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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.

DYNAX CORPORATION
PO Box 285, Pound Ridge, NY 10576 USA
T 914 764 0202 techinfo@dynaxcorp.com
F 914 764 0553 www.dynaxcorp.com

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FIRE & RESCUE

Editor
Ann-Marie Knegt
am.knegt@hgluk.com
+44 (0) 1935 374001

Managing Editor
Jose Maria Sanchez de Muniain
j.sanchez@hgluk.com
+44 (0) 1935 374011

Group Sales Manager
Kelly Francis
k.francis@hgluk.com
+44 (0) 207 973 4666

Production
Tim Malone
t.malone@hgluk.com
+44 (0) 1935 374014

Managing Director
Graham Bond

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A division of the Hemming Group Ltd,
8 The Old Yarn Mills, Sherborne,
Dorset, DT9 3RQ, England
Tel: + 44 (0) 1935 816 030
Fax: + 44 (0) 1935 817 200
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Front cover artwork designed by: Darren Small, www.facebook.com/darrensmallphotography/ and supplied by Newcastle International Training Academy.

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EDITOR'S COMMENT

According to Dennis van't Ende, a fire instructor for the Dutch Air Force, and one of the instructors interviewed for our training article (P.12), there is a saying in The Netherlands. 'There are those who work at the fire department and those who are firefighters.' Meaning that some people join the fire service to call themselves a firefighter, but they feel no real commitment to the job, while others really are firefighters, who enjoy their work and care deeply about the profession.

While not wanting to come across as overly sentimental, it is the latter who tend to become training instructors. The international training instructors interviewed for this issue all have varying points of view, backgrounds, and philosophies. They have different ideas on what their favourite equipment is (and why), and how training and deployment strategies should be approached.

What they all have in common, however, is an incredible passion for their work as as instructors, the institutions they work for, and most of all their students. This makes our training feature a truly interesting read, and I'm sure many Fire & Rescue readers will recognise themselves in these trainers. So I'm going to close this Editor's Comment with another pearl of wisdom, this time from Graham Reeves, fire instructor at Newcastle International Training Academy (featured on our front cover): 'Courage is not living without fear; courage is being scared to death and doing the right thing anyway.'

Ann-Marie Knegt, Editor

UK FIRE BRIGADE UNDER SCRUTINY

The UK government has commissioned a full statutory inspection of Avon Fire and Rescue Authority – the first of its kind. It is expected to take at least three months and will look at the governance of the authority, including its duties of accountability and assurance under the Fire and Rescue National Framework.

The inspection was ordered on 2 February by the Minister for Policing and the Fire Service, Brandon Lewis, in response to serious, wide-ranging allegations over the authority's governance in relation to spending, contracts, complaints, discipline, and culture. It follows the authority's repeated refusal to commission its own independent investigation into the claims.

In June 2016, the chairman of Avon Fire and Rescue Authority approached the Home Office requesting assistance with launching an inquiry into concerns raised by members of the authority. That request was subsequently withdrawn.

In August 2016 and again last October, the Home Office asked the authority to commission a full investigation, independent of the authority, into all the allegations; this was declined by the chair and vice chairs of the authority.

Areas that will be reviewed by the independent consultant will include the authority's decisions in relation to employees' salaries and expenses, and hospitality, as well as processes and practices for entering into contracts.

Brandon Lewis, Minister for Policing and the Fire Service, said: 'It is disappointing that Avon Fire and Rescue Authority chose to not commission a full independent investigation, to reassure the communities it serves that these allegations have been taken seriously and investigated thoroughly.

'The extent, seriousness, and persistence of the allegations cannot be ignored, and it will now be for the lead inspector, Dr Craig Baker, and his team to determine whether or not they are true.'

Baker has advised public sector organisations for over 30 years in the UK and overseas and, in the private sector, has worked with the Boston Consulting Group and Ernst and Young. He previously worked at the Audit Commission and worked on the production of its 2005 report, *In the line of fire*, which considered value for money in the fire service.

A final report will be delivered to the Home Secretary setting out the inspector's findings and any recommendations.

NFPA issues safety bulletin on firefighter protective hoods

The National Fire Protection Association has issued a safety bulletin on firefighter protective hoods, saying they are highly penetrable and expose skin to hazardous and toxic substances.

It is well documented that firefighter personal protective equipment is exposed to a wide range of toxins, pathogens, and other hazardous substances. According to a study by the Center for Disease Control and the National Institute of Occupational Safety and Health, firefighters have a greater number of cancer diagnoses and cancer-related deaths.

Protective hoods are the most penetrable piece of clothing worn by firefighters. They do not stop soot and chemicals from depositing on a firefighter's neck and head – areas that are extremely vulnerable to dermal exposure.

'NFPA has had the back of firefighters for more than 120 years,' said Ed Conlin, Public Fire Protection division manager. 'Given the increase in occupational cancer in the fire service, we feel it is best to err on the side of caution as we await additional scientific research on PPE and learn more about the absorption of carcinogens near the forehead, jaw, neck, and throat.'The NFPA protective hood bulletin recommends that fire departments establish an overall health and safety programme and practices for care and maintenance in accordance with NFPA 1851, Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting.

Drone demo for sea rescue

A distress alert initiated from a smartphone at sea has autonomously launched a drone from the Irish coastline to locate the casualty.

The world-first demonstration took place in Crosshaven, Cork, Ireland, on 13 February, and involved the integration of three technology systems to alert, search, and respond to an emergency.

Once overhead, the drone's sensors streamed situational awareness information to the emergency operations centre coordinating the response. The demonstration showcased a number of capabilities, including incident alerting from a Safetrx app on a smartphone, and user information, including GPS location and tracking, being made available to both the Safetrx console and to Drone SAR and D4H.

Safetrx is a proven maritime safety platform and its maritime search and rescue application has over 695,000 recorded hours of use around the world. During the demonstration, Safetrx triggered Drone SAR, which generated an autonomous drone mission to the specified GPS location. From there it streamed high resolution video back to its management console as well as to the D4H situational awareness platform. The latter coordinated the issuing of operations instructions to first responders.

Oisin McGrath, CEO of Drone SAR, said: 'Using the most advanced drone technology, our rescue software, and the Safetrx app we can now fly drones autonomously to a distress signal. Reducing search time and risk to personnel is key, and if one life is saved, that is a success. We are very excited that we proved that our integration with Safetrx, which commenced in November last year, works so well.'

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Training Base Weeze launches ARFF/RFF Training Academy

Training Base Weeze, the international training centre for emergency services, has expanded its area of expertise into the aircraft rescue firefighting/rescue firefighting (ARFF/RFF) sector. The facility, based on the German-Dutch border, is launching the new ARFF and RFF training academy on 14 March 2017 with a special ceremony.

Weeze has made a considerable investment in the latest training simulators for this purpose, including a passenger aircraft simulator, a helicopter, and an original ATR-42 aircraft fuselage.

One of the reasons for the launch of the ARFF training academy is the introduction by the EASA (European Aviation Safety Agency) of new directive AMC1 ADR.OPS.B.010(B)1, which states that airport fire and rescue services and other airport staff should practice on the type of aircraft that they most commonly receive at their own aerodrome. Continued dialogue with students and instructors revealed that there is a requirement for high quality training in this field on real fires and the most realistic simulators possible.

Training Base Weeze is a TEEX (Texas Engineering Extension Service) accredited facility and is a TEEX Cooperative Learning Centre. Stephan Hanegraaf, international training and business development manager for Training Base Weeze, said: 'This means we can draw from this immense pool of knowledge and experience. Only the best instructors have been appointed to deliver the courses. They are all active within the aviation fire service in multiple countries. They have far-reaching experience in delivering training courses in civil as well as military aviation.'

The new ARFF/RFF curriculum consists of three new courses: EASA training technical assistance (rescue technicians for aircraft and helicopters), recurrent EASA ARFF-training, and on-scene commander training. The new courses are suitable for all 32 countries which fall under EASA jurisdiction, and are aimed at ARFF/RFF firefighters and senior officers.

ITALY WINS INTERNATIONAL TEAM OF THE YEAR AWARD

All the fire department teams that responded during the series of earthquakes in central Italy in summer 2016 have now received the Conrad Dietrich Magirus Award 2016. The International Firefighting Team of the Year Award 2016 was received by representatives on behalf of all firefighters who responded to the earthquakes.

The jury, as well as online voters, awarded prizes to two particularly demanding firefighting operations. The fire department from São Paulo in Brazil was also among the top three teams, as was the fire department of Altenmarkt, Austria.

The São Paulo fire department fought a hazardous fire in an industrial facility, and the Altenmarkt faced a major fire in a magnesium foundry with multiple explosions.

The German National Firefighting Team of the Year Award went to the Volunteer Fire Department from Lehrte, Lower Saxony, for a demanding rescue operation on the A2 motorway. The Volunteer Fire Department Erkrath in North Rhine-Westphalia earned the Special Award for Social Engagement.

London Fire Commissioner Danielle Cotton QFSM was the guest of honour, and she paid tribute to her colleagues. 'The submissions show the great physical and mental demands of fire department tasks. I am pleased that the Conrad Dietrich Magirus Award honours this commitment.'

A jury consisting, Michel Bour, general secretary of the International Federation of Fire and Rescue Services, Ann-Marie Knegt, editor of *Fire & Rescue*, Hermann Kollinger from Austrian fire brigade magazine *Brennpunkt*, Piotr Pajor, vice president of Firemax in Poland, and Tristan Reitz from Magirus chose the best applications, which were then subject to public online voting. The teams from Italy and Lower Saxony were chosen as winners after receiving the most votes from the jury and online voters. They received the Conrad Dietrich Magirus Statue as well as a trip for ten members from each fire department to the Fire Department of New York.

ENVIRONMENTAL AWARD FOR ANGUS JETFOAM

Angus Fire has been awarded gold at the 2016 Green Apple Awards for Environmental Best Practice.

The Green Apple Awards are an annual international campaign to recognise, reward, and promote environmental best practice around the world. The gold award in the Science and Technology category recognises Angus Fire's development of Jetfoam, a fluorine-free firefighting foam that is able to film-form on aviation fuels. Jetfoam was developed by the company's foam research team at its Centre of Excellence in Bentham, North Yorkshire.

The fire performance of Jetfoam has been independently tested and certified to the International Civil Aviation Organisation level B performance standard, and it has been adopted by civil airports in the UK, Europe, and worldwide.

'The patented formulation for Jetfoam offers significant environmental benefits over existing firefighting foams and contains no persistent ingredients,' said David plant, Angus's global product manager for firefighting chemicals. 'Once discharged into the environment, Jetfoam begins to degrade, a process which will be almost complete within two weeks. To maintain the product's environmental credentials, and to ensure there is no risk of contamination, Jetfoam is manufactured in a production line dedicated to fluorine-free foams.'

Now in their 18th year, the Green Apple Environment Awards are one of the major environmental recognition schemes. This award is accredited by The Royal Society for the Encouragement of Arts, Manufacturers and Commerce, a London-based organisation committed to finding practical solutions to social challenges. The event also feeds into the European Business Awards for the Environment, where Jetfoam has now been entered.

Stopperswitch buttons redesign

The indoor and outdoor push buttons within the Stopperswitch series from Safety Technology International (STI) have undergone a redesign.

'The low/high voltage push buttons can fit any standard UK-type switch socket and are quick and easy to install. There are three types: key-to-reset, momentary, and pneumatic,' explained STI's Kelsey Taylor. Indoor models are supplied as a dual mount, designed to fit either flush or surface onsite installations. Outdoor models are supplied with a weatherproof back box.

Further options have been introduced, which include a standard function marking label sheet with 12 operating labels for a variety of uses, ready for self-assembly. Custom label is also available upon request. The option to change the button colour to the housing broadens the variety of applications. The Stopperswitches can also be protected by an STI cover to prevent false or accidental activations. Models are available with or without sounder alarm, which further reduces the chances of a malicious false alarm.

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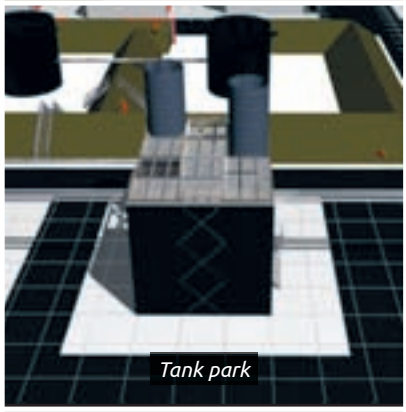
Industrial training site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MAGIRUS LAUNCHES RESCUE CAGE FOR URBAN USE

A compact new rescue cage for up to four people has been developed by Magirus, and can be used on the company's articulated turntable ladders with a height of up to 42m.

The RC400-C has a payload of 400kg and was designed specifically to cope with the often cramped building conditions of inner cities. It offers fast and direct access to confined entry points, utilising corner entry and foldaway side doors and handrails to ensure safe access.

The control stand of the cage is located in the centre for an all-round view, and objects can be anchored to the cage floor to prevent them falling out. The water hoses, which have a flow of up to 2,500 lpm, are mounted on the outside of the cage. The plug-in water monitor can be controlled electronically or manually.

The two lateral, multifunction pillars can be operated independently, and the cage can be used with accessories such as the Magirus RS270 support for stretchers and basket stretchers. This can be rotated by 360 degrees on both sides of the cage to ensure optimal positioning.

Magirus now has five rescue cages in its range. These are based on three different base bodies to enable users to select the cage that best suits their operational needs and tactics.

NEW AUTHORISED SERVICE CENTRE FOR BRONTO SKYLIFT

The first authorised service centre for Bronto Skylift in the Middle East is to be set up following the agreement of a service and after sale partnership with Bristol Vehicles Manufacturing Division (VMD), the Abu Dhabi-based firefighting, rescue and safety vehicles manufacturer.

Bronto Skylift makes truck-mounted hydraulic platforms, which are used in industrial and high-rise firefighting applications. The partnership with Bristol VMD comes following a number of fires in tower blocks and warehouses in the region.

Bristol's parent company Concorde-Corodex Group will act as the official sales agent for Bronto in the UAE. Bristol will provide fabrication expertise, local after sales service, and 24/7 service centres at its facilities in Abu Dhabi and Dubai for Bronto's clients in the GCC and Middle East, focusing on countries where Bronto does not have authorised service partners.

The service centres will serve firefighting organisations such as the civil defence and police forces as well as the oil and gas sector, rescue operations, and utility companies.

The partnership will make 'a tremendous difference in the ongoing effort to improve the region's ability to control potentially destructive fires,' said Mahmoud Awad, MD of Concorde-Corodex Group.

Bronto produces around 50 different models of hydraulic platforms, which range in height between 17m and 112m. They can be mounted on any commercial truck chassis, and the company has used the latest technologies to ensure its equipment can be set up quickly and without any special preparation.

The latest developments from the company include the F-XR range of aerial platforms, which includes the F60XR, the highest platform that has a rescue ladder along the boom and a transport length of just 12m.

There have also been new additions to the company's F-WFT range of water and foam towers designed for use with targets that are difficult to access and extinguish. These have a capacity of up to 6,000 lpm, and the newest models offer an increased maximum height of between 56m and 66m.

Finally, the company has just released the fifth generation of its control system, the Bronto+. This automatically calculates maximum safe outreach in any given situation, and has been designed to be easier and quicker to operate, utilising a simple interface and resistive, touch screen technology.

AT STINGER GOES INTO ACTION AT LANCASHIRE FRS

An AT-Stinger fire truck from Rosenbauer that combines municipal and industrial firefighting technology is now in operation with Lancashire Fire and Rescue Service in the UK and will enhance the service's aerial firefighting capabilities.

This efficient and flexible first attack vehicle was designed jointly with Lancashire FRS. It features a stinger extinguishing arm with a Rosenbauer piercing tool on the roof that is more commonly used in fighting aircraft fires. Lancashire FRS plans to use it to break through roofing materials and fight fires in the underlying structures. It can also support a breathing apparatus team, for example, by lowering a room temperature with a water jet before the team moves in.

The vehicle will be trialled for six months each at Burnley and Blackburn and will be called to all fire and technical emergencies. It can launch an attack immediately from an elevated position and can cover virtually all attack positions, thanks to the range of movement of the stinger extinguishing arm, the RM65 monitor, and the piercing tool.

The stinger HRET is also equipped with both a colour and a thermal imaging camera to aid with the positioning of the monitor and the piercing tool.

The vehicle's pump system consists of an NH55 pump in combination with the automatic Fixmix foam pre-proportioning system. The pump has an output of up to 5,500 lpm in tank suction mode at 10 bar, as well as up to 400 lpm at 40 bar. The RM65 monitor can deliver up to 4,000 lpm and the stinger nozzle can deliver up to 1,000 lpm.

The AT-Stinger is mounted on an MAN 4x2 chassis and the crew cabin and technical fire service superstructure are from the AT series.

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11-17 MARCH FLOODFIGHTER CONFERENCE, CHARLOTTE, NORTH CAROLINA, US

The 2017 Floodfighter masterclass from Surf Life Saving GB will be hosted by Charlotte Fire Department, North Carolina.

