the number of UAVs used by the Emergencies Ministry will exceed 1,000, with dedicated UAV centres established in all Russian regions.

'These will enable us to detect wildfires, threats and risks in the early stages, as well as monitoring situations in real time and modelling further developments,' said Emercom Minister Vladimir Puchkov, adding: 'Drones can go into dangerous situations that would pose a risk to responders and they minimise the costs of involving additional resources.'

The second batch of Beriev Be-200 twin-jet amphibious aircraft has been ordered, which suppress fires by dropping water and/or chemical retardants. Eight ferric aluminium alloy water tanks are located under the cabin floor in the centre fuselage section and can be filled as the aircraft skims rivers, lakes or the open sea at 160kmph. Four retractable water scoops can scoop a total of 12 tonnes of water in 14 seconds. The tanks can also be filled from a hydrant or water cistern on the ground, and can be removed for carrying up to 26 firefighters or seven tonnes of firefighting equipment.

Water can be dropped in a single salvo, or in up to eight consecutive drops. The Be-200 is also equipped with six auxiliary tanks for fire-retarding chemicals, with a total capacity of 1.2m³. The aircraft can empty its water tanks over the site of a fire in 0.8-1 second when flying above the minimum drop speed of 220kmph. The Be-200 can take off from either a 1,250m-long land runway or a stretch of open water not less than 1,000m long and 2.5m deep, in Sea State 3 with waves of

The Be-200ES can scoop a total of 12 tonnes of water from rivers, lakes or the open sea in 14 seconds. (©David Oliver) Below: the workhorse of Emercom's helicopter fleet is the multi-role Mi-8, used for passenger and cargo transport, medevac and firefighting missions. (©Russian Helicopters)

up to 1.3m high.

The designer of these amphibious aircraft, the Beriev Aircraft Company – now part of Russia's United Aircraft Corporation (UAC) – is currently focusing on the production of the latest variant of the firefighting amphibian, the Be-200ES.

The plane has undergone a major upgrade and is being supplied to the domestic market under contracts from the Ministry of Defence of Russia. Emercom has ordered six Be-200ES aircraft, in addition to five Be-200ChS aircraft already delivered.

The Be-200 has good export potential because it is the most modern machine in its class, according to the general director of the Beriev Aviation Company, Yuri Grudinin. 'It is the only amphibious jet aircraft in the world and can carry twice the volume of water or chemical retardants as its nearest competitor. The aircraft has demonstrated its capabilities in extinguishing fires in Greece, France, Indonesia, Israel, Italy and Portugal.'

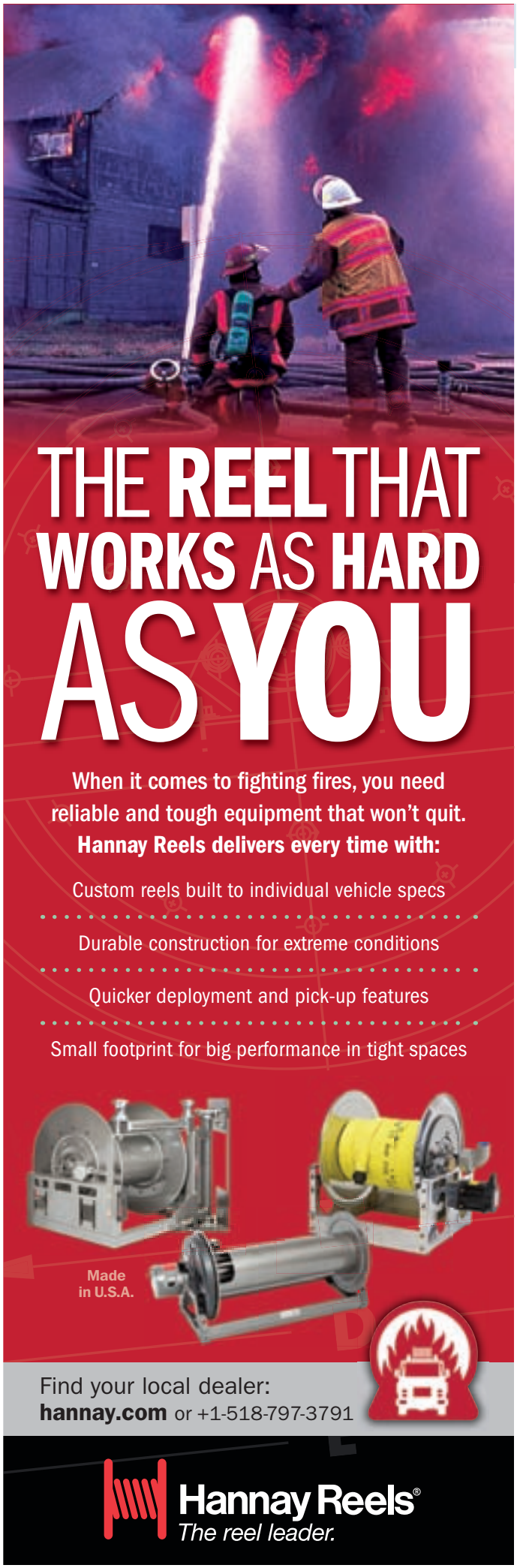
The Beriev Be-200ES features an upgraded fly-by-wire electronic flight control system as well as a redesigned centre section and wing. The designers have modified the flight navigation system and improved the hydraulic system. Radio communication equipment has been replaced by more modern systems, and other systems have been replaced or upgraded, in particular the weather radar and thermal detection systems. Beriev is currently producing eight Be-200s per year at its Taganrog plant. These are tested and certified at the Beriev Experimental Test Base at Gelenzhik on the Black Sea north of Sochi, which is also an Emercom operational centre.

According to acting director of the Department of UAV Air Rescue Technologies, Konstantin Moiseyenko, in 2016 Emercom's aircraft rescued more than 1,650 people, transported more than 62,000 rescuers, and delivered more than 11,000 tonnes of cargo, including 496 tonnes of relief goods. Additionally, the aircraft and helicopters made more than 2,700 flights, dropping about 19,000 tonnes of fire retardants onto wildfires. 'More than 60,000 homes were protected in Khakasiya and the Transbaikalian Territory by the joint efforts of the fire and rescue divisions, emergency services and Emercom's aircraft,' said Moiseyenko.

Sergei Vorontsov, deputy head of the National Crisis Management Centre, added that four seriously ill people, including three children, were transported from abroad in four medical evacuations. 'A total of 71 medical evacuations were carried out across Russia, and aircraft transported more than 300 seriously ill people, including 241 children. In addition, 189 people were evacuated by helicopter, including 36 children.'

In October 2016, aircraft and helicopters supported Emercom's largest ever civil defence exercise, which involved more than 200,000 specialists from the Russian Federation's rescue and recovery units.

Emercom's powerful Kamov Ka-32-11BC helicopter is used for SAR and firefighting. (©Emercom)



Battery-driven extrication

When considering battery-driven rescue tools you should keep your focus on the 'business end' rather than the power source, writes Ian Dunbar, Holmatro.

Interest in battery-driven hydraulic rescue tools has grown significantly in the last five years. Although the concept has been around for more than a decade in the form of combi tools, the introduction of dedicated cutters, spreaders, and rams has changed the market. As a result, I now spend more time discussing these tools with rescuers all over the world.

For many years the practice of taking a tool and connecting it to a hydraulic pump via a hose has been the norm for firefighters. The introduction of a single core hose in the mid 2000s made the process safer, quicker, and easier. However, the focus was always on the blades – the innovative features, the arms or the tips – and rarely on the power supply. With the introduction of battery tools, the focus often shifts to the battery and self-contained power unit, but it is more appropriate to maintain the focus on the most important features of the tool.

It is important to note that battery tools are slightly heavier than their hosed counterparts because they are self-contained, meaning they incorporate their own oil reservoir, pump, motor, and power unit. However, a well-designed tool should still be well balanced and ergonomic, despite the slight additional weight. The cutting and spreading forces of hydraulic rescue tools are the same, regardless of whether they are connected to a pump via a hose, or self-contained and battery-driven.

The main difference between the two types is speed. This is because the small pump unit inside the battery tool cannot deliver the same flow rate as a larger external pump. Speed aside, there is no difference in performance.

Given this parity of performance, the business end of the tool should be the main subject of discussion. Instead of seeing it as a battery tool, we should treat it as a rescue tool that just happens to be powered by a battery. By doing so, we appreciate what is really important about the tools we choose.

Things to consider include weight, ergonomics, design, quality, features (eg integrated LED lights) and performance. Irrespective of how they are powered, these are the things that should be considered when choosing dedicated hydraulic rescue tools. There are also specific considerations depending on the type of tool.

Battery tools are slightly heavier than their hosed counterparts because they incorporate an oil reservoir, pump, motor and power unit.

Cutters

For cutters, the maximum theoretical cutting force is simply a calculation based on the operating pressure and the size of the cylinder inside the tool. It may be a useful guide initially, but true cutting performance is what really matters. Several factors affect the cutting performance. These include blade shape and profile; blade geometry; blade construction (cast or forged); and how the blades are held together (eg bolt and nut, or i-Bolt).

Spreaders

The maximum available force that can be generated by hydraulic spreaders is massive. However, this is not to be confused with usable spreading force. In theory, the highest capacity of any spreader is located at the base of the arms (nearest to the control handle). Since this capacity is not usable, the industry standard way of assessing spreading force is to identify the minimum available spreading force. This is measured 25mm from the tips over the full spreading distance, as this is generally the area that is us ed during rescue operations. Other factors to consider with spreaders include the design and profile of the spreading tips and the inclusion of a speed valve. This will increase the speed of opening when the tool is unloaded.

Rams

These are relatively simple by design. A ram is a hydraulic cylinder providing high pushing/pulling forces. The main considerations for rams depend on your desired application. Generally they are used to relocate structural parts of vehicles following intrusion, and therefore are often used in confined spaces. As previously described, weight and ergonomics are important in general, but with rams you should also think about the retracted and extended length – the desired application will dictate the necessary size – and the ram head design and available attachments.

Battery management

Self-contained battery tools are currently a big talking point in this sector. Gasoline pumps rarely require refueling during a rescue operation, but batteries can run down, and for this reason I am commonly asked how long a battery will last. However, it is almost impossible to quote battery duration in terms of time, and the simplest way to find out how long any given battery-powered tool will last in a particular scenario is to perform your own test. Remember, the battery life will differ depending on several variables. These include:

- Temperature - low temperatures have a negative effect on battery duration.
- The type of construction to be cut or spread. Testing battery tools on cars more than ten years' old will not give a true indication of battery life. New car constructions require higher pressures and use more battery life.
- The skills of the operator. Instead of thinking of battery life in terms of time, consider instead how many times a full

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battery will allow a tool to open and close. For example, an unskilled operator may not perform the task as efficiently as someone with more experience, which will reduce the useful duration of the battery.

