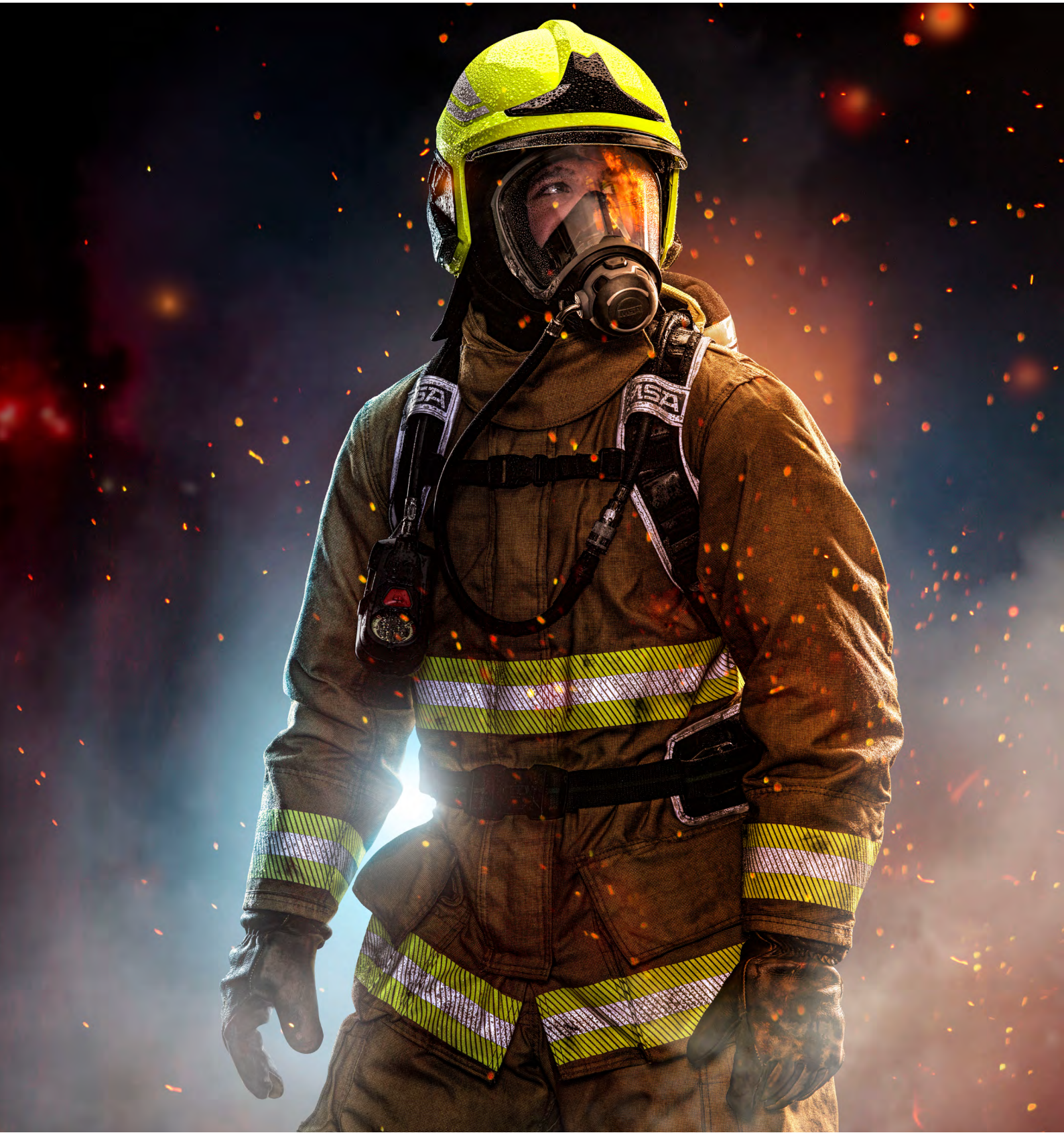
MSA White Paper

The evolution of SCBA:
How modern innovation is improving firefighter safety

MSA
The Safety Company



WHEN YOU GO IN, WE GO IN WITH YOU.