This year's International Floodfighter Emergency Management, Flood and Water Rescue conference will showcase current best practice and review new techniques, equipment, and emergency management guidance. The conference will be recognised by the IFE as a CPD qualifying event.

This is the most recent event in a 12-year partnership programme that has seen the exchange visits of first responders, managers and volunteers from the UK, Europe, Australia, and the US. Over the years, hundreds of UK and international delegates have attended workshops and conferences hosted by colleagues in the US, and in the process have expanded their knowledge base and gained enhanced tactical water rescue skills.

The conference is designed to help delegates meet the evolving challenges in water and flood rescue caused by extreme weather conditions. The aim is to enable knowledge sharing to support response, strategic management, and incident tactics. There will also be numerous networking opportunities.

Delegates can expect a packed programme that ranges from the latest SAR techniques for both river and wide area search operations to multiple boat operations, and the use of SAR drones, as well as the implications of this technology for the future.

The emphasis is firmly on working in the field for the first five days. There will be night boat rescue operations and a focus on navigation techniques, supplemented by HART, the mountain and helo-aquatic and reconnaissance techniques. There will also be a Dive Rescue Station 38 visit to enable delegates to gain further technical input into dive SAR operations and specialist fire and rescue boat operations.

The event is targeted at those responsible for strategy, response and tactical operations, including SAR operators, government representatives, specialist flood-and-water response staff, senior managers, flood incident managers, instructors, tactical advisers, and those responsible for specialist rescue training or procurement of flood and water rescue response apparatus and services.

Places are limited and will be allocated on a first come, first served basis. To secure your place or for further information, contact David Lane at floodfighters@btinternet.com

28-31 MARCH, EMERGENCY MANAGEMENT AIRPORT SUMMIT, SINGAPORE

The Emergency Management for Airports Summit 2017 will take place in Singapore. *Fire & Rescue* magazine readers are eligible for a 10% discount when signing up for this event.

Different types of emergencies occur in airports, which can severely disrupt airport operations and impact the lives of millions of people working or travelling within the airport. An increased scrutiny around safety and operational efficiency in airports, coupled with a seemingly increasing number of airport emergencies over the last 12 months, has seen an escalating focus around the world on emergency management and crisis management in airports.

Part of Equip Global's global Airport Summit Series, this four-day conference with workshops provides an opportunity for emergency management and operations leaders across airports and aviation authorities to share insights and hear case studies on strategies in the development of effective airport emergency response systems for both flight and non-flight related cases.

People can also sign up for a set of separate workshops.

For a copy of the conference brochure, please email Lukas Tan at enquiry@equip-global.com. *Fire & Rescue* readers please quote Hemmingfire2017 when contacting the organisation for 10% discount.

24-29 APRIL, 2017, FDIC INTERNATIONAL, INDIANA CONVENTION CENTRE, LUKAS OIL STADIUM, INDIANAPOLIS, IN, USA

The FDIC (Fire Department Instructors Conference) International is the largest fire and emergency services conference in North America, and this year the event is celebrating its 90th edition.

Established in 1928, FDIC provides comprehensive training for today's serious firefighters and brings together a whole range of companies to showcase the latest tools and technology designed to save lives. Visitors have the opportunity to see first-hand live demonstrations of the latest innovations that influence fire service safety and performance.

FDIC International is one of the largest annual gatherings of fire professionals worldwide. Delegates and companies from across the globe attend for a week filled with informative fire-focused meetings, workshops, tours, an extensive programme, and the exhibition. FDIC International highlights perspectives on the role of firefighters and helps participants develop a vision to meet challenges and ensure the future sustainability of the industry.

The heritage and tradition encompassed by FDIC are certainly a big part of why more and more firefighters attend. FDIC is one of the leading firefighter training conferences in the world.

'Many people travel hundreds and thousands of miles to receive the cutting-edge training only offered at FDIC,' said Eric West, marketing manager for Penwell. 'For many veteran attendees, however, it is the intangible aspect of this event that makes it so special. Seeing old friends, talking with industry icons, and the many impromptu conversations that occur outside classroom doors and around the table at a favourite restaurant, are all part of the FDIC experience,'

'Whether you're an experienced veteran or a novice firefighter, please join us in Indianapolis this April. We look forward to seeing familiar faces and meeting new friends,' said West.

For more information visit www.fdic.com.

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www.rettmobil.org

The faces of fire training

Fire & Rescue profiles top instructors from five international fire training facilities to find out what motivates them, and gains an insight into the latest trends and challenges in fire training across Europe.

ORGANISATION: INTERNATIONAL FIRE TRAINING CENTRE, NORTH EAST ENGLAND
NAME: ANDY BENNETT
AGE: 49
JOB DESCRIPTION: AVIATION FIREFIGHTING TUTOR

How would you describe a typical course day at the academy?

My first task of the day is to make a coffee. Then I check my emails and my allocated course for the day, week, or longer, and pick up the course paperwork. If it is a new course, I carry out a welcome and introduction and enrol the delegates.

Most courses are a mix of practical and theoretical learning. If we are spending the day on the practical fireground, we arrive there at approximately 09.00 and leave around 16.00. If the course is on an exercise phase, we aim to fit in at least four exercises, complete with debriefs and feedback.

Once back in the office, I check my emails again, bring the paperwork up to date, and ensure that any incidents that need to be reported are passed on to my curriculum manager.

What is the best thing about being a fire instructor?

The diversity of the courses we deliver. From one week to the next, I might teach a course of men and women completely new to the profession, with the responsibility of using my experience and knowledge to mould them into professional firefighters. Then I might teach a revalidation course, which may include fire service professionals of an equal or more experienced standing. And, although I am an aviation fire and rescue tutor, I have experience in many other firefighting related fields, so I might also be called on to teach an offshore or industrial course, which present different ways of applying firefighting principles.

IFTC's Andy Bennett would like to see more emphasis on incident command and compartment fire behaviour training.

What is the main mistake you see students make?

New firefighters have to make a huge adjustment when they start training. They have to adjust their mindset from just looking after themselves to forming part of an effective team and focusing not only on the task in front of them, but on the people to either side of them. The main mistakes I see are made during this transitional process.

What should they be taught instead?

Firefighter training at the moment reflects the needs of the industry. A lot of liaison is carried out with airports and fire authorities to ensure that what is being taught is relevant to the working environment.

I would like to see more emphasis placed on two key areas: incident command and compartment fire behavioural training.

These two subjects are predominantly course-specific, however, with absorption of breathing apparatus control procedures into the incident command system, and the continued need for fire behavioural awareness, I believe associated training should be delivered more regularly across the experience range.

What do you see as the main strategic development in training?

There are a lot of strategic developments in training at the moment, and one of the main ones centres around breathing apparatus. UK BA guidance is changing, which is having an impact on procedures. As a training provider to the aviation rescue and firefighting services, IFTC has to be at the forefront of these changes and adopt the new procedures and equipment, such as telemetry.

Airfield fire appliances are also getting more and more advanced. High-reach extendable turret vehicles are being used in greater numbers worldwide. IFTC has been proactive in developing a training course that aims to improve skills and awareness when using this type of technology.

What is your favourite piece of equipment and why?

My favourite piece of equipment has to be breathing apparatus because of its importance in fire service operations, and the pleasure I derive from teaching BA procedures to delegates, especially new recruits.

I am the centre lead for compartment fire behavioural training, and the breathing apparatus set plays an important part in the sessions. It is amazing to see the confidence of my

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students grow in this environment thanks to this piece of equipment.

What sets your training academy apart from others?

We are in the fortunate position that we can burn hydrocarbon fuels such as aviation turbine fuel. A lot of training providers are only able to offer gaseous burns using LPGs. Although the gas burns do the job of simulating fire, they are more controlled and don't offer the same challenges or the realism of burning fuel.

We also offer a vast array of aviation, offshore and industrial simulators whereas other schools may only have one per sector.

What is your favourite quote when it comes to firefighting?

It's not so much a quote as the opening statement from a set of principles associated with training people to do a very dangerous job. People join the fire service with different attitudes and expectations, and it takes a particular mindset to want to do this job. Operations today are built upon dynamic risk assessment, so I always try to instil the first statement of those safety principles in my trainees: 'firefighters will take some risk to save saveable lives'. And there's the quote I use in regards to risk management: 'you own the risks'.

ORGANISATION: ROYAL NETHERLANDS AIR FORCE FIREFIGHTING TRAINING ACADEMY, SOUTH WEST NETHERLANDS
NAME: DENNIS VAN'T ENDE
AGE: 36
JOB DESCRIPTION: FIRE INSTRUCTOR AT THE WOENSDRECHT AIR FORCE BASE

How would you describe a typical course day at the academy?

There isn't really such a thing as a typical day at our fire and rescue training centre because we run such a wide array of courses.

The Woensdrecht Air Force base is where we train all our new recruits, as well as our commanders (lieutenants and captains) and our on-scene commanders. We specialise in aircraft firefighting and we have an aircraft fire trainer, fuel spills, an F16, and a helicopter to train on.

There are eight instructors on the base and we teach a lot of different classes. For example, we offer six-month training courses for firefighters covering EMS, fire, extraction, Hazmat, pumping, and aircraft firefighting, and one-year courses for crew commanders. We also train on-scene commanders in four-week courses using our virtual reality system ADMS.

In addition, the airfield crews keep up to date by training here for one day, twice a year, and the army and navy use the facilities for various training programmes – including helicopter firefighting and BA training for army Hazmat teams – as do the Belgium Air Force and the Swiss Air Force.

We also offer, amongst others things, team-building courses for military and civilian groups, cabin crew training for cabin crews and pilots, and education on our virtual training systems.

So, as you can see, there isn't such a thing as a typical day for an instructor here, which makes working at the fire and rescue training centre so interesting for me.

What is the best thing about being a fire instructor?

The opportunity to teach someone something new. And I also love the fact that we offer such a wide variety of courses, so as an instructor I never get bored – there is always something new to do.

As instructors, we also need to keep up to date on the courses we offer, develop new courses for aircraft firefighting, and review and improve course materials.

What is the main mistake you see students make?

Some of them think that becoming a firefighter is easy, but once they get all the course materials and realise how much is involved, they question whether they really need to know it all.

When we start training it is our job to make the trainees understand that the fire isn't the only thing in the room and that they also need to be aware of their surroundings. In The Netherlands we use a method called RSTV (Smoke – Flow – Temperature – Flames) for reading the smoke, the flow path, the temperature, and the flame front. This is a continuous process that all firefighters need to engage in when they go into fires.

Then there's the motivation of the people who become firefighters. In The Netherlands we have a saying that there are those who work at the fire department and those who are firefighters. There's a big difference between the two. Some people join to be with the fire department, and others are real firefighters.

What should they be taught instead?

In my view high schools have a major role to play here, and so do the job agencies. They need to educate young people

The Woensdrecht training base is where the Royal Netherlands Air Force trains all its new recruits and on-scene commanders, and the base specialises in aircraft firefighting.

on what it takes to become a firefighter and what that job actually entails.

What do you see as the main strategic development in training at the moment?

The switch from print books to e-learning. In The Netherlands we are moving over to e-learning so we need to prepare instructors for a different way of teaching. Our exam format is also going to change next year, and there will be more responsibility for the instructor.

What is your favourite piece of equipment and why?

The props we use for training, particularly the backdraft and flash-over containers. Enabling students to experience a good flash-over session or a big backdraft is one of the best aspects of my job. Our virtual reality training system is another favourite of mine because we need to be forward-looking and a virtual system makes training fast and efficient.

What sets your training academy apart from others?

We are military so our specific focus is aircraft firefighting. Our fireground is also very big – 62,500m^2. It has a structural trainer with 11 different burns inside, an aircraft fire trainer, an F16, a helicopter, and a fuel spill. Most of our burns are liquid propane so the fires burn very cleanly.

What is your favorite quote when it comes to firefighting?

It has to be our air force quote: 'One team, one task'.

ORGANISATION: NEWCASTLE INTERNATIONAL AIRPORT TRAINING CENTRE, NORTH EAST ENGLAND
NAME: GRAHAM REEVE
AGE: 47
JOB DESCRIPTION: FIREFIGHTING TRAINING INSTRUCTOR

How would you describe a typical course day at the academy?

Depending on the type of course, we usually prep our training venues the day before, so on the day we welcome our students and give them a hot drink before heading into the classroom. Here we complete the administration, conduct the introductions and do the safety briefing.

Then we cover PPE/RPE, carry out the pre-exercise briefing, and head out onto the fireground to conduct the exercises appropriate to the course.

After each exercise we have a debriefing session to enable all students to talk about their actions on the fireground with the instructors. Self-realisation within a structured debrief will reveal the learning points for each student.

After a break for a hot lunch, the students are ready for the afternoon session. Once this is complete, they leave the academy with a sense of achievement and we prepare for the following day.

Newcastle International Training Academy's aviation fire training courses recently became City and Guilds-accredited.

What is the best thing about being a fire instructor?

I've been in an instructional role in the fire and rescue service now for 15 years – just over half my career. Whatever course I teach, whether it is a recruit course, a promotional course, or a revalidation course, I always feel proud that the knowledge I have imparted to my delegates might one day save someone's life – and preserve theirs – if these skills are put into practice.

What is the main mistake you see students make?

Students make a wide variety of mistakes within the training environment. I prefer to call them learning or training points, as students can learn a lot from these training points during the debrief. Occasionally, the overwhelming size of some of the practical incidents can distract the students from the main objectives.

What should they be taught instead?

To look at the bigger picture and not just at what is in front of them. To look at what is happening all round and act on it in a safe, calculated manner, and to believe in themselves.

What do you see as the main strategic development in training at the moment?

I see the technological advances within the industry as key to the future of operations as well as training. HRET appliances, for example, are so much more effective when they are operated by highly skilled individuals who can use them to their full potential.

Additionally, recent legislation relating to training has changed the needs of our customers, and more bespoke training is now being provided alongside the standard industry courses.

What is your favourite piece of equipment and why?

The breathing apparatus. This piece of equipment has enabled me to carry out the main part of my job, both operationally and within the training environment. Using the BA I, can enter an otherwise irrespirable atmosphere. Historically, it has enabled firefighters to save many lives, proving without a doubt that it is a vital piece of equipment within fire and rescue services around the world.

What sets your training academy apart from others?

We are extremely fortunate to have a wealth of instructional experience. Full-time instructors from a range of fire service disciplines complement the operational instructors who do the job day in, day out. This combination ensures that our customers receive the best instruction from current fire officers who understand the issues they face.

At Newcastle we also pride ourselves on providing an extremely high level of customer service. Our customers benefit from fantastic food and accommodation at our partner hotel, the on-site Double Tree by Hilton. And our region itself provides an opportunity to relax and unwind after training – customers have excellent connectivity to a busy city, and the fantastic countryside and coastline is only a few miles away.

What is your favourite quote when it comes to firefighting?

'Courage is not living without fear; courage is being scared to death and doing the right thing anyway.'

ORGANISATION: JOVELLANOS TRAINING CENTRE, NORTH SPAIN
NAME: JAIME BLEYE
AGE: 40
JOB DESCRIPTION: NAUTICAL ENGINEER AND FIREFIGHTING INSTRUCTOR, SPECIALISING IN MARINE FIREFIGHTING AND LNG SAFETY AND EMERGENCY SPILL RESPONSE

How would you describe a typical course day at the academy?

Our usual schedule is from 08.00 to 15.00, but these hours are occasionally extended if required by a particular training action. We divide the day into theoretical and practical sessions. The theoretical part usually lasts for a couple of hours, then we have a coffee break before heading to the changing room, where we provide all the necessary PPE to the trainees. The practical drills can last over four hours and they can be exhausting, especially with extreme weather conditions, but this is undoubtedly the best part of the training.

What is the best thing about being a fire instructor?

Meeting people. It is enriching to keep in touch and share experiences and knowledge with others whose ambition in life is saving other people's lives. I am glad to say that I have had the chance to make many friends during my job as a fire instructor. At the end of the course some trainees thank me, and I always reply: 'Thanks to you – you and your attitude made it possible'. It is a source of satisfaction and an emotional moment for me.

What is the main mistake you see students make?

The main mistake is getting hung up on doing things in a certain way just because they have always been done that way.

What should they be taught instead?

We just try to teach the latest and best techniques. Firefighting equipment and firefighting techniques are continually evolving. Veteran firefighters are commonly more resistant to change, but we always give our students the chance to discuss any action during the debriefing exercise.

What do you see as the main strategic development in training at the moment?

We have identified a lack of specific training in marine firefighting for land-based firefighters. Apart from the MIRGs (Maritime Incident Response Groups) most firefighters don't know how to deal with a fire onboard a ship, and a ship on fire needs a completely different strategical and tactical approach from any other kind of fire.

Most of the Jovellanos Centre training instructors have a professional mariner background, so training firefighters in marine firefighting is one of our major achievements.

What is your favourite piece of equipment and why?