It is also worth noting that the latest 5Ah batteries are designed for use in these tools, and battery technology will only improve in the coming years, leading to extended battery life.

Battery-driven tools do offer a number of operational advantages. They are immediately ready for use, for example, although it is important to remember that before any extrication can begin, a 360-degree scene survey should first be completed.

Self-contained tools also have zero emissions, and they can be used indoors or in areas where ventilation may be problematic. They are silent when not in use, and don't require hoses, and they are also portable and often innovative.

These advantages should be carefully considered against the increase in weight and reduction in speed that come with battery-driven tools, as detailed above. Additionally, other associated issues must be taken into account, such as rescues from submerged vehicles. In such cases, the principle consideration should be the process of managing the batteries required to ensure an adequate operational supply.

Conclusion

All in all, I believe that there has never been a better time to be a user or purchaser of hydraulic rescue equipment. There is now a much greater choice in terms of type of tool, innovative features, and power options than ever before, and although the majority of new tools purchased worldwide are still the conventional pump-hose-tool configuration, the exponential increase in interest in battery tools over the last five years proves that the mindset within the industry has already started to change.

However, it is important to reiterate that the main focus of any purchasing decision should be on the tool itself and not the source of power. After all, it is the blades, arms, and tips of the tool that will perform the required tasks. Yes, there are downsides to the current design of self-contained tools – the slight weight increase, the reduction in speed – but the advantages can outweigh these issues, making battery-driven tools a genuine option for operational use. And, whatever else the future holds, the coming years will doubtless see major innovations in rescue tools, leading to even more choice and enhanced rescue capability.

ABOUT THE AUTHOR

Ian Dunbar was a member of UK Fire and Rescue Service for 19 years and specialised in vehicle extrication, heavy rescue and trauma care. He was an assessor for World Rescue Organisation and, through his work as a global rescue consultant with Holmatro, he has visited nearly 90 countries in the last five years, giving him a truly global view of technical and medical rescue. He is the author of the book Vehicle Extrication Techniques *and works closely with Holmatro's R&D department, developing new tools and concepts. You can follow Dunbar's rescue blog on www.holmatro.com/en/blog.*

Top trends in firefighter training

With a new year on the horizon, Chris Thain, director at Red One, talks to *Fire & Rescue* about the trends he believes will shape firefighting training in the coming years.

Export to grow

Over the past few years there has been an increasing emphasis towards commercialisation within fire and rescue services. Following the result of the EU referendum in June, the UK government is focusing on forging closer international trading links with the Middle East, Africa and Asia. With an uncertain economic climate for the foreseeable future, coupled with recent volatility in the currency markets making UK exports more competitive, the prospect of exporting goods and services presents a clear opportunity for future growth in this sector.

Chris Thain from fire and rescue training and services provider Red One, the company owned by Devon and Somerset Fire and Rescue Service, believes that this puts British fire and rescue services in a good position to export their expertise and to provide consultancy, operational services, and training to international companies and organisations that are looking to improve the skill sets of their internal teams and increase their overall safety.

Over the past decade such training has become increasingly sophisticated and niche; UK health and safety legislation is among the most developed in the world. Combine this with stringent sector requirements for continuous professional development and you have a sector culture that highly values safety, training and planning.

The economic climate post the EU referendum represents a real opportunity for UK fire and rescue services to export their expertise, says Chris Thain.

'This is one of the reasons why, at Red One, we have developed a more flexible business model that is responsive to client demands,' says Thain. 'At any given time, Red One can call upon and mobilise from a pool of approximately 300 of the UK's most experienced and qualified firefighters, fire officers, training instructors, and FRS consultants. From this pool we can select expert teams for rescue and firefighting services (RFFS) assignments, and provide on-site training or outsourced services to clients anywhere in the world.

'In recent years, we have supplied training staff to Africa, Asia, Europe and the Middle East, and we have a number of additional international assignments in the pipeline.'

Thain believes that global organisations and corporations will continue to recognise the need to look further afield for training and consultancy to assist in ensuring that their fire and rescue services are world class, and the UK is one country they will look to.

Sector-specific expertise is essential

Another current trend Thain highlights is the demand for specific expertise across a number of industrial sectors, including nuclear energy, oil and gas, public sector, utilities, maritime, communications, military, and large public events.

He explains that Red One has responded to this trend by creating a portfolio of specific courses designed to meet industry training requirements, and introducing new training solutions that are continually driven by current sector best practices. For example, a recent addition to Red One's training portfolio is a Maritime Enclosed Entry course. 'This is aimed at individuals who are seeking to further build their skills or train to work within the maritime industry,' says Thain. 'It is designed for both seafarers and shore-based personnel who are engaged in activities in enclosed or confined spaces on ships or offshore structures, where cramped and confined conditions can make it dangerous to work.'

Red One also recently launched its Incident Command courses, which have been used to retrain 600 fire officers in a year. Thain believes that one of the reasons these have been so successful is because they are adaptable and can be tailored to different industrial sectors. As a result, he says, the courses are gaining traction internationally with industrial firefighting personnel from as far afield as Abu Dhabi.

Across the sector generally, there has been an increasing

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A recent addition to Red One's training portfolio is the Maritime Enclosed Entry course. Below, right: Chris Thain, director at Red One.

focus on continuous professional development, with fire and rescue personnel taking ever greater responsibility for their own careers and attending courses that will give them a competitive edge and increase their skill set. Thain believes this trend is set to continue and strengthen.

However, he points out that courses need to be recognised and endorsed by the relevant sector bodies and international institutions, complying with regulations, legislation, and standards both in the UK and overseas.

'The most important accreditations for training come from the Institution of Fire Engineers, BTEC, the Maritime & Coastguard Agency, Skills for Justice, City & Guilds, the Careers Transition Partnership and the Rescue 3 organisation. Red One is also a member of the Fire Industry Association, the REC and JOIFF, and is currently progressing its accredited training provider recognition in accordance with US NFPA standards.'

Your FRS is a partner, not just a supplier

With the legislative and operational requirements of fire and rescue changing constantly, Thain says that many companies now rely on external experts to help keep on top of sector developments. In the international fire market in particular there has been much more focus on strategic planning and consultation, and buyers lare looking more towards industrial rescue and firefighting services for high-risk sites.

No longer just a supplier or a tactical partner, Thain says clients are looking to fire and rescue services for wider offers, including planned transition and mobilisation to outsourced management, highly experienced risk management, and an expanded range of skills and expertise to support client operational RFFS.

'Our clients also understand the value in the frontline exposure our fire teams get to real-life incidents, as they frequently attend emergency calls as part of their full-time or retained-duty roles. Our customers respect that this first-hand knowledge and experience is invaluable to pass on to their own staff.'

Also in demand, he says, is the provision of proactive and reactive protection for client facilities, staff leadership development, and core skill enhancement, along with short-notice standby support and enhanced resilience to emergency response site operations.

Take a bespoke approach to clients

Finally, Thain identifies a trend towards developing bespoke courses that he believes will be a key focus of training moving forward. It makes sense that clients want training courses tailored to their industrial sector and specific risk, in order to maximise the return on their investment and get the most effective training for their staff. By taking the time to understand the dynamic risk profile of a client as the first step in the client relationship, training providers can then develop solutions that are bespoke to their client's needs.

Once a bespoke training programme has been devised, the next step is to train the trainers. 'We find this approach very effective with our international clients,' says Thain.

He explains that Red One recently worked with staff from a Caribbean island fire and rescue service that undertook two weeks of compartment fire behaviour training instruction and a week of breathing apparatus instructor training. 'We are now working to train their remaining instructors before embarking on the roll-out of a BA training programme to their entire team. We have also provided additional support beyond training, ensuring that they purchase the correct equipment for their new facility and that this is implemented safely and appropriately.'

Taking all these trends into account, Thain believes this is an exciting time to be in firefighting. 'The FRS sector in the UK is maturing and has international ambitions. The next few years present a huge opportunity to influence global firefighting standards. The services that benefit the most will be those that can mobilise and respond effectively to the needs of clients wherever they are in the world. They will need to demonstrate real expertise and experience in specific sectors, take on the responsibility of being a trusted business partner, and ensure that their client's needs are met through a bespoke rather than a one-size-fits-all approach to service.'

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City and Guilds approved Aviation Fire Training at Newcastle International

The Training Academy at Newcastle International Airport provides a range of City and Guilds accredited Aviation Fire and Operations training courses. The academy has been operating as a training provider for over 25 years, delivering training that includes Aviation Firefighting, Oil and Gas Emergency Response, Industrial Firefighting, and Airside Operations training. Highly trained fire officers bring years of operational experience, complementing the instruction and assessment processes and ensuring relevant information sharing between candidates and instructors.

The recently achieved accreditation from City and Guilds gives clients confidence that standards achieved as a former CAA approved training provider have been enhanced rather than diminished. The academy's strategic partnership with Newcastle College brings additional resources such as an aircraft engineering facility and aviation engineering academics as well as educational oversight and verification.

This partnership is helping to shape new and innovative training and assessment methods that will complement existing ones as well as the new initiatives that a revised CAPP 699 will require.

EASA driven requirements for regulated training in the operations sector has also brought new customers to the academy from UK airports, and in particular from Europe where the Aircraft Marshalling and Wildlife Management City and Guilds courses have proved very popular.

The extensive fire ground and rigs also provide an opportunity for clients to meet their Class B fuel training requirements, either during recognised courses or via bespoke Maintenance of Competence training.

Newcastle International Airport Training Academy and its staff are looking forward to working with new and existing clients throughout 2017 by providing modern, industry relevant training and assessment in a range of disciplines.

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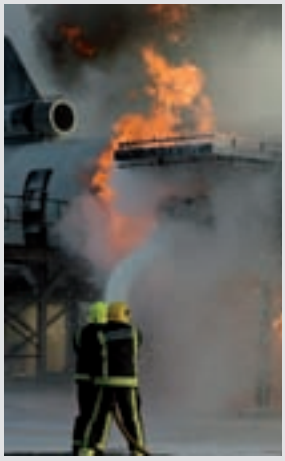

Extreme hazard training comes to the Asia Pacific

Williams Fire & Hazard Control is bringing its Xtreme Industrial Fire & Hazard Training School to the Asia Pacific region following a successful run in the USA and EMEA regions.

The four-day fire hazard training course is designed to offer a comprehensive hands-on learning experience for those involved in operational industrial fire response at on-shore petroleum, oil and gas facilities, and has been designed to benefit emergency response specialists and HSE managers. It will take place from the 16-19 January 2017 at the NPC training facility in Rayong, Thailand.