The evolution of SCBA
How modern innovation is improving firefighter safety

The biggest barrier to firefighters trying to extinguish a blaze, or attempt a rescue within a building, is smoke. The need to provide crews with the ability to breath, manoeuvre within a building freely and interact with colleagues has shaped the development of breathing apparatus. From the first cumbersome smoke helmets, dependant on an umbilical cord, to self-contained Proto oxygen sets, to the revolutionary introduction of compressed air sets in the 1960s, breathing apparatus has saved countless lives.

Today's firefighters constantly face new and sometimes unexpected challenges. This whitepaper, based on views from an industry roundtable panel discussion led by safety equipment innovator MSA Safety, examines the latest threats facing firefighters, and considers how modern-day Self-Contained Breathing Apparatus (SCBA) can evolve to meet them.

Firefighters deserve to be protected

In the immediate aftermath of the 9/11 terrorist attack on the World Trade Centre's Twin Towers, no one will forget the footage of the New York City Fire Department crews running towards the blaze in Manhattan. Wearing full fire protection equipment, they entered stairwells and began to ascend. Their standard issue PPE and breathing apparatus weighed in at ~34 kg, excluding any other tools carried. Despite the fact that both buildings were 110 floors high, the equipment enabled one crew to reach the 78th storey, before, catastrophically, the South Tower collapsed.

In the UK's 2017 Grenfell Tower blaze, where insulating cladding fuelled the rapid spread of fire with highly toxic smoke and fumes, a firefighter talking to the *Independent* newspaper[1] has explained how, wearing breathing apparatus, crews attempted to create a bridgehead – a safe space for firefighters to gather inside the building – and to connect a hose to a dry riser outlet. Despite the tragic loss of 72 lives, firefighters were able to rescue 65 residents.

It's clear the design, performance, reliability and ease-of-use of modern breathing apparatus directly affects a firefighter's ability to enter a building, search for, find, rescue and evacuate trapped individuals. The safety industry has a duty of care to constantly look at ways breathing apparatus technology and best practice might be enhanced or improved. At the start of every fire station shift, lives are at stake.

[1] *The Independent: https://www.independent.co.uk/voices/grenfell-tower-fire-one-year-one-kensington-a8397276.html*

Great design: simplicity and purpose

Ever since the first self-contained Proto oxygen breathing equipment was developed, initially for use in the mines in 1915, and later adopted for the fire service, a guiding principle for all breathing apparatus remains *simplicity*.

A user might be a fully retained professional firefighter, a part-time volunteer or simply an employee facing a response to an industrial emergency within a plant. Clearly, the amount of annual training time spent with apparatus will vary widely between each group. But in each case, whatever apparatus is provided, it must be fit for purpose: simple to put on and easy for the wearer to focus on the job at hand. Users need a gauge that they can easily and quickly understand, for example.

From a manufacturing and design perspective, allowing users to define what works for them in a breathing apparatus. Specification is important, explains Jason Traynor, General Manager, Global Respiratory Protection and Fire Helmets, MSA Safety: "Needs and applications differ from fire service to fire service – often within the same country. By providing modular specification choices, manufacturers can accommodate varying user needs and budgets far more effectively".

In industrial workplaces, the breathing apparatus provided may not be scrutinised to the same level during monthly checks as equipment used, say, by a fire brigade. Adopting highly reliable, simple and consistent apparatus makes it easier to ensure workers are confident when checking their equipment before use and using it in a variety of emergency scenarios.

Effective voice communications for firefighters engaged in fighting a fire are vital for tactical and strategic decision-making, coordination, and transmitting urgent safety-related messages. Yet communication problems are continually cited as contributing factors in fires and emergency incidents where firefighters are killed or injured. Problems can often relate to mechanical and/or technical issues, including radio malfunction, limited system capacity, or atmospheric interference. The predominant communications-related concern typically reported by firefighters is the difficulty in communicating while using SCBA.[2]

Firefighters clearly need to communicate effectively when wearing breathing apparatus – be it talking to team members, to an entry control officer or to those being rescued or evacuated. And while several fire services now exploit telemetry to monitor the status of their firefighters, many still report that communication systems are in need of further improvement. In response, MSA Safety for one is looking to develop enhanced systems that can combine with a helmet or breathing apparatus. Its latest SCBA solution, for example, includes a microphone designed to protect against surrounding sound and a headset that easily attaches to the outside of the mask, integrating seamlessly with mask design.