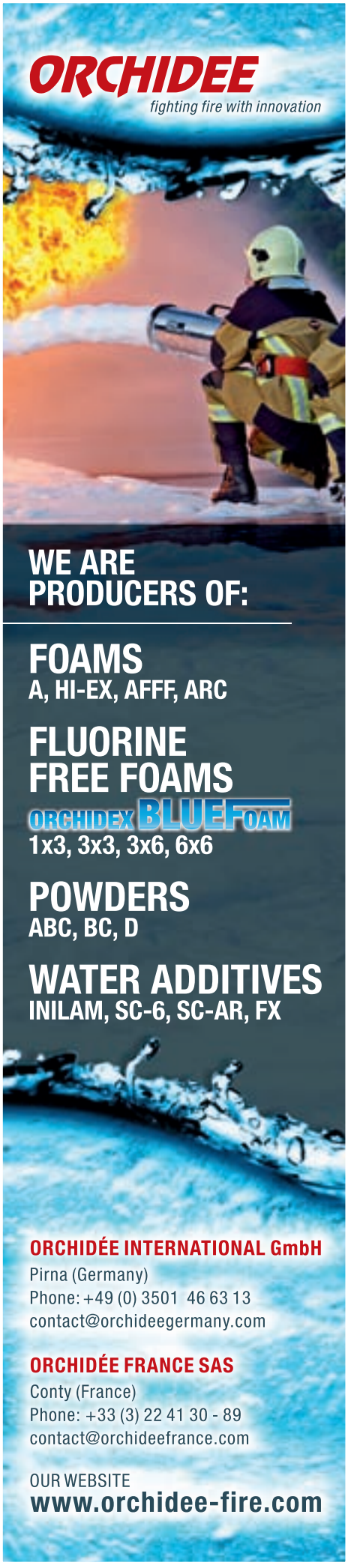
I think my favourite piece of equipment is the breathing apparatus, because I know when I wear the BA that I am prepared to deal with the fire. However, every single piece of fire equipment is important. I remember the first time I was inside an interior fire, and I realised that a good torch can be vital, and that the communication system must work properly. The truth is that it is not easy to choose one piece of equipment over another.

What sets your training academy apart from the others?

I know that I am working in a good academy, but when a firefighter with vast experience visits Jovellanos and tells you that we own the best fireground he has ever trained on – that's when you really realise and appreciate the kind of top academy you work at. It goes without saying, however, that our training is rather extensive because we cover LNG, LPG, marine firefighting, ARFF, dangerous goods, HUET, OPITO courses, GWO, and more. On top of that, our location in Gijón in the north of Spain is a beautiful seafaring city and a wonderful place to visit.

What is your favourite quote when it comes to firefighting?

'Train hard. Train as if your life depends on it, because it does.'



ORGANISATION: TRENTINO FIRE SCHOOL, NORTH ITALY
NAME: LUCA PARISI
AGE: 47
JOB DESCRIPTION: PROFESSIONAL FIREFIGHTER AND FIRE INSTRUCTOR

How would you describe a typical course day at the academy?

My role at the academy is to train new recruits and qualified firefighters about compartment fire behaviour.

In a typical day we welcome our trainees and explain the schedule and the safety measures that are in place. After that they change into their fire suits and we start with some nozzle training. Then we enter the cell – the compartment fire training rig.

Each instructor enters the cell with a team of two, and once inside we have four tasks. First the trainees have to go into a hostile environment, which is warm and dark. It is our role to ensure that the trainees are calm enough to move properly inside the space, and there we pull some tricks to increase stress levels.

Then we move to the second part of the cell, and the trainees have to explore the compartment, which includes a kitchen and a dining room. Then they have to go near the seat of the fire and describe it – flame colour, smoke, type of heat, and so on.

Finally, we cover air management. The trainees must continually check their air gauges on their breathing apparatus so they know how much air they have used up to reach that point, and can calculate how much longer they can remain inside in order to make a safe exit. Throughout the exercise we work to keep the trainees calm, oriented and focused on air management.

After exiting the cell, we perform a debriefing about what happened inside. This is a crucial step in driving home the concepts involved. The day ends with proper decontamination of PPE and SCBA equipment.

What is the best thing about being a fire instructor?

Seeing the spark of curiosity in my students and the will to improve.

I believe that we need to pass on the desire for change and improvement as well as knowledge to our trainees. We are not trying to create robots who respond the same way every time, but rather firefighters who think before they act, and if we can do this it means we have done a good job.

Luca Parisi believes that fires should only be fought from the inside once every other way of tackling the fire has been found to be ineffective.

What is the main mistake you see students make?

I think that the main mistake is wanting to know why everything happens on the fireground, but that's simply not possible. There are too many factors that contribute to the development of a fire event, so the only answer we can give is: 'the situation will vary at all times, keep that in mind at all costs'. When, as a firefighter, you understand this, you can change your approach to handle whatever happens in the best possible way.

What should they be taught instead?

Sometimes I think we can lose sight of our goals as instructors. For example, we may do something not because it is useful for our students, but because it is the way we have always done it. For example, why do we teach trainees to fight a fire from the inside before teaching them how to fight it from the outside? We know that smoke is toxic and carcinogenic, yet we continue to train recruits to fight fires from the inside before considering if we can fight them from outside. I think the instructor's own ego comes into play with some issues.

What do you see as the main strategic development in training at the moment?

Following on from my point above, I think we need to change the sequence of procedures during training as proposed by Lars Axelsson. At the moment, the stream of topics is as follows: *fire behaviour, fire suppression, interior attack, exterior attack, ventilation.* This reflects how we currently pass on knowledge, and this order is what will remain in the minds of our students. However, surely the correct sequence should be: *fire behaviour, fire suppression, exterior attack, ventilation, and interior attack* – we only enter the compartment after we have tried to fight the fire in another manner.

What is your favourite piece of equipment and why?

The branch, because when we start talking about nozzles, most of my students think they already know everything there is to know, but this isn't the case. They usually have a lack of fundamental knowledge, and sometimes they are so focused on other equipment that they forget about this tool. When I teach them how to use it properly, I am able to reinforce their basic knowledge.

What sets your training academy apart from others?

That's easy – we are the first training academy in Italy to use several carbonaceous internal fires. There are others, but these are smaller and use only one prop. We have different cells for class A internal fires and another for cold smoke training.

We started out around ten years ago and we travelled all over Europe to Sweden, Germany, France, Portugal, Belgium and Croatia to gain the necessary knowledge to safely conduct real fire scenarios. Now we have more than 30 certified instructors and we trained the Italian Air Force's instructors as well. Moreover, we can offer courses in German and English, and combine world-class real fire training with a beautiful local area.

What is your favourite quote when it comes to firefighting?

'Not hot to burn, but warm to inform'. It is not about showing our students how good we are, but providing them with the most useful environment in which to learn.

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The human factor

The learning strategies of andragogy are particularly effective for ARFF training, argues Eric Maranne from VR training provider Crise. He explains how, in combination with human factors, these principles can be incorporated into virtual reality systems that provide a truly comprehensive training approach.

Andragogy consists of learning strategies focused on adults. The approach is based on learner-constructed contracts or plans to guide learning experiences. It implies a more self-directed approach to learning, with a focus on real-life application and based on previous and acquired experience.

Andragogy has a few key principles (from Malcolm Knowles, 1984). These include a need to explain why specific things are being taught (eg, certain commands, functions, operations, etc.) Instruction should be task-orientated rather than based on memorisation, so learning activities should be in the context of common tasks and experience, including mistakes, to provide the basis for learning activities.

Adults are most interested in learning subjects that have immediate relevance to their job or personal life, therefore instruction should take into account the wide range of different backgrounds of learners, and learning materials and activities should allow for different levels/types of previous experience. Instruction requires helping trainees overcome inhibitions, behaviours, and beliefs about learning.

Using shared virtual reality simulation technology makes it possible to meet most of these goals, and it is the perfect tool for task orientation and interaction. If we take the example of the risks associated with the use of hydrogen fuel cells for aeroplane auxillary power units – a relatively new area where skills and understanding are currently lacking – the production of real-life, foreseeable problems related to H_2 use makes it possible for the learner to picture and then define why specific protocols, functions, operations, etc. are required.

Using VR, relevance and real-life relationships can be designed through the choice of environments, operational problems, and scenarios. The low cost of VR scenario creation makes it possible to provide a rich set of scenarios to fit learners' diverse experience as extensively as possible, including lessons learned and existing experience shared.

Finally, VR can provide training schemes ranging from single-user to full-blown multi-agency set ups. By providing a fresh approach to learning, this technology helps to overcome existing beliefs and inhibitions.

In the course, VR simulation is used in all compartments of training, including: orientation exercises; tabletop exercises; drills; functional exercises; preparation and after-action review of full-scale exercises; distance learning; dissemination; and, after training, periodic preparedness validation.

Orientation exercises are designed to guide the user towards a particular problem. This should be understood both as an explanation of 'why' it is necessary to train to H_2 specifics, and, in addition, as an orientation towards the different components of the proposed training course. Maintenance procedures, as well as relevant intervention strategies and tactics, can be explained, focusing on the 'why' rather than the 'how'.

Tabletop exercises are a low-stress way of stimulating discussion of a simulated event. Designed to expose the 'why' and 'how', discussion makes it possible to talk about issues in depth, in the context and experience of participants, and to make decisions using slow-paced, problem-solving methods. This process is driven by the instructor, in contrast to the spontaneous fast pace typical of actual or simulated emergency conditions.

Exercises are designed to support the participant in understanding the problem and the protocols, functions, and operations designed to deal with it. This enables the learner to understand how these protocols can fit into their everyday life and organisation. Constructive problem-solving classroom concepts are a direct application of tabletop approaches.

The purpose of a drill is to use repetition to instruct thoroughly. Through numerous drills, experience can be accumulated by participants and many diverse incidents can be presented to trainees. VR is used to provide shared operational exposure and understanding by demonstrating the interactive pacing of decisions, actions, and effects, and to sustain the drill action with spontaneous or planned events.

Functional exercises are used to train and evaluate the capabilities of an emergency response system. VR is used in much the same way as in drills, but scenarios are different and longer, making it possible to encompass a functional and command-wide systemic response. In these exercises, the participating teams are made up of both first responders and the associated tactical level command structure.

Full-scale exercises, performed on real infrastructures, are prepared on the VR system, improving the effectiveness of real ground training. After-action review is also performed on the VR system, reinforcing the ground training. The cognitive

Crise is pioneering the concept of using andragogy-based VR training for managing technical risks such as CT/CBRNe.

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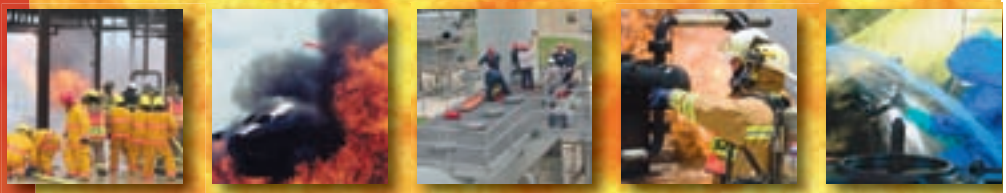

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TACTICAL LEVEL LEARNING AND TRAINING

Eric Maranne, MD of Crise, has a background in cognitive research.

French virtual training provider Crise is a specialist in tactical level learning and training frameworks. The company was set up in 1999 and its first training package was for wildfire management. Since then it has pioneered the concept of andragogy-based VR training for managing technical risks such as CT/CBRNe, and currently the company is focusing on using this approach for ARFF training.

MD Eric Maranne explains why andragogy-based training, which is a more hands-on, less didactic approach to learning, is particularly suited to emerging technologies. 'A good example is hydrogen fuel cell deployment for aeroplane APUs (auxiliary power units). Fire authorities and first responders have limited knowledge of these new technologies.'

This means, he says, that effective training must provide accurate up-to-date knowledge of hydrogen safety basics as well as ensuring that firefighters have the practical skills to handle potential incidents within FCH systems and infrastructure. Also important is learning how to protect the general public without putting lives at risk.

Hydrogen risks, Maranne explains, and the associated preconceptions that people have because of the Hindenburg fire, make this training a very interesting process. 'We have developed a curriculum for the ARFF market, which focuses specifically on this risk and includes the basics of hydrogen safety, first responders' procedures, and incident management expectations.'

representation of the events developed in the preceding steps can be taken into account by trainees to build a personal and shared representation of the operational context.

Finally, the simulator infrastructure enables Internet-based training. A web-based simulated radio infrastructure and web-enabled multiuser 3D interactive component enables distant trainees to perform drills or functional exercises for periodic preparedness checking.

This comprehensive approach to training is supported by the Crise training framework. It makes it possible to articulate the exercise efficiently and to take into account human factors.

Human factors

The science of human factors encompasses all the elements that affect performance, from the use of equipment to the psychology of decision making, situational awareness, team dynamics, leadership, and communication.

In an emergency organisation, performance depends on the effectiveness and speed of collective action, on the accuracy of collective situation assessment, and the effectiveness of implementation. Real-time observation and measurement of these is difficult without methodology and technology.

Based on concepts developed by Karl Weick [1] of 'enactment', 'loose coupling', 'sense-making', and 'mindfulness', the Crise framework embeds powerful tools of observation and the use of these key elements to evaluate adaptability, vulnerability, and control and mindfulness balance at organisation and team level.

Each trainee's view is tracked in real time. Meaningful objects placed in the 3D environment can be monitored for views, be it a hydrogen pipe, a victim, a fire or a tool. Individual sense-making begins with perception. Weak and strong signals coming out of 3D perception can be evaluated, and a trainee's observation frequency recorded. The results of these observations can be used to evaluate the incident evolution automatically, and are used to evaluate trainees' (and teams') progress.

The embedded radio communication infrastructure simulation makes it possible to monitor all radio exchanges. The analysis of these exchanges is rich: the size, rate, and flow data provide information on team dynamics and leadership. In addition, lexical recognition allows for evaluation of information spread. For example, when a victim is discovered by a trainee, it is possible to track the word 'victim' in radio exchanges to observe how well the situation is managed.

It is worth noting that these observations are coupled with a 'best practice path' when available. Effectiveness of implementation may sometimes be measured as the distance from this best practice path

Beyond the use of team-based, operational, and tactical VR training systems, human factors and andragogy principles can be used for efficient and resilient training in ARFF, and are specifically well suited to emerging new risks on airport platforms. Such coupling enables both efficient training and ensures resiliency in the training process itself. In turn, the feedback provided by the analysis of performance enables training organisations to improve their own resilience.

[1] *Karl Weick, 1988, Enacted sensemaking in crisis situation; 2007, Managing the unexpected: resilient performance in an age of uncertainty.*

Human factors and andradogy principles can be adopted for ARFF training.

Working together to enhance resilience

The *Resilience and Emergencies Series* project from Coventry University brings together leaders from the resilience community in both public and private sectors to explore some of the biggest challenges faced in the field, write Dr El Parker and Dr Katherine Lamb.

Breaking down the barriers between agencies involved in all phases of incident response is the key aim of Coventry University's year-long project into resilience and emergencies. In particular, the project is focusing on barriers during the pre-planning, response, and recovery phases, and seeks to gain a better understanding of the roles, responsibilities, and priorities of those involved, and to produce the most cohesive community response possible.

The series will focus on four key themes over the course of a year: emergency planning and response for public spaces; the future of resilient cities; issues for crowded places; and the challenges facing the emergency services in the 21st century.

There is a significant disconnect between the emergency response community, the private sector, and academic experts in this field. By working together and forming networks and alliances, the aim is to foster greater understanding of shared expectations. Through the utilisation of established joint learning and principles of best practice, the most efficient and cohesive response will be provided for the wider community.

The first event will focus on the impact of a major incident and prolonged emergency response on a public space. The interaction of the emergency services and the key roles played by the private sector throughout the simulated incident will be under the microscope.

All large corporate entities have a crisis response team, but how much training do these individuals get? Do they understand what the emergency responders will expect them

The project focuses on the barriers that are present during the pre-planning, response and recovery phases.

Event one, 8 March 2017. Operation: market place

Simulation technology will immerse delegates in the environment of a retail centre where they will learn how to deal with an everyday emergency that soon escalates into something more significant. Supported by emergency management practitioners, delegates will learn more about the interplay between the emergency services and the private sector in the vital early hours.

This is an interactive, dynamic, multi-agency crisis-response scenario, which will provide opportunities to observe, understand, and interact with emergency service personnel and key stakeholders throughout the incident. It will challenge conventional decision making and introduce some of the key topics for crisis management, continuity and emergency response.

Event two, 11 July 2017. Operation: safer cities

An exploration of the challenges for both community resilience and the role of critical national infrastructure in our communities, exploring the potential for resilient cities.

Event three, 20 September 2017. Operation: mass gatherings

This session considers the issues relating to crowd safety management and crowded places.

Event four, 9 November 2017. Operation: combined response – new threats and new technology

The demands on the UK's resilience practitioners are constantly evolving. Sector leaders will examine how these challenges can be approached.

To join us for the first free event, or to register your interest in future events in the Coventry University: Resilience and Emergencies Series, please email the authors (see page 25).

to do? Or the significance of their role in the resolution of both the dynamic and recovery phases of an incident?