Attendees will have the chance to learn from the experience of the Williams' rapid response team, which has fought more than 200 of the industry's most threatening flammable liquid fires over the last 34 years. The training school also represents an opportunity for participants to discuss best practice with their peers from across the industry.

Real-life case studies

The course covers the latest methodologies and fire behaviours using real-life case studies, while live fire exercises will enable participants to tackle real pressure-fed, hydrocarbon fuel, combined elevated tank and bund fires.

The course includes both field training and classroom elements. The field training will suit those directly involved in operational roles, such as fire officers and municipal fire departments, while the classroom course is ideal for specifying engineers, safety consultants, corporate safety specialists, chief fire officers, and CEOs.

Hands-on experience

Hands-on experience with the latest product innovations from Williams is also included in the course, such as the Ambassador 2x6 Gun Trailer, capable of discharge flow rates of between 7,600 and 22,700 litres per minute.

Williams is the only global company that responds to emergencies with its own hardware and specially formulated foam concentrate, so participants will be able to see the results of the learnt foam chemistry first hand. 'When faced with fires at petroleum, oil or gas facilities, it is experience that makes the difference, and this course is the perfect opportunity to gain that experience in a safe environment,' said Chauncey Naylor, director for training and emergency response operations at Williams.

'Everything we do is governed by in-depth know-how, whether that is designing new products, writing methodology or formulating new foam, and we want to impart this knowledge to as many people in the industry as possible.'

The course will be delivered in English, so students should have a good understanding of written and spoken English.

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Rayong, Thailand

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Multi-agency training

A crude oil storage tank overfills and its contents ignite in the bund, leading to a multi-tank fire – this nightmare scenario formed the basis for a multi-agency training exercise that took place in September at the Esso Refinery at Fawley, Southampton, UK.

When the alarm was raised, firefighting personnel and high-volume pumps from four neighbouring counties responded to the multi-tank fire, liaising with the refinery's Fire & Response Group and laying out the equipment necessary to feed the Williams Six-Gun monitor.

The exercise was a crucial element for maintaining the highest level of safety possible at the Exxon Mobil-owned Esso Refinery at Fawley, near Southampton. This, the largest in the UK and one of the most complex in Europe, is classified as a top-tier site under the Control of Major Accident Regulations, the national implementation of the European Union's Seveso II Directive.

The refinery's mile-long marine terminal handles around 2,000 ship movements and 22 million tonnes of crude oil and other products every year. As well as processing around 270,000 barrels of crude oil a day, it also produces 750,000 tonnes of chemicals every year.

The passing over of incident command to increasingly senior officers resulted in some delays.

The multi-tank aspect of the exercise was particularly appropriate for a site that not only contains numerous large-diameter tanks but also lies directly adjacent to another top tier COMAH site, in addition to a number of other COMAH plants in the area. Schools, nurseries and residential housing developments also surround this industrial complex.

The joint action by Hampshire Fire & Rescue, Hampshire Constabulary and Exxon Mobil began at 0900 and ended at 1300 with a hot debrief and lunch. The sequence of events ran as follows: the refinery's Fire & Response Group (FRG) responding to a bund fire in Tank 312 assessed the scene and requested assistance from HFRS by dialling the emergency number (prefixed 'for exercise purposes'). Fire control mobilised appliances at their home stations, manned by firefighters aware that they were taking part in an exercise, but without knowing the details. The first attending crews liaised with the refinery's FRG and the remaining resources moved to the so-called Process Forward Control point. This was a safe position close to the incident determined by the shift site manager, readily identifiable by a fluorescent orange high-vis jacket emblazoned with 'emergency manager' on the back.

Unsurprisingly for a complex exercise involving two public agencies and one sizeable private organisation, there were a number of objectives to tick off. These included the test of key actions detailed in the pre-operational plan and operational support plans of HFRS and Exxon Mobil; liaison between the municipal and the refinery's FRG; the effectiveness of the refinery's management coordination centre; the response of the high volume pumps to the site and their ability to supply the requisite amount of water to the fire ground; and the role of the Airwave Tactical Advisor and the use of the Airwave network. The latter is a national private network for mission critical comms that uses TETRA technology to enable emergency services to talk with each other via shared talk groups.

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Monitors were also used to cool down the adjacent tanks.

In contrast with the police, who regularly use the technology, it is widely recognised that talk groups are rarely used by the fire services except at a basic level and, consequently, few firefighters know how to use them in scenarios requiring interagency cooperation.

The exercise also presented HFRS with a valuable opportunity to use the METHANE model, which has been designed to help agencies gather initial information about a major incident in a consistent manner. The acronym stands for: Major incident declared: Exact location: Type of incident: Hazards present or suspected: Access: Number, type, severity of casualties: Emergency present and those required.

Four high volume pumps (HVP) were deployed from East Sussex, West Sussex, Dorset, and Kent. As with all exercises, some allowances were made for logistical reasons and Kent FRS's high-volume pump, usually sited some 140km away, had therefore been allowed to arrive the previous night at the main holding area in Eastleigh Fire Station.

As would have been the case in a real scenario using out-of-county FRS resources, all appliances were guided down to the site by Hampshire Constabulary in a convoy procedure.

In a twist from the previous exercise that had taken place here in May 2012, the HVPs did not tap into the virtually unlimited water supply available from a small lake 3km away, as this would have inevitably prolonged the exercise as well as caused greater disruption for the operator.

Although foam was not used, foam concentrate stocks and foam proportioning equipment was deployed.

Instead, the water came from three holding tanks that draw salt water from the marine terminal for process cooling as well as for feeding the emergency fire main. Should the pumps supplying these holding tanks have failed, there would still have been sufficient water in the tanks to supply a fire requiring 27,240 lpm for six hours.

For the purposes of the exercise, however, and so as not to interrupt the process-cooling operations, the water was drawn at a relatively low 4-bar pressure from the holding tanks. The lower flow nevertheless did manage to satisfy the discharge rates of the Williams Six Gun monitor (7,571-22,700 lpm) covering the involved tank – if only just.

For the fire and rescue services, one of the positive outcomes was the quick access facilitated by the main gate guards to the industrial compound, and subsequent navigation to the incident area and Process Forward Control point – no easy task with fire personnel responding from neighbouring counties with no prior knowledge of the area.

Other positive outcomes included successful set up of HFRS's Silver Command in the refinery's management coordination centre, and the use of Airwave radio talk groups between the various emergency response agencies.

One such talk group had to be set between the fire ground and the command and control centre, as the distances involved were too great for the VHF/UHF radios. Visiting fire brigades were provided with TETRA radios and successfully taught (or 'upskilled') by the Airwave Tactical Adviser to change channels to the appropriate talk groups. A key learning point here was the ongoing requirement for dedicated radio experts on site to facilitate the communications between the different agencies involved.

PC Mike Batten, who attended the incident as the Hants Constabulary Hazmat Advisor, linked up with the FRS Hazmat Advisor at both Bronze Command and then – in a departure from previous exercises – he also sat in Silver Command as the exercise developed.

'I was happy with the multi-agency liaison at Bronze and with my on-scene working relationship with the HFRS Hazmat Advisor, which was one of the best I have experienced,' he remarked, adding that he had used his body-worn video to record the exercise for debriefing purposes.

One key learning point related to training management. The arrival of increasingly senior FRS personnel to the Process Forward Control point inevitably resulted in the passing over

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Water was drawn from three holding tanks at a relatively low 4-bar pressure.

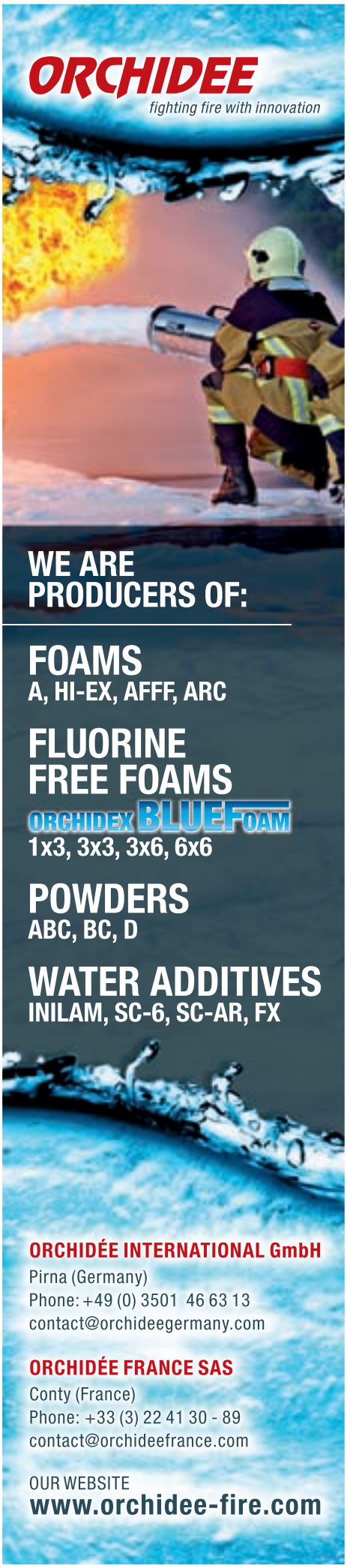
of responsibility for incident command, which obliged the refinery's emergency manager to explain the incident's sequence of events on a number of occasions – sometimes with only minutes in between. Although this could be regarded as a useful way of testing a greater number of firefighters, it did result in delays for the progress of the scenario.

Like any exercise of its type, there were some minor niggles. Some players felt the application of foam would have enhanced the exercise, although the refinery did mobilise its foam concentrate stocks to the foam proportioner at the incident area.

The Process Forward Control point, marked by the emergency manager's car, was sited in the middle of the site's perimeter road. Some felt the unused contractor premises that lay alongside could have been put to better use, but as it turned out the weather was on the players' side. Although the formal debrief had yet to take place by the time of going to press, by all accounts the aims and objectives of the one-day exercise were judged to have been met.

Hardley Station watch commander Chas McGill, who had helped plan the day over the past nine months, told *F&R* that he hoped the success of the day would lead to further exercises in the refinery. He said there had been a four-year gap between this and its predecessor, Exercise Shannon. 'I think we can improve on this, especially considering that so much has changed in that time – people have changed, the plant has changed, and our procedures have changed. Ideally we would carry out an exercise on a petrochemical plant like this, built in the 1950s, on an annual basis, with a programme covering scenarios other than tank fires. But of course getting people to buy into taking part in an exercise on a weekend is difficult, which is why such long lead times are essential.'

The training exercise enabled Esso Refinery to test its firefighting equipment, including its Williams Six Gun monitor.



Power pump

High-capacity truck-mounted fire pumps are not just for tackling major blazes at factory complexes, as Steve Banner finds out.