[2] *International Academies of Emergency Dispatch: https://www.emergencydispatch.org/articles/fireinfo.pdf*

Ergonomics. One size definitely doesn't fit all

Today's serving firefighters span people of all genders, shapes and sizes. Historically, having a smaller frame or face has left some apparatus users, including women, finding it difficult to achieve a good fit when wearing standard breathing equipment and PPE. Weight distribution and wearability have also been raised as concerns. Fortunately, the fire protection market has recognised the issue and is changing.

The latest facepiece from MSA, for example, has been produced in three sizes and also offers three sizes of nose cup to ensure the perfect fit. Explains MSA's Jason Traynor: "When we look at weight and comfort, our SCBA designs over the past five years have evolved to move weight lower, and closer to the hips.

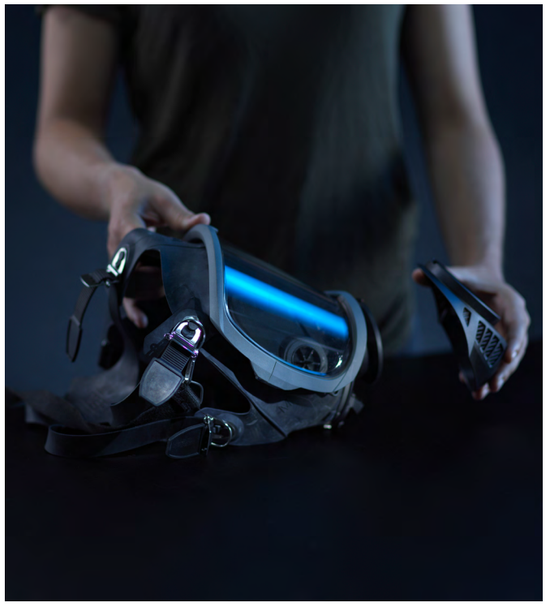
So, to ensure the ideal distribution, we've made sure the hip belt is fully height-adjustable for the user to match their build and frame. Once again, the move to a flexible, modular model for equipment is improving performance and safety whilst building user confidence".

The desire to configure breathing equipment more flexibly is also being driven by the need to consider specific use cases. For example, responding to incidents in plant, nuclear or aerospace environments will often see firefighters forced to work in very confined spaces. Here, the ability to rapidly change the size, profile and configuration of compressed air cylinders – such as via a universal back plate design – affords more effective and manoeuvrable equipment for any team on the ground.

Delivering expectations. Highlighting value during procurement

Sadly, the breathing apparatus performance users want and what public-service procurement perceives it can afford or will approve can be very different. Key influencers in the buying process, whilst knowledgeable, are often not front-line users of breathing apparatus fighting fires.

One way in which the industry can improve this situation is to the make the business case for better quality equipment more clearly. Alongside creating wider procurement frameworks and investigating flexible finance options, buying decision-makers should be able to focus more closely on value – in particular the whole life cost, including maintenance, training and inspections, and components designed for longer life and supported by warranties, as opposed to just the initial equipment purchase price. Generally improving a buyer's experience with continued engagement over a longer period of time, including aftercare support, can also help to provide all-important added value to the procurement process.