It has been proven that greater understanding of these expectations and the familiarity of these managers with their crisis-response role, will better equip them to cope with an incident. This significantly shortens the impact duration on the community from political, economic, societal, technological, legal, and environmental ramifications.

This first event will demonstrate how systems, processes, and competencies founded within the emergency services can be applied to the private sector, to 'up-skill' individuals and equip them to perform their key roles during an incident. In particular, the decision making and command skills of these crisis managers will be explored.

The Effective Command methodology will also be demonstrated as a training and assessment process. The utilisation of a methodology grounded within the emergency response domain – its suitability and functionality has already been determined – will also lead to a commonality of language and a global understanding of the processes to be established.

The second event will focus on city resilience, building on the joint understanding and commonality of language explored in the first session. City resilience is defined as 'the capacity of a city (individuals, communities, institutions, businesses, and systems) to survive, adapt, and thrive no matter what kinds of chronic stresses or acute shocks they experience' (Rockefeller Foundation: 2013).

In the UK, urban planning and regeneration, economic drivers, sustainability agendas, and risk management often struggle to align and sometimes come into direct conflict. Cities experience many natural and human-induced pressures, from severe weather and flooding to terrorist attacks, which can lead to significant disruption, and at worst to cascading social impacts, economic loss, and extensive long-term physical damage.

Historically, urban risk management has focused on understanding the impact of specific hazards and taking appropriate measures to mitigate these risks. In recent years, the growing diversity of hazards, coupled with the increasing complexity of cities and the uncertainty associated with climate change, globalisation, and rapid urbanisation, has made building urban resilience into a critical agenda.

In order to build urban resilience, it is important for those involved to understand the complex interrelationship of physical, socio-economic and political factors that influence risk and its management through prevention and mitigation, co-ordinated organisational preparedness, response and recovery, and engaging with communities and business to facilitate preparedness.

From the Olympics to the January sales, crowds have become a significant part of the economic life of the UK. The third session considers issues relating to crowd safety management and crowded places, and in particular the management of large-scale, complex environments and audiences.

Events featuring large crowds face two very distinct threats: those posed by the volume of the crowd itself and its interaction within a constrained space, and the external threat, whether that be from something as straightforward as the weather, or as complex as those who see a malicious opportunity wherever large numbers of people are gathered.

The management of such events requires a range of skills. It is important that the people tasked with managing crowds understand the internal dynamics of the crowd and the implications for flows and density that the environment might bring. Alongside this, the speed with which a situation can evolve in a crowded place requires efficient, proactive management structures to ensure that appropriate decisions are made in what are often extremely limited timeframes.

Difficulties are compounded by issues such as the temporary infrastructure experienced at greenfield festival sites, the influence of social media on crowd behaviour, the likely psychological features of the crowd, and the use of large numbers of low-skilled security staff.

The fourth event will focus on new threats and new technology, and the impact of developments on the demands placed on the UK's resilience practitioners. The role of the emergency responders is constantly evolving. Sector leaders will examine how these challenges can be approached in a post-JESIP era.

Coventry University is well placed to deliver these sessions as it has an established portfolio of courses in disaster management and emergency planning, including certification courses, diplomas, degrees, and post-graduate qualifications. In addition, Coventry University has a full simulation centre. This is a unique facility for an academic institution and is the home of experiential learning at Coventry University. It has been used to support all levels of development or

The VR scenarios are created by a team of sector-component experts to ensure the full immersion of the participants.

assessment, from leadership in complex and high-risk situations to behavioural business process improvement to health and safety planning.

Within the centre, we create environments and situations using XVR virtual reality on a 12' curved screen, with nine individual rooms with integral CCTV, and an observation room that allows all the rooms to be remotely observed and the outcomes to be recorded. Work situations can be simulated on the screen with live interactions with actors/facilitators to create an authentic environment to enable 'learning by doing'.

The centre enables individuals and teams to experience, practice, and explore risks in a safe environment. The scenarios are created by a team of sector-component experts to ensure the full immersion of the participant. In this way, the simulations enable participants to test their actions and decisions, develop their response to situations, and apply their knowledge.

After the simulations, the participants receive feedback from the facilitation team, experienced observers and, if appropriate, from their colleagues. This combination of feedback, self-reflection, coaching, and personal observation allows the participant to review and scrutinise their actions, leading to personal improvement, behaviour change, and self-awareness.

Experiential learning is active, accelerated and rapidly absorbed, the learning is embedded and remembered long after the training is undertaken.

The Coventry University Resilience and Emergencies Series is supported by academics and practitioners, and each session immerses participants in a relevant scenario that makes full use of the simulation facilities at Coventry University.

ABOUT THE AUTHORS

Katherine Lamb

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 and for the last six years she has specialised in incident command and crisis decision making. In 2015 Dr Lamb 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 Dr Lamb: katherine@effectivecommand.org

Dr El Parker

Dr El Parker is the senior lecturer in disaster management at Coventry University, and has spent seven years as manager of undergraduate programmes in disaster management. She has conducted numerous research and consultancy projects associated with emergency and disaster management, with a particular focus on community adaptive resilience, communicating risk, developing networks (within and between agencies and communities) and emergency preparedness, sustainable post disaster recovery and reconstruction, increasingly focused on the urban context. Contact Dr Parker: cbx113@coventry.ac.uk

Connect, command

Interoperability is a key aim of emergency services around the world but one of the main challenges is the use of different communications systems. Canadian mobile communications provider Base Camp Connect believes it has a solution that could make interoperability easier. Lotte Debell reports.

When the Montreal Fire Department responded to a fire at the vacant Queen Elizabeth Hotel in downtown Montreal in September 2016, the fire service used Base Camp Connect's system to set up its mobile command post to support the operations of the incident commander.

Around 50 firefighters responded to the incident, which was caused by a fire in the ventilation ducts. The incident commander and command staff were all connected via telephone to the mobile command base using the Base Camp Connect system.

This command vehicle, explains Montreal Fire Department's division chief J Gordon Routley, is used at all major incidents in Montreal and provides the communications link to the outside world from the scene of an incident. 'It supports our on-scene communications, provides us with access to all our databases, all our mapping, our ''pre-fire'' plans, and all of the computer systems of the city. It also provides us with hazardous material information and any other data that we might need to support the operations at the scene of a fire or any kind of major emergency,' says Routley.

Crucially, it also links the fire service personnel with each other and their commander, and also with other emergency services, regardless of the different systems that might be in use. And it does this without the need for complicated set up or even a technician.

'We believe that Base Camp Connect is the only system that allows true interoperability between existing equipment and technologies for voice, data and radio,' says JP Grondin, CEO at Base Camp Connect. 'The system takes in many networks – landlines, cell networks, satellite networks, and radio networks – and brings these together in a single system with a single inbound number.'

Base Camp has three components: voice, data, and radio. These can be used independently or in combination to connect first responders within an organisation or with other organisations, towns, districts or private corporations. The system is rack-mounted in the Montreal mobile command post, but it is also possible to use a mobile version. This means that when leaving the MCP, Base Camp Connect is already connected and instantly provides telephone capability, Internet access and radio interoperability.

'In an emergency, people come together from different emergency services such as the police, fire, and ambulance, as well as different geographical regions and private organisations, and these are often using different technology systems,' says Francis Raveneau, VP of sales. 'Some may use cells, others radios, and they can be on different platforms that

The Base Camp Connect system consists of three components: voice, data and radio.

can't all interconnect. This is where Base Camp Connect comes in.'

Kevin Scallen, chief engineer, explains that the system will work with any available networks to provide voice access to users. 'Landlines are simple – just connect, and you're good to go. With cells, you can insert up to 20 sim cards into the back of the system to provide access – we recommend using at least two different networks in case one fails – and you can also insert a radio repeater and any mobile or portable radio. You also have the option of linking a satellite dish to the system.'

Once you have access, it works like an office system. There is one inbound number that everyone can use, regardless of their communication tool and their location.

These days, access to the Internet is just as important as voice communications, and so Base Camp Connect can provide data access in a variety of ways, much as it does with voice. Available networks can be connected to the system or, if available, wifi can be used to provide users with data. And, if the emergency is in a remote location where there are no data networks, a satellite antenna can be used to connect to the Internet.

'We can also provide wired and wireless connections that require passwords to provide secured communications,' says Scallen. 'And, to ensure that users can work without interruption, the system will automatically cascade available networks to keep everyone connected. So, for example, if an LTE network fails, the system will fall back to the next LTE network. If that also fails, it will defer to the satellite network.'

Finally, the system helps to bridge the many different radio technologies in use by today's emergency services, from UHF to VHF, and P25 to Tetra. 'The system has a module for the interoperability of radios that can accommodate up to ten different systems as a plug and play option. It also provides a seamless option for group calls. And, since radios are connected via Base Camp Connect, they become an extension of the phone system. This means that someone can dial the inbound number for voice and a preconfigured extension number for radio, and reach everyone on the radio on the interoperable channels.'

This might sound complicated to set up and use, but the opposite is true, argues Francis Raveneau, who says the system can be up and running within five minutes, and can be operated without specialist training.

Montreal Fire Department had the system installed in its new command vehicle in 2015, replacing technology that was 20 years old. Ensuring that it is as easy to use as possible has been key, says division chief Routley. 'We wanted it to be seamless for everyone who works at the command post so they don't have to have any real technical expertise. We bring the communications and technology to them and it is ready to use. This way, a small team can provide communications even at large scale events.'

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Holistic training philosophy

One of the most advanced firefighting training and research facilities in the world is due to open in The Netherlands in 2018. Robbert van der Veen, general director of Falck, explains the ambitious, high-tech plans for the new site of the Falck Fire Academy. Ann-Marie Knegt reports.

Falck first opened its training centre in 1985 in the Port of Rotterdam. In 1998 the academy had to move to make space for a large industrial facility, and now history is repeating itself. A large oil storage terminal company is expanding and requires a deep harbour, and the current facility operated by Falck Fire Academy is blocking the access to the water.

Falck has sent an open invitation to industry to help provide the best possible occupational health standards.

This presented the academy with a golden opportunity, says general director Robbert Van der Veen. Since it had to move anyway, why not take all the knowledge and experience that the company had gained over the last 30 years and use it to create a brand new, high-tech training and research centre that sets international standards?

Van der Veen explains that the Falck Fire Academy takes a holistic approach to risk assessment, prevention, and the safety of students and their organisations. This approach addresses the full safety cycle, which consists of: safety policy, prevention, preparation, intervention, and aftercare.

'This way of thinking needs to be represented in our new training centre,' he explains.

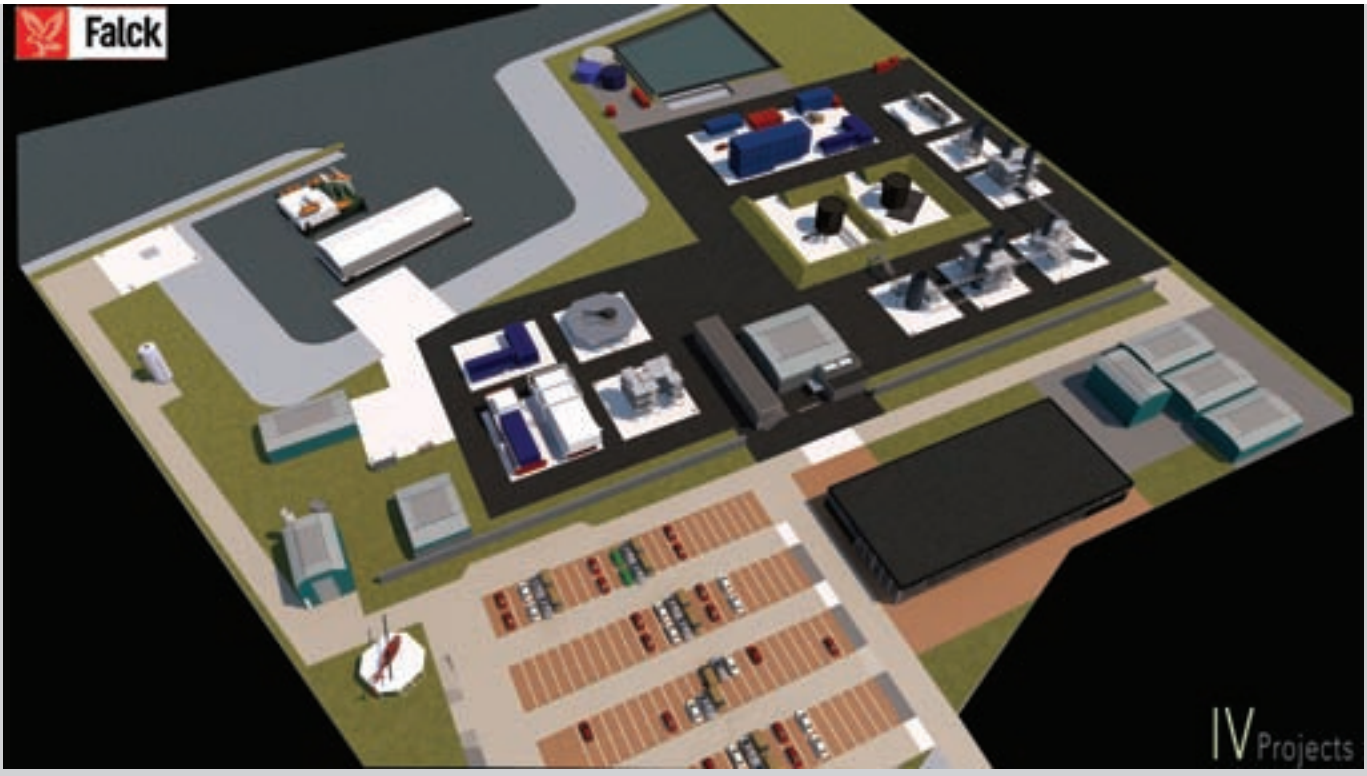
A key element of the new academy is an increased focus on safety, driven by the greater awareness that now exists of the damaging effects of firefighting on human health. This includes occupational health.

'We are creating additional emphasis on clean and dirty spaces, and logistical routes will be defined by safety for our students and instructors,' explains Van der Veen.

'We asked ourselves how to position training objects in the most advantageous manner with regards to wind direction and smoke paths, and considered how other simulators and props should be placed where smoke development is not an issue. At the same time, we have invested heavily in special ventilation systems for our high-rise prop as well as our evaluation rooms.'

The academy is backing up its desire to ensure the safety of students and instructors by making a hefty investment in procedures and services. These include providing students with clean kit twice a day and establishing the right containment and cleaning procedures for PPE and equipment. However, in order to maintain its focus on its key activity, namely training, Van der Veen explains that the academy is looking to outsource a number of services, including the provision, management, and cleaning of firefighting PPE.

'We are sending an open invitation to the industry to present us with innovative and modern ideas for how we can create the best possible occupational health standards. At the same time, we are also looking for new equipment ideas. The Falck Fire Academy would like to cooperate with multiple commercial parties and outsource aspects of the operation



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Falk Fire Academy's general director Robbert Van der Veen has ambitious plans for the new training school.

over the next year or so. In this manner, we will be able to achieve the best possible experience for our students, as well as our instructors and other staff.'

Falck Fire Academy will receive the keys to the future site in September 2017, and aims to have the new training facility operational on 1 March 2018. The old exercising ground should have been mostly broken down by then, but Van der Veen expects that about 25% of the training objects from the old ground will be reused.

These include the wind turbine prop, several storage containers, the helideck, the LNG simulator, and several maritime training props that were added for the 2010 Manilla Amendments to the Standards of Training, Certification and Watchkeeping for Seafarers (STCW), which standardised training requirements for maritime staff.

However, most of the internal props and simulators will be replaced, and the new designs will underscore the principle of modern occupational health.

The second key principle that the Falck Fire Academy will be applying to the new academy is the integration of virtual reality into its training scenarios.

'We will be exploring how to implement VR and practical training and how you can use these in combination with each other,' explains Van der Veen. 'We have found that the higher levels of training, such as incident command, work very well with VR, while the more basic skills training will take place on a practical level on the fireground. Our aim is to bring practical and VR training together into a total immersion experience – one that feels real to the student.'

Currently, Falck is still researching how it will integrate VR into its new academy. The options under consideration include the combination of on and offshore control rooms with a fully adapted VR room complete with big screens and all the right controls, and/or Oculus headsets.

For the first time, the new academy will also include a focus on scientific research, with the addition of an on-site laboratory where the company will conduct small-scale cryogenic research, including storage tank firefighting scenarios, compartment fire behaviour, and other relevant firefighting and high-hazard disciplines.

'Our core business will still be training,' says Van der Veen, 'but we are going to devote about 20% of our time to carrying out research that will focus on the most efficient way to transfer knowledge.'

Falck is also designing a state-of-the-art water filtering and reclamation system for the new facility. Many clients from industrial plants have requested to carry out exercises with their own firefighting foam, and are asking for a more realistic training environment that mimics their own industrial plants and the equipment they work with.

Van der Veen has had plans drawn up in which pipelines and other industrial features are connected above and below ground in an exact copy of a modern industrial plant. All simulators will be controlled from a central room, where the fires can be managed automatically to simulate the way a specific fuel or gas would behave.