Municipal fire brigades with a history of high-rise fires are showing increasing interest in Ferrara's latest development; a combination of a ladder and a high-capacity pump that can be effectively deployed with conflagrations in high-rise buildings.

Ferrara has some experience in big flows. Working with Florida-based US Fire Pump (USFP), it was the first company worldwide to install USFP's High Velocity Pump on one of its industrial fire trucks. Engine-driven – it can be used with engines with an output of up to 800hp – it is designed to meet the USA National Fire Protection Association's 1901 performance standard at up to 23,600lpm.

'We've figured out that a big flow of water is not just effective for industrial use, but also for municipal use,' says Jonny Carroll, vice president of sales at Ferrara Fire Apparatus. 'Big water is the way to go, and this is what our municipal customers are asking for. So we started thinking about the aerial application and how we could get more flow to it.'

The HVP has been recognised by Guinness World Records as the world's highest pumping capacity fire engine.

According to USFP, with sufficient engine power and a pressurised water system to call on, the HVP can exceed 37,800 lpm. Consequently, the Ferrara Inundator Super Pumper the HVP is mounted on has been recognised by Guinness World Records as the world's highest pumping capacity fire engine.

Ferrara's focus on urban fires has been prompted by recent blazes in tall buildings in Dubai, Australia, and Europe. Municipal fire authorities can struggle when they have to tackle this sort of incident, explains Carroll, because they cannot get sufficient water onto the property concerned. '1,500gpm at the tip is great, but it is just not enough water to extinguish a major fire.'

Engaging with the municipal market should help Ferrara make a better return on the investment it has made in the HVP-plus-fire-truck concept because it will widen the company's base of potential customers. 'There are only so many big industrial plants out there,' Carroll observes.

Deploying this size of pump in a municipal context poses some challenges, admits Carroll, but Ferrara has been addressing them. 'The problem with incorporating a ladder with this pump is that you are going to get reaction force because there is so much pressure and flow. So we beefed up the ladder, tested it, and we can get 5,000gpm (18,900 lpm) from the tip of the aerial.'

With that sort of flow, the high-rise fires like the ones that happened in Dubai could have been put out more quickly. 'It would have been a perfect application,' says Carroll. 'The ladder used is 30m (100ft) high and the water throw is 91m (300ft). 'So you get the sort of reach that nobody else can and you're putting the volume on top of that.'

What about the impact of the wind on the HVP water jet? 'We've used an HVP in industrial applications and the wind has not been a concern against the big flow,' says Carroll. 'This is going to change municipal firefighting and the way people think.'

USFP's HVP features an optimised flow-through layout with a 30cm (12in) flanged suction inlet, feeding an

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Ferrara's Inferno industrial appliances at Whiting Refining are owned by BP Products North America.

impeller eye with a diameter of over 25cm (10in). The 20,800-lpm version comes with a 20cm (8in) discharge outlet, rising to 25cm if the 23,600-lpm unit is specified.

The single-piece pump shaft is made from heat-treated stainless steel and the pump operates at an 80% efficiency level. This means it can make use of the same fire truck engine, transmission, and radiator as a less-powerful pump with no loss of performance.

Options include an auxiliary drive output, which can be used to power the hydraulics required by big-capacity foam systems. A flanged output to drive air compressors can also be specified, and the pump itself can be made out of bronze. The 23,600-lpm model can also operate at 150psi, rising to 200psi if the 18,900-lpm variant is selected.

Testing of the HVP for municipalities continues and includes changing the nozzle to see what effect that has. Carroll explains that Ferrara is currently testing it with an Elkhart nozzle.

Aside from reaction force, another challenge is finding a water supply in a big city that has enough capacity to feed an HVP. Balanced against that, however, is the cost-saving in terms of manpower and equipment that can be achieved by deploying one truck in situations that would traditionally have required four to five – and multiple appliances still require water sources.

In many urban areas there is, of course, the option of using water from a lake or reservoir. 'Static water sources are never next to a fire, however, so we've got to find a way of feeding the HVP,' says Carroll.

A floating pump is deployed in the water source. This is then used to push the water required by the truck through a high-volume hose with a diameter of as much as 30cm. The hose is retracted using a hose retrieval system once the job is done. 'You can't load these hoses by hand so you need a way to pull them back in,' says Carroll. He explains that the further away the water source is, the greater the loss of pressure, especially if the hose has to run up an incline. 'So you may need a boost pump along the way.' In this context, it is worth noting that a USFP HVP can still provide a smooth and even output, even when positioned more than 6m off the ground.

Municipalities are not, of course, restricted to using HVPs to fight fires. They can also be used to pump away huge volumes of potentially devastating flood water. With the southeastern USA facing severe floods at the time of writing, it is a role that could become increasingly important as the impact of global warming accelerates.

The 23,600-lpm HVP can operate at 150psi, rising to 200psi if the 18,900-lpm variant is selected.

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Simple storage solution

Damp kit and poor storage conditions can impact on safety and morale. Lotte Debell reports on a simple solution that can help firefighters get a new lease of life from their PPE by ensuring it is properly looked after.

Getting wet is an occupational hazard of being a firefighter. And while getting wet fighting a fire is rather less dangerous than the fire itself, it is still a problem. When a firefighter returns to the station after an incident in wet kit, it is essential that the garments dry out properly before they are needed again. Along with the long-term financial implications of not storing expensive PPE properly, there are also safety concerns associated with attending a fire in damp gear. But drying PPE can be difficult as modern garments are multi-layered and heavy, and kit rooms are often rather overlooked areas of fire stations.

Solving this problem, however, can be as simple as hanging the garments up properly in an environment where they have plenty of room for air to circulate. One company providing an effective solution is the US-based firm Geargrid, which specialises in durable wire products for a range of applications. One of the company's products, and its biggest seller, is a wire-framed, wall-mounted storage locker for PPE.

Geargrid's UK sales agent Jason Wilkins explains that this locker accounts for approximately 70% of the company's business and is currently used in around 75% of the UK's international airports. A growing number of fire and rescue services are also installing it, such as Surrey Fire and Rescue Service in the UK. It was initially designed with input from firefighters, and its simple combination of three hooks and two shelves in each locker provides all the storage space a firefighter needs to keep their kit dry, organised, and in good, safe, operational condition.

'Kitting firefighters out in turnout gear costs thousands of pounds, and if you hang a heavy jacket on a hook day-in, day-out, for months or years, not only will it not dry properly, but it also places additional strain on the garment,' says Wilkins. 'Even when hooks are located in drying rooms, which are designed to dry kit out more quickly, garments won't dry evenly unless they are hung up properly. PPE can still be damp the next day, especially in areas such as under the arms.'

Storing kit properly, Wilkins explains, means hanging it on a hanger so that the collars and shoulders don't wear out, in an open locker that allows the air to circulate freely, in an ambient temperature. The garments can then drip dry naturally and evenly, helping to prevent the build-up of odours and mould.

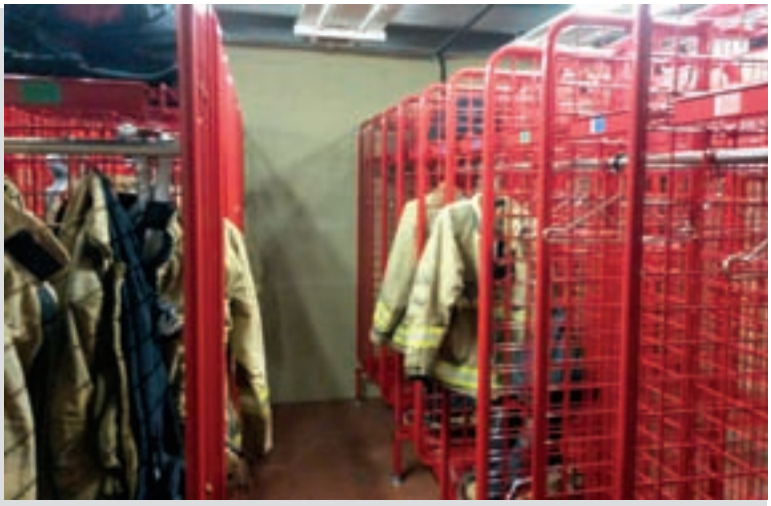
Geargrid's open wire design allows air to circulate from every direction, and the configuration of shelves and hooks enables each firefighter to store their PPE in the way that works for them. For example, storing garments in such a way that a wet jacket doesn't drip into boots.

There are direct cost benefits to ensuring that PPE is stored correctly. It lasts longer, for one, and repair bills for individual items are reduced. Storing PPE according to the manufacturer's instructions can mean that repairs are performed under warranty, further reducing bills. Giving firefighters their own space can also help to bring down the number of lost or misappropriated items of kit.

'If firefighters have somewhere specific to store and organise their kit, it helps to foster a sense of ownership,' says Wilkins. And fire services that have installed Geargrid report that this is definitely a benefit of the system.

'We have found that our firefighters look after their kit better because of these lockers,' says Mike Scott, Fire Chief at City of Eagan fire department, Minnesota, which installed the lockers in 2010. 'When I started out in the fire service more than 30

Geargrid's clients have found that firefighters start looking after their kit better when using the open wire PPE storage lockers. Below: the lockers installed at Edinburgh Airport, Scotland.



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WILDLAND FIREFIGHTER PPE PROVIDES ADVANTAGES FOR FIGHTING OUTDOOR HEAT

The struggle faced by wildland firefighters as they try to achieve a balance of personal protective clothing and heat safety is well known to the Department of Homeland Security's Science and Technology Directorate (DHS S&D) in the US.

Between 2011 and 2013 the DHS S&D carried out research into wildland firefighter PPE with the US Army Natick Soldier Research, Development and Engineering Centre.

The Wildland Firefighter Advanced Personal Protection System initiative aimed to develop an NFPA 1977 and 1975-certified garment system that improved radiant thermal protection; reduced heat stress; improved the form, fit and function of garments and upgraded requirements that industry used to develop advanced gear.

It was instigated by the California Department of Forestry and Fire Protection (Cal Fire), who requested S&T explore options for developing new PPE garment ensembles for wildland firefighters, as it found that firefighters battling wildfires in the state succumbed to heat stress at a higher rate than those afflicted with burn injuries.

The result of the initiative was outlined in the WLFF APPS final report, published in 2014. The report describes the performance of appropriately 1,000 garment ensembles that were operationally wear tested by wildland firefighters during two wildland fire seasons, and reveals a garment system that addresses risks from heat exhaustion.

William Deso, project manager for the APPS Project said: 'The WLFF APPS strikes a balance between protection against burn injuries and comfort for the wearer. The design of the garments was based on input from wildland firefighters to better meet the operational requirements of fighting wildland fires. We believe that the WLFF APPS ensemble is a great improvement for the safety and comfort of the wildland firefighters.'

