

Working in Confined Space: Applying Science and Innovation across the Spectrum of Operations

3M | Scott Safety's Brian Clesham discusses some innovative solutions for surviving and maintaining mission orientation in confined space

What do Special Forces and ships' crews have in common? Apart from numerous professional attributes, a good answer would also be the ability to work in confined space, but for contrasting reasons. One may need to gain entry and use lethal force while the other may be seeking to control damage or escape; but it is never as simple as that. For sure, both parties must be prepared to work in confined space and there are a host of scenarios that may see operators breaking into, operating in, transiting through or escaping from smoke filled, noxious and poor air atmospheres. This might also include atmospheres characterised by incapacitating, deadly and volatile gases and particulates.

Some baseline challenges are immediately apparent for operations in confined space; how to detect and monitor adverse air atmospheres, how to maintain visual acuity for situational awareness and rapid decision making, good communications and finally, how to adapt breathing options during the execution of an operation. All of these challenges must be met with minimum impact on operational performance in the most stringent and life threatening circumstances. It is up to Industry to deliver the life safety products that mitigate these challenges and in such a way that the physiological and psychological burden on the individual is minimised to the greatest extent possible. After all, it is not just about preventing injury and saving life. Operators have a job to do.

Many of the concepts and operating procedures for assuring life safety in smoke filled and poor air atmospheres stem from the emergency services and both the marine and energy sectors; while the diverse interests of military operations are very often served by similar capability requirements. For all responders and operators, equipping, training and maintaining high states of readiness are key. Avoidance of Immediate Danger to Life and Health or



3M | Scott Safety's PROTÉGÉ air atmosphere and gas detection monitors for special forces and first responders. A few life-saving ounces to inform your breathing options. Photo credit: 3M | Scott Safety.

'IDLH' situations involves extensive preparation. Being well equipped with a practised rescue plan may also define success or failure.

Within the industrial sector there is a sad record of avoidable injury and death through exposure to oxygen deficient and toxic air atmospheres. In the USA, enhanced safety standards were imposed when statistics showed an average of 122 accidents per year with 173 fatalities. Of these, 60% of the fatalities were during rescue attempts by on-site colleagues.

Take carbon monoxide, for instance. It is colourless, odourless and tasteless and it also defeats negative pressure filters, so the last thing you want to is to breathe carbon

- ▶ monoxide through your filters. It does not abruptly stop you breathing per se; it just stops your apparent breathing from supporting your body. Disorientation and death arise all too rapidly, so the monitoring of oxygen levels can be critical. Too much oxygen in the air and/or the presence of all manner of dust particles in sufficient volume can risk explosion from ignition sources, further risking secondary explosions, pressure waves and structural collapse.

Both industrial and domestic firefighting have exemplified the need for Self-contained Breathing Apparatus (SCBA) and thermal imaging, to overcome the risk of smoke inhalation, poor air atmospheres and loss of situational awareness to make those time critical decisions; when there may be risk of flame engulfment, entrapment, loss of orientation, injury and death.

The imposing of civil standards is enhanced by several factors; to wit: lessons identified from routine and fatal incidents, boards of inquiry, prosecutions, safety reporting, regulatory compliance and dissemination throughout Industry. Design and delivery of innovative and more effective equipment solutions further enhances best practice and more user-friendly solutions. Crucially, the combination of these factors holds direct relevance for the conduct of successful military operations within confined space. Not just firefighting and overcoming smoke filled atmospheres, but more diverse activities such as contaminated casualty or body recovery and the collection of evidence within a contaminated environment are now more common within the civil domain, but resonate strongly within the military domain.

Just as isomorphic learning can enhance best practice for both parties, it can also prove insightful to manufacturing industry. Companies are always seeking innovative ways of enhancing safety and improving performance parameters for a wide range of end users. It is clear, for instance, that lessons learned from fighting fires, penetrating and transiting thick smoke apply across a wide spectrum of operations.

3M | Scott Safety has a very proud record of keeping people safe. The company is a global leader in the manufacture of life safety products with one of their principal plants based at the heart of the Industrial Revolution, in Lancashire, United Kingdom. Other manufacturing and support hubs are found globally. 3M | Scott Safety now sits proudly within 3M's Personal Safety Division along with 3M | PELTOR, a global leader in military and special operations' communications in high noise environments.