The Falck Fire Academy's focus on large scenario fire training will also be taken a step further, adds Van der Veen. The building of two large oil storage tank simulators with surrounding bunds will be a major attraction for clients from all over the world, and will make it possible to re-enact a major storage tank fire.

A lot of time has been spent talking to customers to gain a thorough understanding of their requirements, and Van der Veen has seen a development towards a 'train the trainer' philosophy in the high-risk industry and public fire services.

'Obviously, every refinery or other high-risk organisation has to have a safety team, and that team needs to maintain high training standards,' he says. 'As a result, we are seeing a growing number of international clients here at the Maasvlakte site, and we are increasingly finding that these clients are choosing to carry out the basic training at home, and are then coming here for the advanced exercises. The knowledge they gain from these exercises is then relayed to their peers on their return.'

While this at-home training can take place with or without mobile training systems, or at existing domestic training centres, Van der Veen says more and more incident commanders and senior level officers are attending the Falck Fire Academy. 'As a result we have been specialising in complex scenarios that are interesting for our target audience, and which could not be simulated at a domestic facility.'

The classroom facilities at the current training centre are now 20 years old, so the new location means brand new classrooms with the latest educational features, including flat screens and other modern comforts, all designed with the 'experience' philosophy in mind.

Accreditation is another thing that is very much at the forefront of the plans. 'We have looked at the international standards we need to apply while still maintaining an innovative approach,' he explains. 'The three key elements of our core business are safety, quality, and reality. Right now we have a unique opportunity to create a training and research centre where instructors work alongside consultants, and where we can really focus on our clients by offering major incident training. When you have both a consultant and an instructor in front of a classroom, you get a much more holistic perspective, and a better cross fertilisation between concepts on paper and the application in practice.'

Van der Veen is extremely excited about the opening of the new training centre. 'We aim to create a totally immersive training experience, which will set a new safety standard for the whole industry across the globe.'

FIVE-DAY FOAM SCHOOL FROM TRAINING SPECIALIST H2K IN ASSOCIATION WITH FOAM MANUFACTURER DR STHAMER-HAMBURG

The JOIFF-accredited course is designed for personnel responsible for emergency response involving large-scale flammable liquid firefighting, as well as insurance company employees and fire engineers who want to gain an insight into fixed and mobile foam systems. It will take place from March 27-31, 2017, at CNPP in Vernon, France.

The five-day foam school will offer a blend of theoretical and practical sessions, including workshops, demonstrations, and practical firefighting. It will cover a number of key areas, including the latest developments and insights into foam systems, firefighting foams and polar solvents, and the relevant standards for foam and foam systems.

These include NFPA 11, the standard for low, medium, and high-expansion foam; EN 1568, for fire-extinguishing media, foam concentrates, and the specification for low-expansion foam concentrates for surface application to water-immiscible liquids; and EN 13565, for fixed firefighting systems, foam systems, and their design and construction and maintenance.

The course will also focus on foam selection, including testing, rating, storage, and stability, and international standards. It will cover fluoro-free foam concentrates, C6 foam concentrates, legislation and good practice.

On a practical level, the course will tackle incident scenarios at atmospheric tanks and bunded areas, lessons learned, demos of firefighting response with fixed foam systems, and practical training.

The practical side of the training will include training with an on-site tank fire; fire in a bunded area; on-site tank fire; hydrocarbon jet fires; and a large-scale ethanol pool fire.

INTEGRATED FIRE SAFETY OF IBCS AND INTERMODALS

This three-day integrated fire safety course will take place from 11-13 April, 2017, at Spinel Safety Centre in Dordrecht, the Netherlands.

The training is aimed at people with direct or indirect responsibility for the identification of credible incidents and the control of risks associated with incidents involving intermediate bulk containers with flammable and combustible liquids, and intermodal containers containing hazardous materials.

NFPA codes and standards 11, 15, 16 and 30 will be referenced throughout the JOIFF-accredited course, which will include subjects that range from the design and construction of warehouses and outside storage facilities for IBCs to (semi)-fixed fire extinguishing systems, and the identification of credible incident scenarios with IBCs and intermodals containing hazardous materials.

The course will feature intermodals for UN class 3 to demonstrate safety provisions for the tank container, and will cover behaviour in composite IBCs during fire exposure, as well as the behaviour of flammable liquids during a fire when firefighting foam is applied.

Credible scenarios involving IBCs and intermodal containers containing hazardous material of UN transport classes 2, 3, 4.1, 4.2, 4.3, 5.1, 5.2, 6, 8 and 9 will be discussed in detail during the three-day training course, which will be organised from a performance-based perspective.

Among the instructors will be Peter de Roos of H2K and Jeanne van Buren of Marsh Risk Consulting.

Key trends in PPE

A firefighter's PPE is one of their most essential pieces of kit, and without it they would be unable to perform their role. *Fire & Rescue* asked two major PPE manufacturers to highlight what they see as the key trends in PPE design and manufacture, and where they believe this is heading in the future.

Richard Ballheimer, technical director, Ballyclare.

Richard Ballheimer, technical director at Ballyclare, sees design and fit playing an increasingly important role in the development of PPE moving forwards.

'Firefighter PPE has been providing very high levels of protection for the last 15-20 years, but that is no longer enough,' he says. 'Usability and ergonomics now play a vital role in protective clothing, and PPE manufacturers like ourselves must seek to minimise the discomfort caused by these garments when they are used in the extreme conditions that firefighters face.'

The challenge for manufacturers is to provide increasing levels of protection and reliability from kit that is more comfortable to wear, explains Ballheimer, and the use of increasingly lighter weight assemblies is, he believes, the key to achieving this. 'Clever design can allow bulk to be reduced or removed from some areas of a garment, and this can help to make the garments more comfortable to wear.'

Ballheimer believes that PPE manufacturers need to look beyond their field if they want to address this need properly – it is no longer enough to simply take an existing range of garments and develop them to meet the changing requirements of their customers. In short, he says, it is time for a revolution in manufacturers' approaches.

Ballyclare put this idea into practice with its latest collection, Xenon. 'During the design process we went back to first principles and looked at the way high quality sportswear and outdoor clothing is designed and manufactured. We learned lessons from that, and built them into the way we approached the design and manufacturing processes. We also spoke with numerous fire and rescue services to get end users' perspectives of their PPE requirements, and carried out a survey of over 1,000 firefighters.'

A focus on design is also important, adds Ballheimer, because firefighters' roles are changing so much and their PPE needs to reflect this. In some cases, he points out, modern community fire team initiatives mean firefighters are spending less time attending fires and more time attending other emergencies such as road traffic collisions.

'These other activities are changing the way that PPE is used and the demands that are placed on it. Fire services have limited budgets, and also a limit to the amount of PPE they can carry on board an appliance, so the PPE they do use must be designed to be much more versatile. This requirement for flexibility is going to increasingly shape the way PPE evolves in the future.'

And there are other challenges that firefighters are now facing that have implications for design. A major current concern is the contamination of PPE, particularly where carcinogens and other harmful substances are involved. These dangerous materials need to be cleaned away thoroughly and reliably, and the design of modern PPE is changing accordingly.

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Ballyclare is increasingly using heat-applied reflective strips as this eliminates crevasses where harmful particles can hide.

Small details can be especially important here, says Ballheimer. 'For example, Ballyclare is now increasingly using heat-applied reflective strips on garments as this eliminates crevasses where harmful particles can hide during the cleaning process. Velcro fastenings have a similar potential to trap particles, so we use this sparingly and cover Velcro fastenings where possible to limit contamination.'

To deal with potential contamination, and to ensure that PPE provides the maximum protection for as long as possible, regular cleaning and maintenance is essential. This is an area that the European fire standards community has been working hard to improve in recent years, says Ballheimer.

'The onus is on manufacturers to offer care and maintenance services that are thorough, reliable, and tailored to the customer's individual needs. Where manufacturers use laundry partners, they must carry out regular in-service testing of the PPE, and thorough verifications of the cleaning and maintenance programmes, to ensure that it is as reliable and effective as possible.'

Standards themselves obviously have an impact on design, and the development of standards is another area that has been impacted by the changing pressures on fire services, says Ballheimer.

'Everybody involved in setting modern standards has a genuine and very keen desire to see that standards keep pace with the ever-changing realities of modern firefighting, but more can always be done in this area to improve the standards and keep them up to date. Unfortunately, the reality is that firefighters who are involved with standards have less and less time to devote to this, and I believe it would be a great boost to the process if they could be more involved.'

In order to help alleviate this situation, some manufacturers such as Ballyclare make it a matter of policy to canvas as much direct feedback from customers as possible. This feedback filters back into way they design PPE, and eventually, back into the process of developing modern standards. Ballyclare plays an active role in the development of international, European, and UK standards.

So what does Ballheimer think the future holds for PPE? Well, he believes that the direction in which firefighters' roles are already changing, and could continue to change, is going to have a significant impact one way or another.

In the UK, the fire service landscape is one of rapid change, and a prominent theme is one of bringing the different emergency services closer together. 'In the future, this could well lead to many current fire service activities being absorbed by ''community responders'' who fulfil many different roles. If that's the case, the demands placed on PPE to cope with a whole range of situations mean that it will have to change significantly,' he says.

'Changes in firefighting tactics will also have an influence on PPE. As technology develops and comes to play a more prominent role in fighting fires, fewer people may be required to enter burning buildings. While the protection levels they require will probably increase, there may be less demand for the specific types of PPE they require.'

And this will, in turn, mean new challenges for manufacturers, who will have to ensure that the garments they produce, and the way they produce them, evolve with the people who wear them.

Roger Startin, joint managing director at Bristol Uniforms.

Roger Startin, joint managing director at Bristol Uniforms, says the last decade has seen significant changes in PPE, with manufacturers striving to produce more lightweight and flexible solutions to suit the ever-evolving role of firefighters across the globe.

Furthermore, he points out that it is not just the role of firefighters that is changing. Manufacturers also need to take into account the fact that the roles, and therefore the requirements, of fire services in different parts of the world vary greatly. Each has its own unique circumstances and challenges to deal with, from type of fire to local landscape and climate conditions.

'Firefighters in Australia and the USA are more likely to face wildland fires, whilst in the Middle East, firefighters deal more regularly with transport-related fires involving hazardous materials,' explains Startin. 'In many European countries, less than 10% of call-outs are fire related, with firefighters much more likely to have to deal with traffic accidents, medical emergencies, public unrest or flooding.'

As a result, manufacturers like Bristol are developing a wide variety of options to suit particular environments and operations. 'Customers want to be able to tailor their PPE. They want to choose fabrics and colours, and to have the option of detachable linings, knee and elbow reinforcements, integrated safety harnesses, and drag rescue devices, for example. By offering diversity and choice we can give our customers a bespoke solution that is right for them.'

This desire for choice, coupled with the increasing diversity in the firefighter's role, is not without its challenges, he adds. 'The biggest challenge we face as manufacturers is the need to design PPE that satisfies an increasingly complex criteria. Effective PPE needs to protect firefighters from radiated heat, flame lick, and occasional flashovers. It must also stop water ingress, whilst at the same time being permeable to help combat heat stress.'

Startin explains that collaborative research and

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development programmes with key fibre and fabric suppliers such as DuPont, PBI, WL Gore, and Hainsworth, have meant that lightweight, more flexible PPE solutions have emerged over the last decade, which not only offer resistance to fire, but also increased breathability, manoeuvrability, and moisture control.

And this is important, says Startin, because selecting the right fabric is key to providing optimum protection for specific environments. The design and style of a garment also plays a crucial role in contributing to a firefighters' safety. Whether operating in bushland, floods, on the roadside, or in extremely cold conditions, firefighters need to be suitably protected.

'In response, we have moved away from the traditional one-style-suits-all approach. Bristol was the first PPE manufacturer to introduce a new layered approach called Layerflex, which uses a set of three garments. Layering is particularly useful when a fire service is faced with a range of operations requiring different levels of protection.'

Conversely, manufacturers are also developing innovative tailored solutions for more specific applications such as Urban Search and Rescue (USAR) and forest and wildfire operations. 'Our Rescueflex range meets the specific needs of USAR and technical rescue teams worldwide as it is lightweight, flexible, and tough, and provides protection against blood-borne pathogens,' says Startin.

'Similarly, we have developed a range of Wildland garments, which provide protection against radiant heat, and sharp thorns and undergrowth.'

Layerflex consists of a set of three garments, helping firefighters remain comfortable during any type of scenario.

To cover the new types of PPE coming to the market, new standards are being introduced. For example, EN16689 for technical rescue PPE has just been approved for publication, with an ISO18639 standard soon to follow.

'There is a huge amount of work being done internationally to revise and update existing standards, which ensures standards move with the times, are fit for purpose, and adequately protect those on the front line,' says Startin. This includes the streamlining of existing standards.

'For example, EN15614 for wildland PPE is being revised along with ISO 15384 under a Vienna Agreement. If successful, this will be named EN ISO15384, simplifying things into one international standard. Also, in recognition of the fact that fire services want fully integrated and compatible PPE, standards are being introduced that cover the whole ensemble, including the recently published ISO11999: PPE for firefighters, which has ten parts.'

The increasing complexity of firefighter kit might explain another growing trend in this sector – the preference among FRS for after-sales care packages from their manufacturers. These involve the collection, cleaning, inspection, repair and return of garments.

'In the UK, Bristol manages the whole process in-house at our specialist service centres in Bristol and Rainham,' explains Startin. 'Many of our distributors in Spain, Slovenia, Netherlands, Australia, and Finland also now offer maintenance services, as the importance of regular cleaning and repair of PPE becomes better recognised and understood. By handing over the care and maintenance of garments to a specialist manufacturer, firefighters can be confident that their kit will continue to protect and perform to the required standards.'

But this is an area that is itself undergoing changes that may impact the development and care of PPE in the future. Currently, Startin says, the majority of FRSs in the UK have their kit cleaned annually, however, in Scandinavian countries it is cleaned much more regularly. 'We envisage more and more countries adopting the Scandinavian approach as contamination and its potential link to cancer will be at the top of the agenda in the fire service for some time. As more studies are undertaken, there will be discussions about how best to mitigate the risks posed by contamination, and this will throw up its own set of challenges for industry. For example, we are looking at the integration of accessories to provide greater protection from contamination and water ingress. And, of course, R&D will continue in other areas as manufacturers work towards making kit ever lighter and more comfortable.'

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A highlight of innovation

A new product that enhances the visibility of firefighters in smoke-filled environments has been developed by Netherlands-based Retroflex. MD Allart Scholts tells Ann-Marie Knegt why he believes his latest product will save lives.

Retroflex has a history of raising the bar for retroreflective tapes. In 2015 the company launched Cofab91-AR, a triple-trim, fire-retardant retroreflective strip designed specifically for use by fire brigades and offshore applications that can withstand up to 100 washes.

Based on the needs of wearers, Cofab91 majors on durability and ergonomic design. Made from a fluorescent meta-aramid with ripstop para-aramid support, it is lightweight, flexible and extremely strong. An even lighter and more flexible version is available in the form of a perforated product, Cofab91-AR P.

Cofab is a glass-bead tape based on a similar material to bullet proof vests. It is tested and certified to all European standards for visibility, flame retardance, and washing, including EN ISO20471, EN 469:index 3, and ISO 14116:2008.

Cofab91 can be washed at home as well as in an industrial manner at temperatures between 40 and 75ºC. It was initially certified for 50 wash cycles, and subsequent certification to 100 washes according to ISO6330 has now been finalised.

'It's the only triple trim on the market that can currently make this claim,' says Scholts. 'Wash performance is extremely important in the fire sector. It is also resistant to wear and tear because it moves with the garments. '

And finally, Cofab91 offers another advantage – cost. 'Because we manufacture our own material, we have full control over quality and we can assure the lowest price.'

Bristol Uniforms is already using Cofab91 in its garments and joint MD Ian Mitchell confirms that the tape is highly durable, even after excessive wear. 'We really see the added value for our turnout gear from using this product. It is flexible, lightweight and offers excellent breathability.'

In addition to Bristol Uniforms, Retroflex works with some of the largest equipment manufacturers in Europe. In the Netherlands, the majority of the Dutch fire service uses a Retroflex product, and the products are also popular in Germany and France, where Cofab91 was recently selected as the winning design of the UGAP tender for firefighters.

However, it is not only Cofab91 that has Scholts really excited. Retroflex has recently launched a completely new product that he believes has genuinely life-saving potential.

Flexphor is something new in the reflective trim market – so new, in fact, that the company sees scope to develop a new standard to cover this type of product.

Flexphor is designed to enhance visibility in environments where there is little or no incoming light, or smoke-filled environments that inhibit the performance of traditional tape. 'We want to ensure that firefighters are visible in any situation, and we're aware that in dense smoke, retro-reflection alone simply doesn't work,' explains Scholts. 'Flexphor can reduce the time it takes to find firefighters in the darkness.'

Like Cofab91 AR, Flexphor is made from a meta-aramid with a ripstop para-aramid, but unlike Cofab91 it is coated with a photoluminescent mineral that absorbs light. A short period exposed to light will 'charge' the tape, which then produces a glow that can last up to an hour.