Extreme heat becomes lethal when the human body faces high temperatures and humidity, and subsequently struggles to sustain the normal body temperature of 37°C.

The general term used for heat disorders is hyperthermia, whose onset usually occurs in three common forms: heat cramps, heat exhaustion, and heat stroke. For firefighters, the strenuous work of combating fires in locations ranging from dense cities, where asphalt retains heat thereby creating the urban heat island effect, to rural wildfires, which require long hours to control and contain blazes, heightens the need to take precautions.

Overexertion, stress, and medical conditions accounted for nearly 60% of firefighter deaths in 2015. Fatalities from sudden cardiac arrest ranked at 51%.

A 2008 study by the Firefighter Life Safety Research Centre at the University of Illinois at Urbana-Champaign concluded that fatalities from heart attacks, slips, trips, and falls appear to be linked to heat stress, a situation that might be alleviated by reconfiguring and enhancing firefighter PPE.

Depending on the age and overall physical fitness of each firefighter, precautions can be difficult to enforce during a chaotic and often unpredictable emergency response. Initial steps for treating someone with hyperthermia include moving the patient to a cooler location and providing the patient with cool water or liquids that contain electrolytes.

The WLFF APPS prototype garments have been certified to the NFPA 1977 standards that outline specific performance parameters for wildland firefighting garments.

Each locker has three hooks and two shelves, allowing firefighters to store their kit in the way that works best for them.

years ago, we used to share lockers for our gear, but now that each firefighter has their own space, they are taking better care of their garments. We have also found that fewer items of kit go missing. It is much easier to keep track of everything, and much harder for a firefighter to take someone else's kit if they can't find their own.'

City of Eagan fire department had tried a number of storage options before settling on Geargrid, including wooden lockers and solid metal lockers. Neither of these solutions allowed kit to dry properly, and the too-small size of the metal lockers meant garments frequently snagged as they were put in and taken out, leading to additional repairs. A trial of a similar wire locker system was abandoned because the product was not robust enough, then Geargrid was installed and they haven't looked back.

'What we really value about this product is its high-quality, robust construction, and that it was made for firefighters, by firefighters,' says Scott. 'Budgets are tight, so value for money is important. We spend a lot of money on buying the best firefighter PPE we can to protect our firefighters, so shouldn't we also make an investment to properly protect that PPE?'

Scott also cites Geargrid's willingness to work with customers to create bespoke solutions as one of the reasons its lockers have been so successfully received. 'We have approached them with specific requirements and they have modified the system to suit our needs. For example, our firefighters wanted somewhere to keep personal items in their lockers, so Geargrid designed a secure box with a padlock that attaches to the lockers, and our firefighters use these to store things like family photos – it all adds to the increased sense of pride they take in their workplace and their kit.'

For Scott and his firefighters, the added professionalism of the working environment is another plus, and this is echoed by Mark Dove, Watch Manager at Edinburgh Airport Fire and

Rescue Service. Unlike the city of Eagan fire department, which has seen the Geargrid system in use for several years, Edinburgh Airport only installed the lockers in July, but the transformation to the work space has been, well, transformative. The decision to install Geargrid came about as the station was investing in new PPE, and the current kit room was identified as being below standard. 'The station was due an upgrade, and so an investment was made available to improve the kit room to ensure we could store the new PPE to manufacturer's recommendations,' says Watch Manager Dove.

'Our previous kit was not stored correctly and this affected its operational life expectancy. Not drying the garments properly meant they were getting damp and mouldy, which was causing additional fatigue on the kit. Knowing we were purchasing new kit, we wanted to make sure we would get the best value for the money we were spending on it by ensuring that it would last longer. We were looking for something that would be beneficial in the long term.'

The problem for Dove was that the floor area of the kit room was very restricted – only around 5m by 5.4m – and they needed 58 lockers to fit in that space. 'We initially thought we would have to split kit storage over two different areas, but Geargrid created a bespoke floorplan for us and managed to fit all 58 lockers in. And, even though the room is restricted in size, there is still room to move around safely. Our firefighters can now go in, locate their kit, and be out again and operational very quickly.'

Initial feedback from firefighters has been positive, adds Dove. 'They are no longer struggling to find their kit or losing items, and our busy kit room is now a much more professional environment. I recommended the purchase of this system and followed the process thorough from ordering, delivery, and system fit-out to operational use, and seeing it in place, I feel we have enhanced the station environment while providing best value for our budget.'

The bespoke fitting service is part of the package offered by Geargrid, explains Wilkins, and the company can either fit to existing space, as in the case of Edinburgh Airport, or can get involved right at the beginning of a station construction or refurbishment project to help get the most from the space and the system. The system is simple and quick to install, and is demountable so it can be moved easily if necessary.

The benefits extend beyond practical and economic considerations, however. There is a genuine safety risk to not drying kit out properly. If damp PPE is worn into a fire situation, the high temperatures could cause scalding. For Scott in Minnesota, which sees very low temperatures in the winter, there are additional health issues to consider if firefighters wear wet kit in cold conditions. Then there's the fact that if kit is not stored correctly and is frequently damp, it will wear out quicker, meaning that firefighters could be going into fires wearing PPE that is not providing full protection.

Investing in something as simple as wire kit storage lockers also sends a clear message to firefighters. It is not just about saving money, reducing lost kit and maximising the life of PPE, although those things are important economic considerations for any fire service. It is about investing in firefighters themselves and their safety. Ensuring that PPE does not suffer unnecessary wear and tear through improper storage, thereby better performing its primary role of protecting the wearer, and that firefighters do not have to risk being scalded by wearing damp kit to a fire, all contribute to a safer working environment. So, however you look at it, this simple solution is going to pay dividends.

FLASHOVER ALARM LAUNCHED

A flashover protection alarm unit called First has been launched by Intellimon, a UK startup company.

First uses artificial intelligence to detect and predict the changes in temperature associated with a flashover, and creates an audible and visual alarm that warns both the individual firefighter and nearby comrades.

The visual warning changes from green to amber as the threat is detected and goes to red when it is imminent. The audible warning is in excess of 90dB and is distinctly different to the accepted 'man down' alarm in established distress signal units. The warning can provide up to 30 seconds advance warning to evacuate the location or to take mitigating action.

The system is designed to integrate with a wide range of breathing apparatus and is powered by the BA's battery set. If the facility is available, the warning can be displayed on the face mask with its simple traffic light display.

First can also aid rapid intervention rescue teams searching for fallen firefighters. An RFID chip is activated when the unit is powered up. Using a hand-held RFID scanner, rescue crews are able to locate a man down much quicker, especially in areas of low visibility.

The intelligent monitoring systems built into the lightweight yet rugged unit continually processes and update temperature data, notifying the operator of critical changes through both the visual and audible warnings. This data can also be fed to a computer through established radio telemetry for command and control and post-incident analysis.

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Technology meets design

Ballyclare presented its latest development in firefighting turnout gear at the Emergency Services Show in September 2016: fire services delivery director Richard Ballheimer believes it represents a real step forwards in terms of design – for a whole host of reasons. Lotte Debell reports.

The multi-functional rescue jacket from the Xenon collection.

The needs and roles of today's firefighters have evolved dramatically over recent years as a result of a changing world as well as diverse factors that range from new building construction materials and methods to an increasing threat of global terrorism. The new Xenon collection has been designed to meet those very same wide-ranging needs, covering everything from a layered system and structural kit to urban search and rescue (USAR) coveralls and wet weather USAR clothing, and a multifunctional rescue jacket.

Ballyclare's Xenon layered system.

As Ballyclare has been supplying kit to fire services for many years it understands this sector – and its challenges – well. It is a market that tends to see a steady evolution in technology rather than revolutionary developments, and what Ballyclare has done with the Xenon collection is to combine the best of the sector's emerging technologies with a new approach to garment design that provides the flexibility and versatility required by the modern fire service to meet the demands of the job.

While Xenon will be available to all the company's customers, it was developed as part of Ballyclare's submission for the Collaborative PPE project. Run by Kent Fire and Rescue Service, this is seeking to provide a procurement framework open to all UK fire and rescue services from summer 2017, covering PPE for all activities that operational staff may encounter.

One of the benefits of the project is innovative design, and at the start of the 18-month design process for Xenon, Ballyclare went right back to the drawing board to develop a range of garments that would offer not only the highest level of safety but also the most sophisticated design.

As Richard Ballheimer explains, this meant looking beyond the fire sector for best-practice design, drawing inspiration and influence from other sectors that also cater for physically demanding activities, such as outdoor and extreme sportswear.

'We wanted to take the best of current design techniques to optimise the fit, comfort, and manoeuvrability of our garments. A key concern was to reduce bulk. Firefighters need lots of flexibility in the joints of turnout gear, mainly the elbows and knees, because of the range of movements they make. Ergonomic design in these areas has been around for years, so for us it was a case of recognising that we could be smarter with design and reduce the amount of material required, increasing freedom of movement, improving comfort, and reducing cost.'

Sportswear has also influenced the look of the garments, which, while secondary to performance, is nonetheless a vital component of modern fire kit. It is something suppliers have to think about, says Ballheimer, because the tender-based procurement system means all garments are submitted to wearer trials and to perform well they must combine comfort, performance, and appearance.

'It's human nature. You cannot get away from the fact that if wearers like how a garment looks, it will score higher in a trial than a garment that doesn't look as good but may well

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The Xenon structural fire suit.

perform to the same level.'

Ballyclare therefore worked closely with firefighters and fire officers on the design features as well as the comfort and performance aspects of the new collection. The end result is a range that combines all these elements, cleverly taking in the new technologies and components that further the overall aims for the range.

'We are constantly talking to our component and finished goods suppliers in order to understand what's out there and what's on the horizon in terms of technology so we can optimise our solutions for customers,' says Ballheimer. 'Thanks to our involvement on standards committees and trade associations, we are afforded a broad view of development in the industry, which benefits our customers.'

For example, Ballyclare is one of the first companies globally to use a new reflective tape from 3M in the range. The heat-applied tape is segmented rather than solid like its predecessors, providing performance as well as style benefits. This makes it more breathable and reduces weight while enabling designers to update the look of garments.

Another new component in Xenon is Parallon from Gore. This is a recently launched multi-barrier lining system that is designed to replace the traditional moisture management membrane and thermal layers in firefighter kit. According to Gore, Parallon is an advancement on conventional construction in that it eliminates the need for a trade-off between breathability and thermal protection. As turnout gear gets wet, the liner system – which aims to prevent water ingress from inside and out – enables it to better maintain its thermal performance. This helps to manage heat stress by minimising potential rises in core temperature and reducing the physical strain of working.

Parallon is just one of the components offered in Xenon. Also in the range is a new thermal layer that combines moisture management with a low co-efficient of friction so that it moves with the wearer and improves comfort.