CBRN environments, smoke or poor air atmospheres all offer different respiratory challenges. Our respiratory protection military and civil defence product range includes standard respirators, Powered Air Purifying Respirators (PAPR), filters, SCBA, air line and escape systems such as the Emergency Life Support Apparatus (ELSA) and naval damage control Extended Duration Breathing Apparatus (EDBA); the latter two arising from lessons identified in the maritime domain during the 1982 conflict in the South Atlantic.

Our expertise, at the cutting edge of respiratory protection technology, was further developed in collaboration with the UK Ministry of Defence who accepted



*GSReS fitted with powered air option. The opposite side portal is blanked off in this instance, but can be easily fitted for SCBA.
Photo credit: 3M | Scott Safety.*

the 3M | Scott Safety General Service Respirator (GSR) into service for their Air, Land and Naval forces. 3M | Scott Safety have since produced the multi-functional GSReS 'evolution Specialist' which offers modular breathing options from dual or single filter canisters to SCBA from the same mask platform. The First Responder Respirator (FRR) completes the 21st Century military and civil defence respirator range; with products offering superior protection, comfort, automatic sweat removal and modular specialist performance. A policy of 100% fit now sees the company offering the mask in five separate sizes to cater for diverse facial constructs, regardless of ethnicity and gender.

A feature of operating in confined space is the alerting to poor air or noxious atmospheres which can immediately inform the need to switch from negative pressure filters or PAPR to SCBA. 3M | Scott Safety's Protégé series of gas and air monitors weigh no more than a few ounces, are maintenance free and can alert the end user visually, by audio alarm or by vibration. When breaching or transiting during an operation and you don't know precisely what's on the other side, you need all the assurance you can get and this very simple lightweight solution saves lives and maintains mission orientation.

Most crises offer an element of isomorphic learning, such that the characteristics that support fire and rescue operations may be transferred to fighting fires on board ship or operating in or transiting through smoke filled environments. Science and innovation forms an enduring component of the company's philosophy. Within the USA, under our 'Firefighter of the Future' programme, the company has worked hand in glove with fire departments to produce the first of its kind in the 'hands free' integrated

thermal imaging camera and mask - the 'Scott Sight'. Scott Sight enables firefighters to move quickly through smoke, maintaining situational awareness and rapid decision making, with hands free to work and conduct search and rescue operations. In the confines below deck, when a ship may be rocking and rolling you need to work fast in an emergency. Having 'hands free' is like having another set of hands. Immediately, one can think of a number of scenarios where 'hands free' also enables the carriage and use of small arms through smoke filled and poor air atmospheres. A number of marauding terrorists incidents spring to mind where such innovation would have leveraged the Special Forces response; Mumbai in 2008 and in the Westgate shopping mall in Nairobi in 2013. An optional upgrade enables thermal video recording from the mask mounted camera; invaluable for training and debriefing.

In conclusion, 3M | Scott Safety is driven by science, innovation and a strong moral component to enhance both operational performance and safety in the complex, physiologically and psychologically stressful circumstances that operators inevitably find themselves in. It's all about enabling the operator and closing out the risks. Our aim is always to attain a world-class performance and deliver operational excellence and support to the End User. ■

Brian Clesham MBE was the former Chief of British Army CBRN when the 3M | Scott Safety General Service Respirator was brought into service and Chief of Staff of the Defence CBRN Centre during its post 9/11 expansion to incorporate training for the Police, Transport Police, Fire and Ambulance services. He has supported both the UK MoD and Foreign & Commonwealth Office in senior NATO and OPCW counter-proliferation forums and is a graduate of the NATO Defence College.

Further information at:
www.scottsafety.com/emea



The 3M | Scott Safety General Service Respirator (GSR). Automatic sweat removal, superior hydration, comfort and exceptional protection factor. Photo credit: Survitec.



General Service Respirator evolution Specialist (GSReS). All the comfort and safety benefits of the GSR with a modular platform for multiple breathing options. Photo credit: 3M | Scott Safety.



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