Flexphor has been certified and tested by the testing institute Aitex for use by firefighters. The company is now in discussion with PPE manufacturers about incorporating Flexphor into FR operational kits. Bristol Uniforms is one of these, and the company has some trials in progress. 'We think its added features could make a real difference in keeping firefighters safe,' says Ian Mitchell.

'I am very proud of what we have created,' says Scholts. 'I believe it has the potential to save many lives.'

Flexphor has been designed to make firefighters visible in environments with little or no light, such as smoke-filled compartments.

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Changes in tactical ventilation

New research into fire behaviour is changing current thinking on the use of ventilation. Supervac's Roger Weinmeister reports on the latest strategies for effective tactical ventilation.

The use of ventilation on the firegound is changing. New concepts, studies, practices, and equipment have emerged in recent years that have impacted the way ventilation is used, and together these represent the maturing of the ventilation process. Now more than ever, it is finely tuned to the safety of both firefighters and potential victims.

As some departments have standard operating procedures on ventilation that were written over a decade ago, this is a good time to review these to reflect current best practices.

The most important step in establishing ventilation protocols is to review the latest body of work, and this includes studies and processes from outside your state, province, and even your country. This is especially important if you are one of the leading departments in your area – to keep moving forward requires the consideration of ideas from outside your organisation.

While some of these can be incorporated without modification, many will need to be adjusted to work with your specific circumstances, and there are many talented fire experts around the world that can help you adjust your approach.

Ventilation is mainly used in compartment fires. Most compartment fires will be O_2-limited (O2L) by the time you arrive at the scene. This is due to the nature of modern fuel loads and energy efficient building practices. With the increased use of man-made fabrics and cushioning in furniture, fire growth is greatly accelerated, while to minimise energy use in structures, the sealing to outside leakage in modern structures is very tight.

If the fire is oxygen-limited when you arrive, you should not change that until all your extinguishing tactics are at the ready. Otherwise, the benefit of releasing smoke works for a very short time, followed by a much more serious flashover situation.

It is strongly recommended that the first fire units do not leave the front door open. They should wait until they are ready to start a transitional attack (applying water or a fire extinguisher from the outside). By limiting the O_2 available to the fire, you have a chance to re-set the fire to a non-O2L state. This allows your tactics to consistently minimise fire damage. If you repeatedly open the front door to assess the fire's progress, you are contributing to fire growth.

A noteworthy recent study on positive pressure ventilation (PPV) has been carried out by Underwriters Laboratory [1]. The authors Stephen Kerber and Robin Zevotek carried out an extremely thorough and technical evaluation of PPV in a more controlled manner to any other study to date. Among their findings was an examination of the relative pressure differences caused by the fire compared to that caused by a typical fan, with the conclusion that using PPV prior to fire knock down (some call this positive pressure attack or PPA), will accelerate the fire. This is due to a flowpath being created in the doorway leading to the fire room – the fan will increase the fresh air coming in low while the pressure from the fire will force smoke out high.

It should be noted that this process occurs even with substantial exit openings. These flow paths are extremely dangerous. Your crews should wait until they have applied at least some water prior to ventilation in an O2L fire.

Another important result of the testing was that the larger the exit opening, the better for effective PPV. The authors discovered that bigger is far better due in part to the pressures created by the fire itself. This result is consistent with actual fireground performance, and helps to eliminate some early concepts of smaller exhaust openings in structures with many small rooms.

Top: a smoke-blocking device that eliminates the need for a firefighter at the door. Below: Supervac's Valor PPV fan.

Picture 3

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A team practises a wind-impacted event in training before facing it on the fireground.

More pioneering work on the study of fire behavior and flow paths has been carried out by Joe Starnes and his Kill The Flashover team (KTF) [2]. One of their most significant ideas concerns the way in which firefighters are trained, and deserves some discussion.

Most training is carried out with pallets in a burn room. While this is effective for many things, it is counterproductive for ventilation training because it does not create an O2L fire, and is usually attacked and extinguished in the free-burning stage. The ventilation takes place after the fire is knocked down to reset the room for the next training evolution.

KTF studies have focused on modern, synthetic fuels that have been allowed to progress to the O2L stage. They have found that ventilation too early in the process can create a flow path that is much more dangerous to the firefighting teams.

There are a few possible solutions to minimise the exposure of fire crews to the dangers of the flow path. Some of the early National Institute of Standards and Technology and UL work has suggested leaving a person at the entry. This works well but has a few limitations – including taking a firefighter from other duties – and can still create a path for smoke as the hoseline prevents the door from closing fully.

An elegant solution has come from Dr Michael Reick, a German chief fire officer. He has invented a smoke-blocking device [3] that eliminates the need for a firefighter at the door, prevents smoke from leaving the compartment, and allows easy exit for firefighters should the situation worsen. Many thousands of these devices are in use worldwide, demonstrating their effectiveness. They have the potential to improve the safety of firefighters at a minimal cost.

Fires that are not O2L require different tactics. If the fire has self-ventilated, it may make your firefight more like existing training exercises. Crews can use their training and experience to determine when to use ventilation to limit smoke and fire spread.

There can be special cases, however, that become much more difficult. Among these is the wind-impacted fire. In such a situation, nature is using ventilation against you. If you find yourself in this situation, there are two options. The first and most effective option is to work from the upwind side, blocking the wind or using the wind to carry water into the seat of the fire. However, while this is easy to visualise on a one or two-storey structure, it becomes much more difficult the higher you are from the ground [4].

Alternatively, if you can block the downwind side, you can slow the effects of the wind-impacted fire. Ventilation, like water, must flow from somewhere, to somewhere. Blocking can be done with doors, salvage covers, or the smoke blocking device. It does not have to be done in the room of origin, but you will eventually need to move your team to that location. While applying as much water as possible with the wind, your crews will have to open, pass, then seal rooms until they are at the room of origin. Here they can use piercing nozzles for extinguishment.

By combining training that uses modern fuel loads, air/smoke/flow path management, and tactical ventilation, a new more sophisticated method for ventilation emerges. This approach calls for extinguishment earlier in the firefight, and for fans to be used tactically after the fire has been re-set to a non-O2L state. It calls for door control throughout the process, but particularly early in the process to minimise fire growth.

By selectively controlling the O_2 to the fire, ventilation can be directed at keeping stairways and other means of egress smoke free for fire operations and for victim self-rescue. There are many cases where these operations are more important than extinguishment. Once the building has been searched and cleared, the fire that has been held in its O2L state can be extinguished. Fire and smoke can be confined to a smaller area of the building, and once the fire risk for civilians is eliminated, this allows for a controlled extinguishment process. After extinguishment, the remaining smoke can be properly ventilated.

While training techniques and fire studies have been improving our knowledge on how to best use ventilation in various situations, there have also been many advancements in equipment. One of the simplest and most effective tools is the smoke blocking device mentioned above. It can help hold smoke, reduce visibility problems, and assist with the subsequent clean-up of the compartment of origin while allowing people to self-rescue in the rest of the structure. It can also be used to enhance PPV by blocking the upper section of a doorway when the fan cannot be set back far enough to properly seal that doorway.

PPV fans have been evolving as well. There are options for petrol, electric, water, and battery-driven units. Many of these have optional guard configurations that allow for cone guards, which produce airflow in a wide pattern similar to a fog nozzle, and stream shaping guards, which produce a narrower pattern and enable further set-backs.

It is becoming more common for fans to be tested to Air Movement and Control Association (AMCA) standards for airflow in PPV situations [5]. Variable speed electric motors can be used to produce airflows nearly as powerful as petrol-driven units, with lower noise and the ability to be slowed during overhaul operations. Many of these units are made from aluminum for corrosion resistance and a lighter weight, while keeping the tyres and tilt-up handles that enable ease of transport up stairways and across busy firegrounds.

Like most improvements in the modern world, these advances are small and iterative. However, that does not mean they are not significant, and they are due largely to increasing communication between fire departments from around the world, and a willingness to incorporate new thinking. With knowledge of techniques and equipment brought up to date and applied to SOPs and training evolutions, it is possible to make the people in your department that little bit safer, and give the citizens you protect a higher chance of survival when the next incident strikes.

(1) http://ulfirefightersafety.com/projects_blog/ul-fsri-releases-final-reports-on-ppappv/ (2) http://killtheflashover.com/ (3) www.smokeblockingdevice.com/ (4) https://www.nist.gov/%3Cfront%3E/wind-driven-fires (5) www.amca.org/certified-listed/type_company.php?pid=13&pn=Positive%20Pressure%2Ventilators

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Tackling emissions

Diesel emissions have been linked with a number of serious health conditions. Lotte Debell reports on a direct-source capture filter that could improve firehouse air quality and help protect firefighters.

Firefighters face a unique set of health challenges because of the nature of the job. Among these are diesel emissions from fire trucks. Diesel exhaust was declared a known carcinogen by the International Agency for Cancer Research in 2012. It contains particulate matter (PM) – tiny particles of carbon, ash, metallic abrasion particles, sulphates and silicates. Short-term exposure can cause dizziness, headaches, and eye, nose, and throat irritation. Long-term exposure increases the risk of cardiovascular, cardiopulmonary and respiratory disease, and lung cancer.

Another nasty component of diesel exhaust is NOx (nitrogen oxides), levels of which are subject to heavy regulation but remain high. This is a concern for firefighters because they are frequently exposed to the harmful effects of both PM and NOx while on duty, at the station, and in the field.

Scott Beecher from New York-based company Ward Diesel, which makes an on-board diesel filter, says attitudes have changed dramatically in the last decade. 'Previously I would have to sell the risks, then sell my product. These days, fire services know they need to protect their staff.'

In an effort to tackle diesel emissions, the US EPA set stringent new levels for PM emissions for 2007-model diesel engines and later, and a new lower level for NOx emissions to be phased-in by 2010. While these have helped to reduce environmental pollution, they have not cleaned up the problem of pollutants in fire stations, says Beecher.

In 2007 the EPA mandated the use of After Treatment Devices to address outdoor air quality. This was followed by the introduction of Selective Catalytic Reduction (SCR) systems in 2010 that require the use of diesel exhaust fluid.

'This is a urea-based fluid for use in SCR systems to reduce NOx emissions,' explains Beecher. 'The urea is injected into the exhaust stream, but it can take 40 to 50 minutes before the exhaust reaches the right temperature for the emissions to interact with the urea and other catalysts, so fire stations don't benefit from these pollution-reduction technologies.'

There are a number of different approaches to cutting down on diesel fumes in the fire station, ranging from hanging-hose systems to ceiling-mounted filters. What Ward Diesel does is different. The company makes an apparatus-mounted filter that is fitted to the engine and removes pollutants at source.

Ward Diesel makes an apparatus-mounted filter that is fitted to the engine and removes pollutants at source.

Unlike hanging hoses, a direct-source capture filter does not rely on someone manually hooking it up – and breathing in diesel exhaust in the process – and goes where the vehicle goes, providing cleaner air on-scene as well as at base. It is also more effective than ceiling filters, as these don't prevent exhaust from entering the station in the first place.

The No Smoke devices activate automatically when the vehicle starts up or is put into reverse. On ignition, the filter operates for a pre-set period of between 10 and 99 seconds to allow the vehicle to exit the fire house. On reversing, it kicks in immediately and runs for a pre-set period once the vehicle is parked. There is also a manual override that allows the filter to operate in specific circumstances when required.

The newer No Smoke 2 also gets around the issue of the high temperatures required by SCR systems as it is a low-temperature catalyst that oxidises the emissions immediately at cold start, low idle, and on-scene.

It is this capacity to filter exhaust at the times of greatest impact to firefighters that has made the system so popular in the US, and No Smoke devices have been fitted on vehicles from Los Angeles to New York.

The Oberlin Fire Department, Ohio, is one example of a fire service that opted for Ward Diesel. 'Our staff conducted extensive research into the various exhaust removal products,' explains Fire Chief Dennis Kirin. 'We determined that hose hookups do not adequately protect firefighters. Upon entering the station, either a firefighter is exposed to unacceptable levels of contamination while hooking up the hose or the hose is not hooked up at all. We determined that the vehicle-mounted No Smoke system was the optimal choice.'

Since its installation, says Kirin, the system has worked perfectly. A major station renovation has made the benefits of Ward Diesel's system even more apparent. 'The renovation included an automated, overhead building exhaust system with gas sensors in the garage area. Since completion of our station project, the filtered vehicle exhaust has never activated the building exhaust system.'

There are indirect benefits as well, as noted by Interlaken Fire Department, New York: 'Vehicle-mounted capture units will remove the need to ventilate the firehouse and will reduce our heating bill, the firehouse's exposure to adverse weather, and improve building security.'

The No Smoke devices are based on the Corning filter. A ceramic substrate with a proprietary coating removes gaseous matter from the exhaust and all visible soot from fire stations. 'It does not impair the performance of the engine and it does not void any engine warranty,' says Beecher.

The No Smoke is designed for 2006 engines and earlier. The No Smoke 2 is designed for 2007/10 engines and later. It has been specifically designed for engines that meet the new emissions standards, including equivalent European standards. Both meet OSHA, NIOSH, and NFPA standards for firehouse air quality.

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Sharing expertise

The Airport Fire Officers Association held its 18th annual conference in January 2017. The leading event for aviation fire service and aerodrome incident response personnel welcomed over 240 delegates from all over the world and from a wide range of organisations. Ann-Marie Knegt reports on some of the highlights.

From interopability to the role of the Institution of Fire Engineers and firsthand accounts of managing emergencies, the 2017 AFOA conference delivered a fascinating and informative programme. Simon Petts, chairman of AFOA, called it the most successful event in the history of the association, and said that the growing strength of the organisation heralds even better things in the future.

'AFOA is now in a very strong position in its 18th year, allowing us to focus on providing our members with the information they require,' he added. 'We are in better shape than ever, and we can now really bring this organisation forward. In 2017 we will be focusing on research, development, and education to help our members achieve even greater success.'

In his opening address, Petts also highlighted new additions to the AFOA committee, including Dave Hyde from West Sussex Fire and Rescue Service, and the appointment of John Purdy from Newcastle International Airport as vice chairman.

'It is a pleasure to be part of the AFOA committee,' said Purdy. 'We are all committed to helping the association move to another level in 2017, and there are some really strong foundations in place that will allow that to happen. We would encourage all our members to make the most out of association, and utilise the opportunities to share information and learn from each other wherever possible.'

JESIP – achieving interoperability

This year's keynote address was delivered by Carl Daniels, deputy senior responsible officer for the Joint Emergency Services Interoperability Programme. Carl explained how several significant events, including the 7/7 bombings and floods, highlighted the gaps in joint working. This lack of understanding between emergency services in the UK initiated a new focus on interoperability.

Communication during these incidents was also an area where things could have been better, said Carl, as responders

Left: Simon Petts, chairman of AFOA. Right: Carl Daniels, deputy senior responsible officer for the Joint Emergency Services Interoperability Programme (JESIP).

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were defaulting to and relying on mobile phones instead of using the Airwave (Tetra) system.

The situation prompted Theresa May, the then Home Secretary, to make a commitment to address the issues of interoperability between the emergency services, which resulted in the formation of JESIP. An academic review commissioned by JESIP looked at 32 major incidents, and this further highlighted common failings. These included poor working practices, poor organisational planning, inadequate training, and persistent mistakes.

JESIP initiated a programme of training that saw 12,500 emergency services commanders attend a classroom session. The learning from the classroom courses was subsequently tested in live validation exercises.

To ensure that learning from incidents and exercises takes place, the Joint Organisational Learning strategy was developed, which allows the issues identified from de-briefing activities to be submitted and analysed, recommendations to be written and sharing to take place.

Until this point, said Daniels, issues had been identified but they had not always been acted upon successfully to improve effective joint working. He argued that it is essential that joint organisational learning (JOL) is accepted as the standard for multi-agency learning and is adopted by all responder agencies to ensure interoperability is continually improved.

JOL provides emergency services and other responder agencies with a consistent and accountable mechanism to ensure that lessons identified are acted on and the outcomes shared to ensure they become 'lessons learned'.

Joint Doctrine Edition Two was published in August 2016 and it continues to provide guidance for interoperability between all responder agencies.

Daniels set out the key components of the joint doctrine. These are: principles for joint working – the principles that commanders are expected to follow when responding to a multi-agency incident; M/ETHANE – a common method for passing incident information between services and their control rooms; and the Joint Decision Model (JDM) – a common model used nationally to enable commanders to make effective decisions together.

Joint Doctrine Edition Two sets out the appropriate responses from staff and those who support them, and how these should be employed in a multi-agency working environment. By following JESIP, argued Daniels, services can achieve the degree of interoperability that is essential to a successful joint response.

IFE career development at Stansted Airport

The role of the Institution of Fire Engineers (IFE) in career development for aviation firefighters was the subject of the presentation from Jules Williams, watch manager at Stansted Airport.