The collection has been structured so that customers can choose not only from a broad range of PPE ensembles, but they can also select from a range of fabrics and colourways.

For example, the structural firefighting jacket and trousers currently come in four choices for the outer layer fabric (PBI X55 205gm^2 in gold and cognac; PBI Pure 205gm^2 in gold and navy, PBI Max; and Nomex NXT in navy and red); three moisture management layer options (Gore-Tex Fireblocker, Gore-Tex Airlock; and Gore Parallon system); and three thermal layer options (Sofileta Axion 3 layer; Gore Parallon system; and Sofileta Axion 2 layer).

This built-in flexibility in garment construction and appearance enables Ballyclare's clients to tailor their gear to meet their specific operational and budget requirements.

The garments

The Xenon collection consists of a structural kit, layered system, a multifunctional rescue jacket, USAR and wet weather USAR kit. Everything is made in both male and female fits.

The structural jacket and overtrousers benefit from the influence of the premium sportswear market, focusing on reduced bulk and increased comfort and freedom of movement. These garments also offer the most variations of construction materials – as previously detailed.

The layered system includes a mid-layer rescue jacket for most lower-risk incidents, and a top-layer structural jacket that is worn on top to provide full level 2 BS EN 469:2005 protection. Both are designed to be worn with Xenon structural firefighting trousers.

The mid-layer rescue jacket meets the requirements for wildland firefighting (BS EN 15614:2007) and is waterproof (BS EN 343:2003), breathable, and high-vis (BS EN ISO 20471:2013). The top-layer structural jacket has been designed with a sculpted collar so that the mid-layer jacket underneath is visible, helping to ensure that firefighters are wearing the proper protection when required.

This simple yet clever design feature helps to negate a downside of the layered approach, which is that it opens up the possibility of firefighters going into a fire without all their layers on and putting themselves at risk.

'If you are a responsible employer and your firefighters wear layered kit, you need to ensure that they are all are wearing both their jackets before they go into a structural fire,' says Ballheimer. 'This is one reason why some fire and rescue services prefer to provide different kit for non-structural duties because then it is possible to clearly identify whether firefighters are wearing the right jacket.' By designing the collar of the top-layer structural jacket to reveal the mid-layer beneath, Ballyclare says it will make a visual kit check that much easier.

The multifunctional rescue jacket is designed to be worn for external firefighting and rescue activities with the Xenon structural trousers. Like the mid-layer jacket in the layered system, it is suitable for wildland firefighting requirements (BS EN 15614:2007) and is waterproof (BS EN 343:2003), breathable and high-vis (BS EN ISO 20471:2013) and also features the option of a removable quilted thermal liner to cope with different climate conditions.

The USAR two-piece coverall is designed for USAR operations and is also suitable for use in collapsed structures. As such, it focuses on freedom of movement to assist firefighters to move in confined spaces. High-vis (BS EN ISO 20471:2013) and flame retardant (BS EN ISO 11612:2015), it is also certified to GO/RT 3279 for rail track-side use. The two garments can be zipped together.

Finally, the USAR wet-weather protection suit is designed to be worn over the USAR coverall for foul weather operations (certified to BS EN 343:2003) or those operations using water-cooled equipment. It has a detachable hood and quilted thermal liner. Like the coveralls, the wet weather suit is certified for high-vis (BS EN ISO 20471:2013) and to GO/RT 3279 for rail track-side use.

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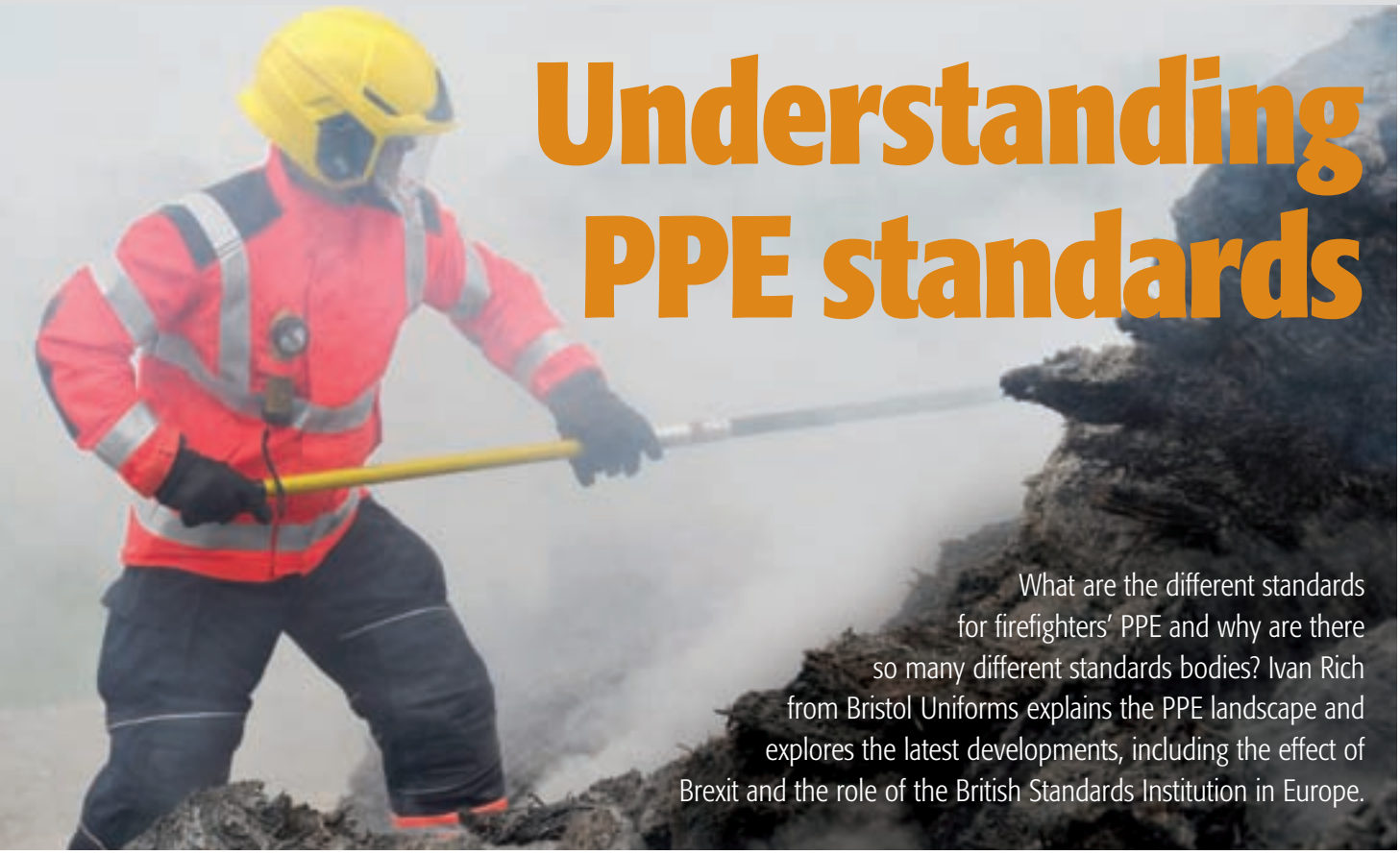

Understanding PPE standards

What are the different standards for firefighters' PPE and why are there so many different standards bodies? Ivan Rich from Bristol Uniforms explains the PPE landscape and explores the latest developments, including the effect of Brexit and the role of the British Standards Institution in Europe.

Fire and emergency services across the globe need to know that they can fully rely on the safety and quality of their personal protective equipment, whether this is purchased at home or abroad. To ensure the best level of protection, most countries demand conformity with both national and international performance standards for PPE. By insisting that any equipment purchased meets appropriate global standards, they can be assured that, at the very least, the minimum safety requirements will be met and the quality of the products will be satisfactory. This helps to break down technical and language barriers between countries and makes it much more straightforward for manufacturers to trade goods and services.

There are currently three major standard-setting bodies on the world stage: European Committee for Standardisation (CEN) which covers Europe; the National Fire Protection Association (NFPA) which covers the USA, Latin America and the Asia/Pacific region; and the International Standards Organisation (ISO) which sets standards worldwide.

A Bristol Uniforms clothing label showing standards information; there is currently no European standard that deals with the cleaning, maintenance and repair of firefigher PPE.

In Europe, the first standard for firefighters' PPE was introduced in 1995. Entitled EN 469, it became the first PPE standard to cover all countries in the European Union, serving to strengthen overall product safety and quality, and to encourage the sharing and adoption of good practices.

The current version of EN 469 is EN 469:2005. This is a harmonised standard, which means that rather than being simply voluntary, it supports essential requirements of the new EU PPE Regulation (EU 2016/425) to which all European PPE must comply by 2018.

EN 469:2005 was reviewed and updated in 2014. However, it was subsequently withdrawn from the Official Journal of the European Union due to errors. The standard is now being reviewed and rewritten in discussion with CEN consultants, who are employed by the EU Commission to monitor and advise on standards development. I sit on a panel group formed by British Standards Institute and we recently met for the second time to discuss the revision of the standard and the list of requirements that the UK would like to see included.

The NFPA Standard for PPE has been adopted in the USA and across the world including Asia, the Middle East, and Latin America. NFPA 1971 was first published in 1975 and has undergone numerous revisions since, most recently in 2013. NFPA 1971:2013 protects firefighting personnel by establishing minimum levels of protection from thermal, physical, environmental, and blood-borne hazards encountered during structural and proximity firefighting operations. Its requirements apply to the design, performance, testing, and certification for structural firefighting. The revision process has commenced and the next edition will be published in 2018.

The original ISO standard for *Protective clothing for firefighters*, ISO 11613, was introduced in 1999. It is currently under revision and is being prepared for a Draft International Standard ballot. This revised standard will be titled *Protective clothing for firefighters who are engaged in support activities associated with structural firefighting - Laboratory test methods*

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Bristol Uniforms' fire kit, as worn by Cambridgeshire FRS, complies with EN, NFPA and ISO standards.

and performance.

ISO has also recently published a new ensemble standard for PPE used by firefighters, ISO 11999. This is entitled *'PPE for firefighters – Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures'*. There will be ten parts to the standard in total – eight have been published already – with part three covering the requirements for clothing.

It makes sense for national, European and international standards to be drafted and developed in line with each other. So wherever possible, CEN, NFPA, ISO and many national standards bodies work closely together to replicate requirements. This makes adhering to standards much easier, and helps to promote global best practice by drawing on international expertise.

Former firefighter and PPE expert Dave Matthews, who leads on a number of BSI, CEN, and ISO committees, believes it is vital for both manufacturers and end users to have a level playing field to protect against unscrupulous PPE suppliers.

Under the Vienna Agreement, for example, CEN has agreed to collaborate with ISO to develop a common European and international standard. More than 30% of the European standards adopted by CEN are identical to international standards. These EN/ISO standards have the dual benefits of automatic and identical implementation across Europe and globally. Some examples include EN ISO 11612:2015, which specifies minimum performance requirements for clothing to protect against heat and flame, and EN ISO 14116:2015, which details performance requirements for the limited flame spread properties of materials and protective clothing.

National standards bodies (NSBs) such as the BSI have to adopt CEN and ISO standards so that by adhering to one standard, manufacturers can easily adhere to them all. NSBs outside Europe, such as Standards Australia, often choose to adhere to ISO standards or have their own standards.

Ultimately, it is up to the customer to decide which standards they would like their PPE to follow, although clearly those in the EU would be advised to follow EN 469 as it a harmonised standard and complies with EU regulations.

There are some who believe this three-tiered approach of developing national, European and international standards is unnecessary and inefficient. In today's global business world, why not do away with national standards and simply follow international guidelines? However, national standards are an essential fallback in countless situations, most crucially when a nation is faced with a specific scenario, or where there is strong national demand that may not be reflected internationally.

If a standard does not exist internationally, NSBs are able to create their own. For example, despite European guidance on how frequently PPE should be cleaned, Europe still rejects calls for a standard that sets criteria for the cleaning, maintenance, and repair of firefighters' PPE.

This is an issue that many countries are taking seriously, since regular cleaning can guard against the dangerous infiltration of carcinogens, which have been linked to higher incidences of cancer among firefighters on the front line. Currently, the only standard in the world setting such criteria is NFPA 1851: 2014. The UK industry in particular is keen to create a standard to help protect against these health concerns, so the BSI is working to develop a national standard to meet this demand.

Finally, many countries in or trading with Europe are keen for an update on the consequences of the UK voting to leave the European Union, the impact this will have on the UK's membership of CEN, and its future adherence to EN standards. There has been speculation that Brexit may trigger a demotion of the UK to Affiliate Member status, currently held by 19 NSBs from EU neighbouring countries.

In response, the British Standards Institute has confirmed that it is 'business as usual'. For the foreseeable future, it sees no change in its status and obligations as a full member of CEN, or in its membership of ISO. The BSI director of standards, Dr Scott Steedman, who also holds the position of vice president of policy at CEN, made this position clear in a recent webinar entitled '*EU referendum – the UK's future role in developing European standards*'.

'Our position is that it is absolutely business as usual for BSI. Our commitment to the European system is undiminished and our work internationally will not be distracted… We see considerable benefits in retaining the single standard model in the UK. It provides access to the largest integrated tariff-free market in the world.' It is possible that the UK could retain full membership despite not being part of the EU, like other CEN members such as Switzerland, Norway, Macedonia and Turkey, although it is unclear at this stage whether the UK would need to rejoin EFTA to retain its status.

Bristol Uniforms, for its part, continues to provide PPE to firefighters in over 110 countries, offering garments to meet not just EN, but NFPA and ISO standards as well. We will continue to play an active part in the development of these performance standards covering structural, wildland and technical rescue PPE.

ABOUT THE AUTHOR

Ivan Rich is the technical manager at Bristol Uniforms and is closely involved in developing and reviewing standards for firefighter PPE. He is the secretary for two European committees, which include standardisation for heat and flame PPE and firefighters' PPE.

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When are PFOS and PFOA safe?

The German Federal Environment Agency (UBA) publishes official safe levels of PFOA and PFOS in human blood.

Safety thresholds for PFOA and PFOS in blood plasma have been set at two nanograms per millilitre and five nanograms per millilitre respectively by the German Human Biomonitoring (HBM) Commission.

These levels, so-called HBM I values, represent the concentration of a substance below which, according to the HBM's latest assessment, adverse health effects are not expected, and no exposure reduction measures are necessary. The values have been published in Germany's Federal Health Gazette, Bundesgesundheitsblatt, which is the equivalent of the US Federal Register.

Evaluation of human epidemiological studies led the HBM Commission to conclude in July this year that exposure to PFOA and PFOS was adversely associated with fertility and pregnancy; weight of newborns at birth; lipid metabolism; immunity after vaccination; hormonal development; thyroid metabolism; and onset of menopause. It described these associated effects as 'well proven' and 'relevant'.

A NATIONAL PART 139 CERTALERT was issued on 27 October 2016 to all airport operators, aircraft rescue and firefighting departments (ARFF), and FAA airport certification safety inspectors in the US about the possibility of particles of aqueous film forming foam (AFFF) in AFFF tanks on ARFF vehicles and AFFF storage tanks.

The alert (No.16-09) asks airports to check their vehicles, foam trailers and bulk storage tanks to establish whether the presence of these particulates is a widespread problem.

According to the background information provided, at least four different ARFF departments around the country have discovered crystallised particulates in the ARFF tanks on their vehicles. The alert states that while this has not so far been found to affect the firefighting capabilities of the AFFF, there are concerns that it could potentially restrict the AFFF proportioning system and alter the AFFF production or nozzle discharge.

As a result, the FAA is asking Certificated Part 139 airports to inspect the AFFF tanks on all their ARFF vehicles, foam trailers, and bulk AFFF storage tanks. Information is provided as to what to look for (grey/white crystalline particles), and what constitutes cause for concern (a high concentration of particles settled at the bottom of the tank), along with instructions on how to conduct the inspection.

If particles are discovered, the affected airport is advised to contact the AFFF manufacturer for guidance, providing information about the vehicle, trailer or tank, and as much history as possible about the AFFF in question.

All airports are asked to complete an FAA survey following the inspections, regardless of whether particles are found, and those that do find particles are asked to send a sample of both the liquid AFFF concentrate and the particles to the FAA.

The UBA recently demonstrated that it was prepared to argue the validity of these conclusions even if it meant contradicting its own government. In September it publicly corrected the Minister of Agriculture and Consumer Protection Peter Hauk after he had said in a television interview that no scientific studies were yet available that proved perfluorinated compounds (PFCs) were harmful.

According to Martin Ittershagen, head of public relations for the Federal Environment Agency: 'The comments made in the interview with regards to the health effects of PCFs are wrong. There are numerous scientific findings from epidemiological studies through to experiments on animals.' He later added: 'When exceeding the HBM-I value, health effects cannot be excluded with sufficient certainty based on the current knowledge we have.'

PFOA and PFOS are fluorinated organic chemicals that are part of a larger group of chemicals referred to as perfluoroalkyl substances. PFOA and PFOS, the most extensively produced and studied of these chemicals, have been used to make carpets, weatherproof clothing, fabrics for furniture, paper packaging, and cookware. They have also been used for making AFFF firefighting foam.

All human populations around the world carry varying levels of PFOA and PFOS in their blood. In a 2012 scientific study of blood serum concentrations of perfluorinated compounds in men from Greenlandic Inuit and European populations it was found that in Greenland the average level of PFOS in blood was 52 nanograms per millilitre, ten times higher than the safe level published in Germany. In Poland, it was four times the limit and nearly twice the limit in Ukraine.

Nevertheless, these levels have been in decline since 3M began to phase out PFOS production in 2000, and since the US Environmental Protection Agency introduced the PFOA Stewardship Programme that aims to eliminate PFOA production by 2015.

Given that PFOA and PFOS have been key ingredients in firefighting foam for years, the latest findings from the HBM Commission could raise concerns from members of the firefighting community that have used AFFFs containing PFOS or PFOA before their replacement with short-chain (C6) fluorotelomer surfactants.

LETTER TO THE EDITOR

The article 'New Queensland foam policy' published in F&R Q3 page 32, revealed a blinkered, over-precautionary foam policy. Even short-chain AFFFs are effectively banned from future use. Misleading aspects, errors, omissions and interpretation issues, require correction and resolution with industry, including:

1. *This policy's impact is not small. All industry sectors are affected. Most major sites use fluorinated foams for proven speed, effectiveness, and reliability – protecting life safety, minimising fire incident escalation, and best discharging duties of care.*

2. *Short-chain C6 foam usage as viable options to fluorine-free foam (F3) are accepted through risk assessment, particularly major hazard facilities, providing that foam/run-off is collected/contained without environmental release. But '...water contaminated by fluorinated organic compounds must not be released to the environment if the levels of fluorinated organics exceed the levels in Table 6.4.2A', could require F3 usage to be incinerated.*

3. *Table 6.4.2A's contaminated water trigger values are exceptionally low: PFOS and PFOA 0.3µg/L (ppb) each, sum of TOPA (Total Oxidisable Precursor Assay) C4-C14 plus C4-C8 sulfonates 1.0µg/L, without agreed standards, nor inter-laboratory cross-check analyses established. 0.3ppb equates to 1 second in 100 years. Whether C6, F3 or water alone is used in most fire incidents, residues from other 95% fluorochemicals usage probably exceed these values, from stain-repellent carpets/upholstery, garments/raingear, paper products, food packaging, firefighter tunics in structural/ vehicle firewater runoff.*

4. *This policy does not go far enough. How such 'residual' fluorochemical run-off should be collected and 'prevented from entering the environment' is not addressed. Nor this insidious waste generated daily, potentially entering via landfill leachate and sewage treatment waste, when the policy acknowledges waste water treatment plants fail to trap fluorochemicals. Is it right such important waste streams are overlooked?*

5. *Over-precautionary focus on foam agents overlooks more important environmental impacts from fire incidents. Smoke, noxious gases, polycyclic aromatic hydrocarbons include carcinogens, more damaging to firefighters and environments, than foams used. UK Environment Agency advises: 'Fire Service foam buyers primary concern should be which foam is the most effective at putting out the fire. All firewater runoff and all foams present a pollution hazard." Their inclusive approach ensures life safety, limits escalation, reduces foam and runoff volumes, and minimises subsequent environmental pollution. Shouldn't we all be following this superior approach?*