The idea of setting up an IFE aviation special interest group was first floated at AFOA 2016, with one of its aims to create an IFE career development pathway to support aviation firefighters. Williams explained that an IFE career development model that was set up at Stansted three years ago had been successful on many levels.

'I want to set out how you can use the IFE at your own airport,' Williams told delegates, 'and demonstrate how we have used certain elements of the IFE to develop our personnel and lay the foundations for career progression.'

As a result of the implementation of Stansted's career development pathway, all 17 of the airport's managers are now qualified IFE graduates, and all crew leaders are qualified technicians or above. Half the airport's firefighters have enrolled in a two-year study programme, and an in-house IFE examinations centre has been set up.

Chris Henkey, retired airline captain for British Airways, spoke of an engine fire at McCarran International Airport, Las Vegas.

Jules Williams, Stansted Airport, explained how the airport has used aspects of the IFE in its career development pathway. Below right: Ian Thompson, station manager, and Antonia Pudney, marketing associate, Newcastle International training Academy.

'Personnel regularly ask about further training within the IFE,' said Williams. 'Our system has created a training structure that everyone can relate to and access easily. We have independent exam assessment by a broad range of senior IFE professionals, and we can access IFE branches across the world to share knowledge and best practice.'

Williams explained that prior to 2012, when Stansted was sold by BAA to Manchester Airport Group, the airport used Heathrow's education centre, and crew leaders and managers were required to attain National Vocational Qualifications to levels two and three respectively.

This programme provided structure for development but lacked specific fire service qualities. However, with all the reorganisation brought about by the sale of the airport, opportunities were identified to improve career development.

'We knew we wanted a structure that was not insular or specific to Stansted,' said Williams. 'We now have all our on-going progression in house. We complete initial acquisition at an IFTC for each role, then all roles are placed into our in-house MOC scheme. We knew that we wanted a career development system that engaged with likeminded professionals to promote best practice and ensure we did not develop into an isolated fire service.'

With this in mind, Stansted looked to the IFE because its qualifications are recognised the world over, and it is the only regulated awarding organisation in the UK that specialises only in the fire sector.

The international nature of the IFE was key. 'Many fire services use the IFE examinations for career progression, and IFE qualifications give instant international recognition of competence and commitment.'

There are more than 180 IFE affiliate organisations worldwide, and this is the route Stansted decided to take. 'It was not mandatory to do so to run our development model, but it embedded our organisation into the IFE while we continued to work together to shape the model for Stansted AFRS development,' said Williams.

Stansted's model is divided into two distinct areas – membership and examinations. 'This was pivotal. The IFE was able to accredit our current qualifications for all grades above firefighter with IFE membership levels. This gave credibility to the system, as rather than simply implementing new examination criteria, we were able to accredit the supervisor positions.'

Stansted's structure for academic development covers everyone from trainees to airport fire managers. It is as follows: for airport fire managers, MIFireE and DAFM G/MIFireE, IFE level four certificates; for station managers, GIFireE; for watch managers, T/GIFireE, IFE level three diplomas; for crew leaders, TIFireE, level three certificates; for firefighters, level two certificates; and for trainee firefighters, recruit induction criteria.

'We became an IFE-accredited centre and this means we can run all exams at the station. Any AFRS that has an MOC CAP 699 scheme should be able to do this,' commented Williams.

The only exam with a practical element is for incident commanders, and Stansted is currently evaluating the possibility of undertaking this assessment on its fire training ground. 'This will link our model into a theory and practical assessment. Our instructors will complete a check sheet of performance criteria set by the IFE, assessed by our in-house A1 assessors and verified as required by our IQA.'

Looking to the future, Williams outlined the potential for a national framework for IFE career development. This will involve developing practical IFE incident command qualifications at Stansted, as well as further development of the Stansted, Heathrow, Manchester, and Gatwick IFE programmes. 'We also want to work on the development of the IFE SIG in aviation, and its role in the UK AFRS,' Williams told delegates.

Preventing catastrophe at Dublin Airport

Gerry Keogh, Chief Fire Officer at Dublin Airport for 37 years, recalled the events of August 26, 2015, when a fire with flames leaping 4m high broke out in a paint-spraying hanger containing two aircraft fully loaded with fuel. A fast response and good firefighting prevented a catastrophe.

Dublin Airport has five hangars, and some are leased to commercial enterprises, including a company which specialises in aircraft painting. Under the lease terms, the companies look after their own in-house fire safety and are assured a fast response from the Airport Fire Service in the event of a fire. The fire alarm systems are monitored in the fire station, and the pre-determined response for a fire at the hangars is an airport foam tender and a 4x4 vehicle.

On the day in question, an Airbus A321 and an RJ Avro were in the hangar. The Avro had been coated in solvents to start removing paint, and the rags to wash off the solvent were left in the corner of the hangar in sealed drums. Had these been involved and exposed to the fire, the situation could have been even more hazardous.

The fire resulted from a failure of the motor in the overhead air handling unit, which had been extracting painting fumes, and it was confined to the ducting.

'We are a Category 9 airport and have 19 firefighters and two officers on duty at any one time,' said Keogh. 'This number is sometimes reduced at nights and on this particular night there were about 16 firefighters.'

The first response teams reported that smoke was issuing from the hangar and the control room operator decided to respond with everything available, leaving the airport with no fire cover. Dublin Fire Brigade were also called and responded to the airport with six units.

'In summary, the fire started at 07.09. The airport closed at 07.18. The fire was extinguished at 07.42 and the airport re-opened for flights at 08.45,' said Keogh.

'Why did we have to close the airport? There were two fully fuelled aircraft and over 200 people working in the hangars. With such a high risk we had no choice but to respond to the

fire with all resources available, thus closing the airport for flights until the fire was brought under control. As it was, we had ten flights diverted and three cancelled during 90 minutes of closure.'

Aircraft engine fire and rescue at Las Vegas airport

In another firsthand account, Chris Henkey, who retired after 42 years flying, latterly as a British Airways pilot of Boeing 777s, recalled the engine fire at McCarran International Airport, Las Vegas, on September 8, 2015. It was scheduled as his penultimate flight before his retirement, but proved to be his last.

The twin-engined Boeing 777-236ER had taxied from the terminal and was on the runway.

'We had all the passengers on board and were cleared for immediate take off. I pressed the switch in front of the thrust levers and then put the engines to full power and off we went. At probably about 100 miles an hour there was a bang and the aircraft veered to the left. I got it back under control before we stopped,' Captain Henkey said.

As they were stopping, the instruments on the left hand side went red. 'One showed an exhaust gas temperature of 1,000°C – getting very hot, very quickly – and then we had the fire warning come up. I asked the co-pilot to do the engine fire checklist to try to extinguish the engine fire.'

They couldn't actually see the fire, explained Henkey, as the sun was behind them. He asked the other co-pilot to go back into the cabin to report, and screaming and shouting was heard. When the co-pilot returned to report that the situation was dire, Henkey announced a passenger evacuation. He also called in a mayday to air traffic control and requested the assistance of the emergency services.

'Air traffic control reported that the emergency services were already on their way. The fire services were stationed facing us so they saw the whole incident.'

All 159 passengers and 13 crew members were evacuated safely using the emergency slides, and Captain Henkey was the last to leave. By then the fire services had begun spraying foam over the aircraft, making the slides very slippery. He jumped out and suffered minor injuries.

'Back in the terminal somebody gave me a microphone and I addressed the passengers, explaining what had happened and that I was pleased everybody was off safely, albeit with a few minor injuries. The fire service guys had a look at the passengers and a few were taken to hospital to check for smoke inhalation.'

Captain Henkey said that prompt action by the airport's fire service not only saved lives, but also meant that the aircraft was repaired and back in the air within months.

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Triangle of vulnerability

Public complacency and potential intelligence failures can only embolden already creative and intelligent terrorist organisations that remain focused on the aviation industry, argued Dr Dave Sloggett in his address to this year's AFOA conference. Fiona Petty reports.

Living in a heightened state of emergency has become the new normal in the UK, argued Dr Dave Sloggett in his address to this year's AFOA conference held at Gatwick, and this represents a security risk in its own right.

Discussing what he called 'the triangle of vulnerability', Dr Sloggett pointed out that the threat level in the UK has been at 'severe' for just over 55% of the last ten years. The result, he said, is a public so accustomed to the idea of an imminent attack that they are no longer alert to the warning signs.

It could be argued, said Dr Sloggett, that the government will not raise the threat level to 'critical' until after an attack has taken place. To do so would deter terrorists and make them postpone an attack by a few days, by which time the emergency services would be exhausted from waiting for an attack to come at any moment. An example of this occurred in Brussels at Christmas 2015. The siege mentality of being at critical was broken by members of the public who simply returned to their normal lives after three days.

The general public are used to living in an atmosphere of fear. To some extent, suggested Dr Sloggett, this has created a situation in which the public is immunised from things going on around them and fail to spot obvious indicators of an emerging threat.

As an example of public complacency, Dr Sloggett cited the public response to the activities of Damon Smith, a 19-year-old student who moved to London in September 2016.

Smith's journey to radicalism started with the dramatic impact on his self-esteem of long-term bullying at school. The process of radicalisation was also quite quick, measured in weeks not months – a worrying new trend.

Two weeks after starting university, Smith left an unattended bag on a tube at Greenwich Underground station containing a bomb he had assembled using instructions found on the Internet. This act was witnessed by two of the twelve passengers in the carriage. They failed to appreciate that his action constituted a potential threat.

The public need to take more responsibility for their own safety and that of those around them, argued Dr Sloggett.

Despite this suspicious behaviour, a passenger delivered the bag to the driver indicating that it had been left by a passenger. Unbelievably, bearing in mind the incidence of bombs on trains, the driver accepted the bag and kept it in the cab while he contacted lost property.

When asked by the lost property staff to see if there was evidence of ownership, the driver opened the bag to find the bomb. Luckily it was defective. However, the intention was clear. It was to be a repeat of the attacks of 7 July 2007 when three bombs were detonated on London Underground trains. The bomb design used by Smith is reported to have been almost the same as those used to attack the Boston Marathon on 15 April 2013.

Our western value of 'judging others by our own standards' is increasingly being tested. The public now has to rise to the challenge and ensure the safety of themselves and others. This cannot simply be delegated to the authorities. The nature of the threat is emerging so quickly that the security and emergency services are struggling to keep up.

While the intelligence agencies have an impressive record of interventions over the past ten years, terrorists are increasingly operating off the radar of the security services by using smarter, encrypted mobile applications such as Telegram. This is problematic. If the intelligence services fail, it is up to the emergency services to pick up the pieces.

The Tunisia shootings – in the news recently thanks to the coroner's hearings – highlight the responsibility of holidaymakers to make their own judgements as to their safety, and also put the spotlight on the issue of safety advice from the Foreign and Commonwealth Office and the tourism industry.

Early indications from the coroner's hearings do not make pleasant reading. A gulf appears to have opened up between the FCO and the tourism industry over their assessment of the threat in Tunisia. Into that gulf fell the 38 people who died, and those who suffered long-term physical or mental injuries.

The attack at the Bardo Museum in Tunis just three months beforehand should have provided a clue as to the security situation in the country. Other warnings and indicators were readily available in open sources. The number of young people travelling from Tunisia to Syria and Iraq to join so-called Islamic State clearly outnumbered those travelling from other locations. It was and remains the primary source of non-Iraqi and non-Syrian fighters.

This clearly illustrates that as members of the public we need to take more responsibility for our own safety and the safety of those around us. The problem of apathy is understandable given that the last significant terror attack in the UK has all but disappeared from public view.

In a second example of complacency – this time from law enforcement – Dr Sloggett described the back story behind

the attack in Nice that saw 84 people die. The truck that ploughed its way through revellers celebrating Bastille Day could so easily have been stopped. Nine hours before the fireworks took place, the truck was waved through a security gate and allowed to park because the driver told the police it was full of ice-cream. Even scant attention to detail would have revealed this was not the case.

The lorry was not refrigerated. It also had no name on the side indicating it was selling ice-cream. This was a catastrophic example of human error and complacency by the French police, and this kind of failure is not an isolated incident. It is an issue across Europe.

The Paris attacks show how terrorism is innovating. IS fighters are on the move. An estimated 1,750 have returned to Western Europe, with many presumably ready to engage in hostile acts.

Arguably the most innovative aspect of the dreadful attacks in Paris was that they were led by a single person who had military training in the Iraqi armed-forces. The attacks were a structured military operation, with a commander giving orders to three separate commando teams operating on the ground using a variety of tactics.

Their actions that night – including a 15-minute shooting spree targeting restaurants – were coordinated in what in military terms is known as a scheme of manoeuvre. These tactics seek to create moral dilemmas and to dislocate the response of the emergency services – risking command inertia and a higher death toll of members of the public.

Alarmingly, the commander was seen on CCTV re-entering Paris via the underground after the attack. He systematically photographed the response of the emergency services.

In the US, the Fort Lauderdale shooting shows a lack of clarity and systematic failures by the intelligence services – despite the obvious distress shown by the gunman Esteban Santiago.

Santiago had previously presented himself to the FBI in Anchorage explaining that he was hearing voices. He was in possession of a gun and the police took it off him. However, once he was discharged, the gun was returned to him even though he was clearly in need of help. The attack could so easily have been stopped had this situation been handled differently.

The Berlin Christmas market attacker Amis Amri was also known to police. He had come to their attention on several occasions, and the authorities could have arrested him seven times before he made that fateful journey, killing 24 people and horrifically injuring a further 49.

Problems of the structures of intelligence services in European countries, such as Germany, are clearly being exploited by terrorists.

An attitude of 'it could never happen to us' needs to be replaced with a cautious and suspicious approach, said Dr Sloggett. If not, hindsight will be of little comfort the next time people die in an act of terror that could have been prevented.

Since January 2009 the number of terrorist attacks has risen to over 2,000 each month. There is nothing to indicate that this number will decrease. Complacency and intelligence failures are just another tool IS can use to its advantage.

This deadly triangle of vulnerability reflects the emerging way in which the threat is challenging society at large. While the authorities are doing their best to control and neutralise the sources of the attacks, they cannot all be prevented. It is time for the public to understand this and play their role more fully. Their lives could quite literally depend on it.

Surrey's wild waters

The densely populated county of Surrey in the UK faces considerable risk from flooding thanks to numerous waterways such as the Thames. As a result, Surrey FRS has developed a highly trained water-rescue capability, write David Crease, Paul Kenny and Dr Ian Greatbatch.

Fire and rescue services that operate around waterways face a particular set of challenges. For Surrey FRS in the UK, which operates in a county that contains nearly 34km^2 of water, including a 35km-long stretch of the Thames, those challenges include serious flood risk as well as the dangers associated with the recreational use of England's major river.

The Thames is not Surrey's only river. The Way and the Mole are among the county's most well-known waterways, and it also has two major canal networks, several populated islands (locally referred to as 'aits'), and reservoirs serving London and the South East as well as ponds, lakes, and minor rivers. With a population of around 1.1 million in 650 square miles, Surrey is one of the most densely populated counties in the South East.

There have been fire and rescue service patrols on the river in surrey since the 19th century, and a dedicated fire service boat has been in operation for more than 40 years. This has seen various states of readiness, training, and usage throughout the decades until the turn of the century, where, in response to flooding in the late 1990s, a new training regime was established. This ultimately led to the current set up (via inputs of policy, training and resources via the DEFRA Flood Conops of 2010).

There have been fire and rescue service patrols on the Thames in Surrey since the 19th century.

This tradition of water rescue is proudly maintained by Surrey FRS, and continues to be an important skillset and service, especially as widespread flooding becomes more common.

The presence of a long stretch of the Thames means that flooding is not the only concern. All rivers carry a danger of drowning, but the Thames especially has long been considered a recreational resource, and as traditional industries along the river have diminished, housing and recreation has taken its place. There are roughly 35 pubs along the river in the Surrey stretch, and hundreds more within a short walk. It is well-established that alcohol both reduces the perception of risk, as well as the physical ability to swim effectively or self-rescue.

The Thames may look benign, especially on a hot summer's day, and in conjunction with the perception of the river as a recreational area, this leads to temptation. The problem is that the river is not only very cold, it is also very powerful. This leads to a risk of 'swim failure', where the swimmer is unable to maintain a horizontal swimming position, their legs start to drop and, if the water is deep enough, they drown.

The average temperature of the Thames is around 13°C, and research shows that as water approaches 10°C, swim position typically changes, as does the effectiveness of the swimming stroke, and swim failure is likely (Tipton et al, 1999).

One of the key issues is the effective communication of these dangers to the public, especially to young males, the group most vulnerable to accidental drowning. There are fewer public information films nowadays, and there is also a

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Surrey firefighters carry out a casualty-recovery exercise.

clear communications gap between young people and the relevant authorities because of the ubiquity of social media.

As a result, safety agencies need to be aware of the changing trends in social media use – the growing popularity of Snapchat, for example – as well as adopting the kind of language in use by this demographic. There is an understanding that the fire and rescue service needs to be seen as a friendly face that offers meaningful advice, rather than as an authoritarian voice that may stimulate feelings of rebellion. It is also acknowledged that poorly targeted social media campaigns can backfire.