Mike Willson, Wilson Consulting, Tasmania

US AIR FORCE BUYS C6 FOAM

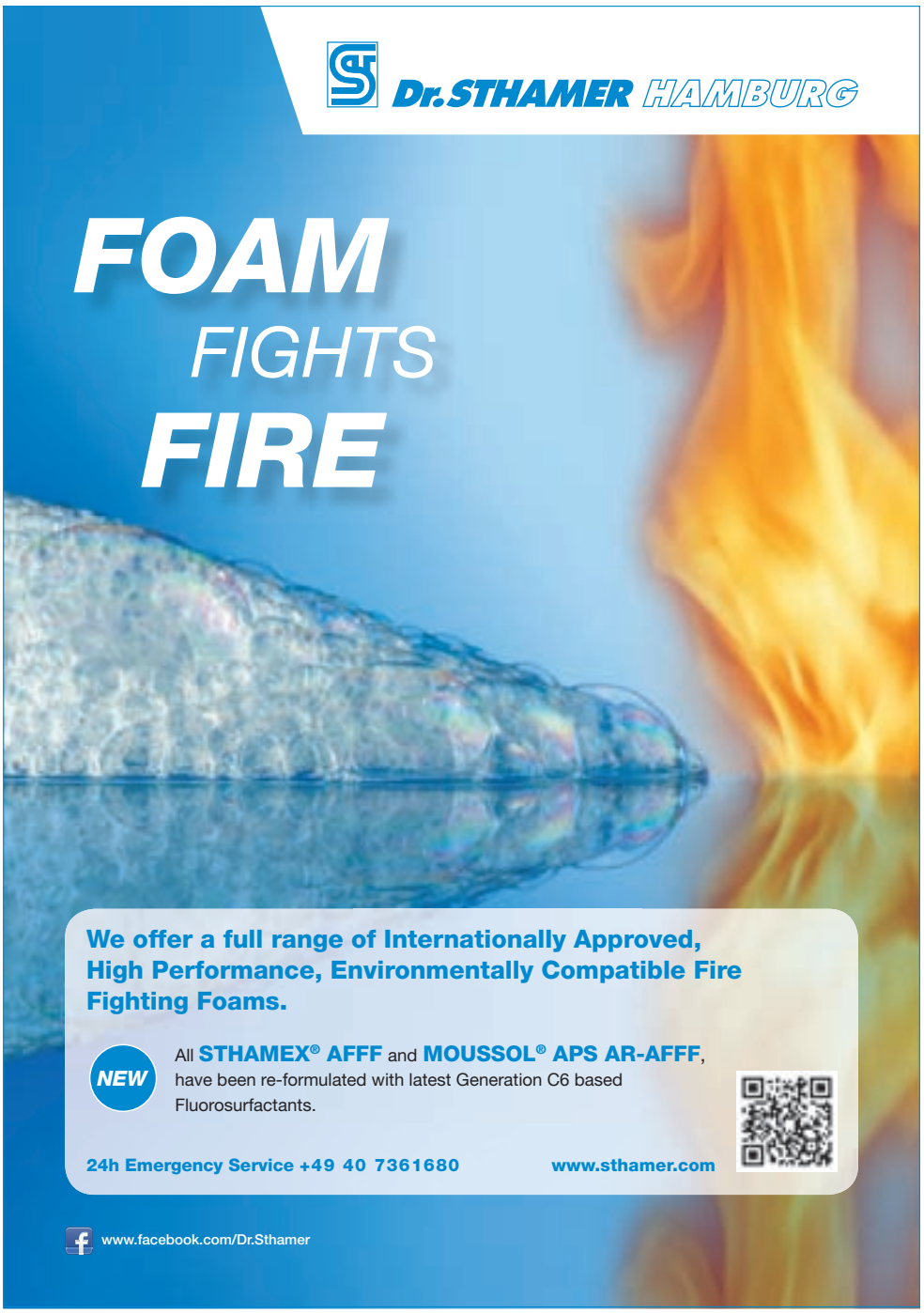
The US Air Force has awarded a US$6.2 million contract to replace firefighting foam used in fire vehicles with an environmentally responsible foam to reduce the risk of possible contamination of soil and groundwater.

In August ICL Performance Products was awarded the contract for 1.5 million litres of Phos-Chek 3%, six-carbon chain aqueous film forming foam. All foam in fire vehicles and fire stations is expected to be replaced by the end of 2016.

AFFF is currently used by civilian and military firefighters to extinguish fires in aircraft accidents and other emergencies where jet fuel and other petroleum-based flammable materials are present. The US Air Force has stated that it will continue to use AFFF in its defence operations to protect people, critical weapon systems, and infrastructure, but the move to buy C6 foam signals that it intends to do so in a more environmentally responsible manner, and one that also makes its operations safer for the public.

The Air Force also recently awarded a contract to retrofit all aircraft rescue and firefighting vehicles with specialised equipment that will enable firefighters to conduct fire vehicle operational checks, and required annual foam tests without discharging any AFFF into the environment.

The Air Force is considering several courses of action to address the AFFF used in aircraft hangar fire suppression systems.



Multi-purpose agent

A fire extinguishing agent recently introduced to the market as an alternative to conventional extinguishing media is achieving high marks from fire and rescue services, reports *Fire & Rescue.*

The water-based fire extinguishing solution is made from natural ingredients and works on all types of fires with the exception of high-voltage electrical fires.

Its manufacturer, Firescape Global, has developed a number of products for fire and rescue services as well as solutions for domestic and commercial applications.

The technology has been in development for several years, and the company has worked closely with fire and rescue services in the UK to test and accredit the products. These range from high-pressure hose reels and fire extinguishers to rapid response aerosols and sachets.

According to Firescape CEO Tony Crawley, the company's extinguishing fluid is more effective than conventional extinguishing media based on technical specifications obtained during testing exercises from an independent industry expert. 'Our product is also more eco-friendly, and it can be used in much smaller quantities, reducing the toxic run-off from a fire.'

Other benefits of Firescape include an instant cooling effect, which reduces the possibility of re-ignition, a reduction in smoke and steam when tackling fires in confined spaces, and ease of use. The products are approved by the London Fire Brigade trading arm London Fire Brigade Enterprises.

Firescape has worked extensively with various UK fire services to test the product in real-life scenarios.

Most recently, the company's products were tested during a two-day exercise with London Fire Brigade, Dorset and Wiltshire Fire and Rescue Service, and Hampshire Fire and Rescue Service at the Fire Service College in Moreton-in-Marsh, Gloucestershire, UK. The tests involved a number of fire scenarios, including fuel fires, a hybrid vehicle with a lithium battery, thatched roofs and car tyres, which were designed to demonstrate how the fire services can best use the Firescape products.

Crawley believes that the company's Extinguish Safe system, which offers the Firescape fluid in conventional fire extinguishers, is particularly suited for use by fire and rescue services. These Firescape extinguishers can be used in small, rapid response vehicles or CAFS type systems, potentially enabling fire services to respond to incidents more quickly and efficiently.

'A single nine-litre Firescape extinguisher can extinguish a car fire, which reduces the environmental impact while enabling firefighters to quickly respond to incidents without deploying lengths of hose reel. It also means that crews can

Various UK fire brigades have tested the Firescape agent, which has been approved by London Fire Brigade Enterprises.

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be available for other incidents more rapidly,' says Crawley.

The Bulk Safe system allows fire services to induce the Firescape solution via their current onboard foam storage tanks or via 30-litre mobile drums. The solution can be diluted with water at high pressure, shortening the firefighting process through the instant cooling delivered by the fluid, and reducing the overall environmental impact of the operation.

'We believe that once our product is fully adopted by fire services globally it will help to reduce operating costs, improve the safety of fire crews and potentially save lives,' says Crawley: 'Looking to the future, we will continue to develop the products and we plan to introduce innovative new delivery applications for the Firescape product range. These are currently undergoing a comprehensive testing programme.

'We will also be focusing on our key partners around the world, opening offices in key regions, as well as working to strengthen our relationship with a large US entity that supplies military, federal and government institutions.'

ESN – a revolution for fire services?

Josh Hewer is senior analyst for transport and policing at Kable, a global telecoms and IT consultancy.

The Emergency Services Network (ESN) is one of the most technologically ambitious programmes in the UK Government's portfolio.

From our research supporting the recent National Audit Office (NAO) report, it is clear that the UK has very few peers in terms of its aim to provide a Long-Term Evolution (LTE) network by 2019. This will replace a tried-and-tested radio network, Airwave. It is a technology that should offer significant benefits to fire officers and staff across all three emergency services, but it is not without risk.

Transitioning fire officers away from radios and onto mobile telephones is in line with the overall evolution of emergency services communications. With the investment by services in mobile policing, wearables, and in-vehicle devices already underway, there is clearly an appetite for enhanced data capabilities. However, are officers from across the emergency services ready to put all their eggs in one basket?

For our work with the NAO we identified a few other countries pursuing an LTE network for emergency services communications. These include South Korea and the United States. However, what is being provided to emergency services in these countries differs significantly to what is being proposed in the UK. The key difference is the state of existing emergency services networks – in both South Korea and the US there has never been a forerunner national network like Airwave. That officers from all three emergency services in the UK already have access to a shared network is relatively unusual across the world.

For their inaugural networks, South Korea and the US will use the same provisioning currently being pursued by the Home Office. Both countries believe that it is crucial they establish a nationwide voice network, something that has never before been available to their emergency responders. This is the essential lifeline offered in the UK under Airwave. In the case of South Korea, the country's latent technology base and world-leading mobile connectivity means that an LTE network could be ushered in for voice.

In the wake of the 2014 Sewol ferry disaster, the South Korean government pledged to rapidly establish an emergency services network so that the lack of coordination that hampered the disaster response would never happen again. With 97% LTE coverage, Safenet is starting from a far higher base than the UK, and for South Korea LTE was the only way to rapidly establish the much-needed network. The UK already has a near complete network via Airwave, and arguably, a more measured approach to introducing LTE may be a sensible path to take.

In the US, Firstnet will establish a hybrid core LTE infrastructure for responders. Airwave and ESN may involve sizeable costs, but these are nothing when compared to the scope of the project proposed in the US. The higher cost reflects the larger geographic area and number of users in the US. The US project also has a far longer timeline and appears to be more adaptable in empowering stateside emergency services to own, what in the UK, is Motorola's User Services lot.

Australia is pursuing a similar strategy, further cementing the view that LTE is the future direction of emergency services communications. But it is a strategy that requires time to adopt.

While emergency services in the UK do differ from many others in terms of their experience under the legacy contract, adopting a new technology is still challenging, regardless of existing user familiarity with smartphones. Despite the promises and aspirations of the government, the devices adopted will not be generic consumer devices. In Germany, even integrating the established TETRA communications has proved challenging, given the impact of redesigning business processes to accommodate a technology.

The emergency services in the UK will need to learn from one another about ESN because there is a lack of expertise globally in integrating LTE as the core network for emergency services communications. Given the time pressures involved, the Home Office needs to collaborate with responders to generate the expertise required to bring in ESN. For transitioning organisations, a managed service model may help provide much-needed expertise.

However, global knowledge in this area is lacking, and as LTE is the future of emergency services communications, perhaps in-house development could provide a useful future revenue stream for services to share their experiences worldwide. It would also suggest that for individual officers, ESN experience will be highly valued as LTE is rolled out elsewhere.

You can download the NAO report via this link: https://www.nao.org.uk/wp-content/uploads/2016/09/Upgrading-emergency-service-communications-the-Emergency-services-Network.pdf

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