If these factors are combined – alcohol use, poor risk perception, and lack of understanding of the risks – the danger of an incident occuring increases, and this is a priority in strategic planning within the fire service. Surrey FRS is working hard with the local community and local government to improve awareness and is intending to launch a widespread incident prevention campaign in the near future.

Surrey FRS on a training exercise on the Solent.

When incidents do occur, Surrey has six stations offering a varied water rescue and flood response. These include four (Defra type D team) flood response stations, which offer a wide capability to assist with evacuations in flood conditions, and two (Defra type B team) swiftwater rescue and flood response stations with powered boat capability, which are based along the Thames.

To achieve this high level of response, all teams undertake considerable training to maintain their skills at locations that offer varying water conditions. There is an experienced training team in the service, with members who come from a variety of backgrounds, who bring those experiences to the training.

The brigade believes it is crucial to provide training that is as realistic as possible, ensuring that the crews have the fullest appreciation of the significant hazards posed by a flood environment. A combination of natural and man-made venues have proved to be the most effective in regards to preparation. Tidal estuaries can be used to simulate a flood with constantly changing conditions, while white-water recreational venues expose teams to powerful, fast-flowing water in a controlled environment. Some members of the teams are also trained as specialist boat handlers, which enables them to manoeuvre a craft in some of the trickiest conditions.

All personnel within the teams are provided with appropriate PPE depending on the level of response they are trained to. This includes a dry suit, a helmet (red or yellow, depending on which team they are in and their level of qualification), a buoyancy aid (equipped with a whistle, torch and knife), a throw bag and gloves as standard.

Typical additional kit for a type D team includes all of the above, plus a small craft to assist with evacuating residents; wading poles to move safely through water, and to identify any raised manholes or ditches, etc; a hose inflation kit, to provide an enhanced reach capability across a body of water; portable lighting; and communications equipment.

Typical kit for a type B team includes all of the kit provided for a D team plus a large Pioneer cathedral hull rescue boat

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with 75hp outboard, typically used for larger incidents on the Thames; two small inflatable craft with 20hp outboard motors; two five-metre mud and ice rescue paths, used to move across mud and ice, commonly to rescue animals; an underwater search camera; floating stretchers for casualties; and long floating lines and technical kit to set up safe restraint systems in fast flowing water.

In addition to this, the service has trained around 20 of its senior officers as water incident managers (Mod 5s in the Defra concept of operations), as well as training in wide area search and lost person behaviour. The brigade also has a high volume pumping capability that is a vital part of any flood operation.

Surrey FRS works closely with Boatability, a private-sector training organisation based in Portsmouth. Boatability now provides all boat training and was chosen not only because of its excellent reputation, but also because it is the only training organisation to offer a City and Guilds qualification in powerboat operations, as well as standard Royal Yachting Association qualifications. This means, from a fire service perspective, that Surrey achieves greater value for money, with transferable and tangible qualifications for its crews.

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ABOUT THE AUTHORS

David Crease *is a watch manager and the water training and technical rescue lead for Surrey Fire and Rescue Service. He has been instrumental in designing, evolving, and delivering special service training in Surrey for the last five years. He can be reached at: david.crease@surreycc.gov.uk.*

Paul Kenny *is a group manager, with responsibility for drowning reduction and water rescue within Surrey Fire and Rescue Service. He is also the lead for flood response and flooding capability. He can be reached at: paul.kenny@surreycc.gov.uk.*

Dr Ian Greatbatch *FRGS, MEPS, FHEA is an associate professor at Kingston University in London. He specialises in search and rescue, fire and rescue and the application of geographical information to those disciplines. He can reached at: i.greatbatch@kingston.ac.uk*

Keep your Hazmat team on its toes

Team cohesion and a focus on constantly evolving drill scenarios is at the heart of effective Hazmat response. Successful outcomes depend on a flexible mindset, regular training, and strong leadership, argues Michael Schunck.

Every Hazmat response team should be looking for continual improvement in its performance. To achieve this effectively, there are two key concepts to evaluate: the management team structure and the necessary capabilities of the response team.

Emergency managers need to consider the specific tasks their team will cover in the emergency response plan, and the phase of the emergency response they will participate in. Hazardous materials response is made up of different groups looking at the same problem from different angles. The key to a successful outcome is mastering your 'slice of the pie' angle.

Firstly, consider the site hazards that you are prepared to handle, and gear your team to focus on the most frequent hazard sites they respond to. If you primarily respond to fixed sites, for example, interaction with plant groups should be one of your regular training functions. And, since you work with this group of people frequently, be aware that these kinds of relationships require camaraderie in a non-stressful atmosphere. Arrange for multiple group training followed by a group social function such as a lunch on a regular basis. This will build the strong relationships you need in times of emergency response stress.

Different groups can be included where relevant. If hazard volumes are large, contractors should be drawn into this loop. If there are multiple locations, repeat sessions need to take place to include everyone. If there is a frequent jurisdictional issue, meet with all emergency managers involved to be sure that everyone is on the same page.

Fire departments and emergency response teams must conduct disaster preparedness drills. These Hazmat team members are setting up a ladder to get on top of the tanker to stop the leak. ©Shutterstock

If site frequency is fixed, can a permanent staging area be secured for quick equipment accessibility? What are your additional manpower needs and where can you draw from? How can the transport of personnel and equipment be improved to and from your site location?

These questions and the answers that work best for your group should be considered for each type of response you are called to. Waterways, highway incidents, railroad events, and private specialised properties all need specific analysis in your emergency response plan. While it is impossible to plan for all of these, focusing on your primary responses will greatly improve the effectiveness of your team response.

Secondly, the management team structure should have a drill-oriented outlook to most training. Assuming that your team is established, has a history, and has responded to incidents, repetition of basic learning is contrary to team growth and expertise. By frequently evolving drill scenarios, your team will become versatile as opposed to stagnant.

Teams should strive to be supple so that they can effectively adapt to changing conditions at any emergency. The best way to foster this outlook is to designate a team leader and give him/her a seat at the management table. This is the most effective technique for identifying the needs, strengths, and weaknesses of a response organisation.

Another tool for increased team effectiveness is incentives. Have your team leader conduct an actual realistic analysis of group cohesion, and demonstrate to the team a genuine desire for improvement. Let them know that the organisation is behind them and proud of their capabilities. The suggestions from team members will probably be surprisingly easy to accommodate. I know of one established team that improved morale and response success from a simple patch redesign. Solutions are frequently a matter of care, not expense.

Then you need to consider the required capabilities of your response team. Your most frequent incidents will dictate the task-oriented equipment required. For example, if your group works closely with the coast guard and is located near a major waterway, you should not focus on desert cooling equipment. PPE and CPC with their accompanying tools should be geared and upgraded based on the type of responses that are frequently serviced by your team. When equipment upgrades become available, concentrate on the items that will enhance your typical responses and not on the latest and greatest high-tech tool.

Too often, the transportation of equipment is neglected. How easily and quickly you can get your equipment to and from a spill site is just as important as having the correct tool at hand. If you are frequently indoors at a site, an open air

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The Fire and Rescue Department of Malaysia, Special Forces Hazmat team, at a chemical spill in Seremban, Malaysia, on 28 October 2015. ©Shutterstock

vehicle may work best. If out of doors, do not forget that your team will be dealing with the elements and light restrictions, usually in the worst of weather conditions.

If you regularly store spilled contaminants for short periods or longer, you must have adequate numbers of the correct type and volume of storage container on hand. Commonly, these types of operations spend their entire update budget on more storage containers or different types specific to their location or contaminant. Improvements to overall effectiveness can be simple, it just requires thought.

Decontamination equipment and its maintenance is another area of potential improvement. If you are not in dry decon mode, then some type of minimal equipment for wet decon will be required. This equipment must be easily transported, easily set-up, and easily decontaminated for return to service.

One technique is to use existing safety showers, or to transport a small unit of this nature in one piece. For mobile response teams, this is a larger logistical problem, but it can still be mastered. For site response, units can be transported and stored in whole by high-low. In the field, trailers outfitted for complete decontamination are often the most effective.

The key is minimising set-up and take-down of the unit, and you should build in a technique for self-decontamination of the unit after the incident is concluded. This can be as simple as a flush of the decontamination unit through the addition of a decontamination solution of choice mixed with water. Transportation of the resulting rinse solution must be calculated for transport by whatever means you choose.

In your drills, be sure to always use team equipment. This accomplishes two goals. Firstly, it ensures the team is familiar with frequently used tools, and secondly, it identifies inefficiencies with your decontamination and operational equipment. This is vital for correcting equipment problems before your group is exposed on-site to a hazardous material.

The frequency of a set drill must not only be modeled after a real scenario specific to your operational location type, but also may have to be repeated to include all shift members or outside team participants. At a minimum, training drills should be held on a monthly basis. Teams that drill less frequently see a decrease in overall effectiveness. Past one month, and skills, moral, and team cohesion begin to falter.

Lastly, for overall maximum effectiveness, response manpower must be taken into account. No matter what situation you find yourself in, the simple fact is that you cannot manage it successfully without sufficient manpower.

Some situations can be handled successfully with smaller teams, but these sacrifice time. This is fine if the hazard will afford a slow emergency response. In many cases, however, smaller teams may find themselves overwhelmed by the incident hazard, which will result in operational failure if not personal injury. Management might blame team effectiveness when, in reality, a reduction in manpower was the cause.

Management and the team leader should calculate team numbers and shift positions based on past incidents, both successful and unsuccessful. If your aim is to provide a professional response for every incident, how many team members are required on each shift? Manpower needs careful consideration, as do all the aforementioned elements. No one strategy takes precedence, which is why we refer to it as the 'team' concept. The team must be considered as a whole if you are to truly enhance its overall effectiveness. Be sure that this becomes one of your team's highest priorities.

ABOUT THE AUTHOR:

Michael F Schunck, or 'Hazmat Mike', serves as faculty adjunct in higher education facilities throughout Michigan, including Oakland Community College, Oakland University, Michigan State University, and Madonna University. Schunck was a presenter at the First State Hazardous Materials Convention at Crystal Mountain, which covered dry decontamination, LEPC planning, and methamphetamine clandestine drug lab response. He has authored various articles focusing on philosophy, environmental technology, Hazmat, bio-weapons and terrorist response. You can follow Schunck's blog on: http://www.hazmatmike.com/about-mike/

Ready for anything

The life of a Hazmat officer is one of contrasts. Day-to-day the job may focus mostly on small-scale scenarios, but these specialist roles need to be ready to deal with major events at a moment's notice. Jemma Dempsey reports on the challenges of preparing for low-frequency/high-hazard incidents.

When Hampshire Police's control room received a call about a potentially radioactive material found in a garden shed, a clearly defined protocol went into action. Via the NAIIR procedure (National Arrangements for Incidents Involving Radioactivity), the on-duty Hazmat officer PC Mike Batten was put through to the Civil and Nuclear Constabulary, and within two hours an expert from the radiological department at the University of Southampton was on site and the tin was safely packaged up and removed.

Contrast that low key event with the Buncefield fire in 2005 when a series of explosions at the Hertfordshire Oil Storage Terminal, owned by Total UK and Texaco, sent the biggest fire plume into the atmosphere since WW2.

For Hazmat officers throughout the UK, and indeed the world, 90% of call outs are small-scale, low-risk events, but their training and capability has to be able to deal with detecting and monitoring all types of hazard. Maintaining Hazmat response capabilities can be challenging because, thankfully, significant responses are not common.

Perhaps the biggest challenge is one of identification. Kent Fire & Rescue Service has a team of 12 specially trained Hazmat officers. The densely populated south eastern county is home to some major risk sites – the Channel Tunnel, Bluewater shopping centre, motorway networks, ports, and the biggest liquefied natural gas (LNG) plant in Europe at Grain on the north eastern peninsula. It also has the nuclear power station at Dungeness.

David Nolan is the Hazmat lead officer for Kent, a role he's held since 2013. 'Kent is different to other UK counties. It has one of the nationally supplied specialist vehicles and some enhanced training is government funded.'

The majority of Nolan's call outs are low risk incidents, from a mercury spill or white powder to industrial accidents and chemicals spills in situations such as a swimming pool plant environment.

'We need an understanding of how these industrial spills are cleaned up, and who is best suited to advise on the resulting chemicals or gases being emitted,' explains Nolan. 'We also have to look at the impact on the environment, from our watercourses to the air quality, where the plume is going and who it might affect.'

Kent has a bank of people Nolan can call on. Some are government agencies and others are specialist chemists. 'We use Bureau Veritas, a European-wide specialist chemist for these kinds of incidents, and they advise us on the next steps. This could be for radiation and nuclear-based incidents right down to very small industrial leaks.'

Dealing with call outs is well documented. The 644-page *National Fire Service Hazmat Manual* explains in a basic way how to deal with all incidents, and planning around foreseeable problems at the big risk COMAH (Control of Major Accident Hazards) registered sites is clear.

However, most incidents, which are generally accidents, don't involve the large infrastructures, and it is impossible to plan the response in such a structured way, points out Nolan. It is the development in unforeseeable problems that is posing new challenges. This includes synthetic drugs, which people may be producing at home in illicit laboratories.

Firefighters practise sealing a leak from an Ammonia liquid container, in a fruit factory in Yesud Hamaala, Israel, on March 21, 2016. @Shutterstock

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Left: Hazmat officer PC Mike Batten of Hampshire Constabulary. Right: David Nolan, Hazmat lead officer for Kent Fire and Rescue Service.

'One of the drugs of choice at the moment is plant food, a psychotic agent that is finding its way into prisons and universities,' says Nolan. 'We now need to assist the police in detecting things like this, which have huge social problems attached and simply weren't in my vocabulary two years ago.'

The constantly changing nature of these drugs is a real issue. Standard industrial chemicals can be easily identified, and all Hazmat officers have access to the chemical hazard database, explains Nolan. 'If I type in the synonym of a chemical, it tells me its properties, including what will happen if it mixes with something, how it should be diluted, which specialists can come and collect it, and the safety equipment I need to wear. While new chemicals may come on the market, the industrial environment doesn't change that often.'

This is not the case with synthetic drugs. 'This is a good example of a situation in which the library that exists within Chemdata, and the kit we use to do the analysis, needs to be expanded to take account of the current risk trends.'

Training is so important here. As in any emergency service, a Hazmat team is only as good as its personnel, and well-trained staff are key to a successful Hazmat operation. The training and specialised equipment required is expensive. Add to the mix the infrequency of call outs, and it is understandable that cash-strapped forces are embracing a degree of interoperability between fire and police.

Training doesn't happen overnight, says Nolan. 'In the UK it takes about a year of courses to gain initial capability, then you sharpen your skills in the operational environment. We work closely with the police now. The fire service has a remit for DIM (detection, identification and monitoring), which was authorised by the Home Office in October 2016. We are the lead DIM authority for the border force, for the national crime agency, and the environment agency.'

In 2012 the JESIP protocol came into force in the UK. The Joint Emergency Services Interoperability Programme was designed to create a better decision-making model against a backdrop of a shared situational awareness. PC Mike Batten, one of six Hazmat officers for Hampshire police, says it works, and works well. 'It is not about who is in charge or calling the shots, it is about who has the best capability, knowledge, and means for successfully resolving an incident, and that can be different agencies at different stages of an incident.'

It is very much a case of inter-agency cooperation, adds Batten. For example, the police can clear the roads for the fire service to respond to an incident, or manage the evacuation process if the fire service deems this necessary. 'It is a joint decision-making process. At the end of the day, it is about individuals' expertise. No single agency can necessarily accomplish everything on its own.'

Although thus far there have been no deliberate or malicious acts of CBRNe in the UK, Hazmat officers are trained to deal with an eventuality where individuals from different agencies with different disciplines are assembled to apply their operational knowledge to a chemical, biological, radiological or explosive incident.

Kent is home to Dungeness, the nuclear power station that has two 550-megawatt reactors. It has a team of on-site specialists called health physicists who can work with the local fire service in an emergency. Nolan says: 'They understand the output of the reactors, they know where it is safe to shut down reactors, and areas of hot working where you perhaps wouldn't want to be cooling it down too quickly. A lot of their staff have dual functions, with a day job spent checking, moving, and maintaining equipment, but in the event of an emergency they also have a response function, which could be to look after the reactor room, for example.'

Having the right equipment for DIM processing is key, and Kent has one of the national DIM vehicles, a large compartmented Iveco. 'It provides on-scene detection, identification and monitoring of chemicals or agents as well as spectographic equipment, and carries protective equipment and decontamination relevant for the task.'

Even without the DIM-enhanced vehicle, Nolan can carry out tentative analysis with a kit in his car as an officer responding on blue lights. 'However, to get something more quantifiable for the NHS, which could be required to perform medical decontamination on people affected by something complex used for terrorist purposes, there is a small time delay. But, even so, we are much better placed than we were prior to 9/11, and even the 7/7 London bombings.'

The kit can detect things like sarin and other blister nerve agents, chemical weapons, and more, says Nolan, who adds that he has not had to use it for such purposes. 'The radiation detection kit is really good – I'm glad I've got it on my side but we don't need it on a day-to-day basis.'

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