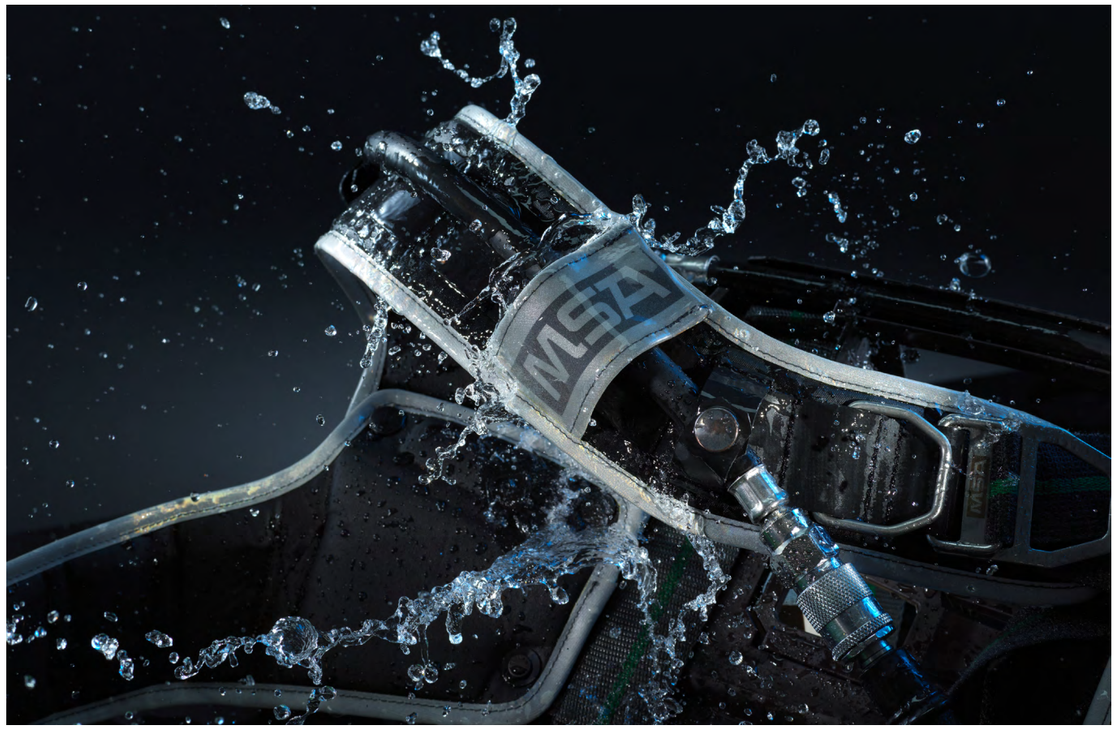
Decontamination after use. Removing carcinogenic deposits

A recent study by the University of Lancashire found that firefighters under 75 are three times more likely to die of cancer than the general population.

Ever since 9/11, reports of long-term health issues associated with inhaling toxic debris and particulate contamination during, and in the aftermath of, major incidents have been widely reported. To date, more than 9,000 members of the World Trade Center Health Program have been certified as having a related cancer; and more than 43,000 people have been certified with a 9/11 related health condition.[3]

Following the Grenfell blaze in the UK, the discovery of high concentrations of cancer-forming toxins and hydrogen cyanide in dust and soil nearby have seen calls for survivors and local residents to be screened for long-term health implications. [4]

In use, it is obvious breathing apparatus and PPE surfaces can quickly collect dust, debris and even potentially carcinogenic deposits such as asbestos particles. For MSA Safety, designing in the ability to allow breathing equipment to be thoroughly cleaned and decontaminated after use was a key part of the development brief for its latest SCBA solution. Choosing material that was machine washable (without the need for disassembly) and dust and water-repellent was central to achieve this.



[3] *The Guardian: https://www.theguardian.com/us-news/2018/sep/10/911-attack-ground-zero-manhattan-cancer*
[4] *The Telegraph: https://www.telegraph.co.uk/news/2018/10/13/grenfell-soil-tests-reveal-huge-numbers-cancer-forming-toxins*

In conclusion: key themes for next-generation SCBA

✓ Improved fire scene communication solutions

Better fire scene communications mean better, safer firefighting and rescue. Ensuring users have the ability to communicate more easily when wearing breathing apparatus is currently a major focus for innovation. Technology providing telemetry and situational awareness is already proving invaluable, and manufacturers should ensure new solutions have retro-fit compatibility with their existing sets.

✓ Increased value with future-proofed purchases

A manufacturing shift towards offering modular variations of breathing apparatus brings with it the opportunity for purchasers to extend the usable lifetime of their equipment and defer obsolescence. The ability to retro-fit innovative enhancements or technologies to existing sets down the line both increases flexibility and adds value.

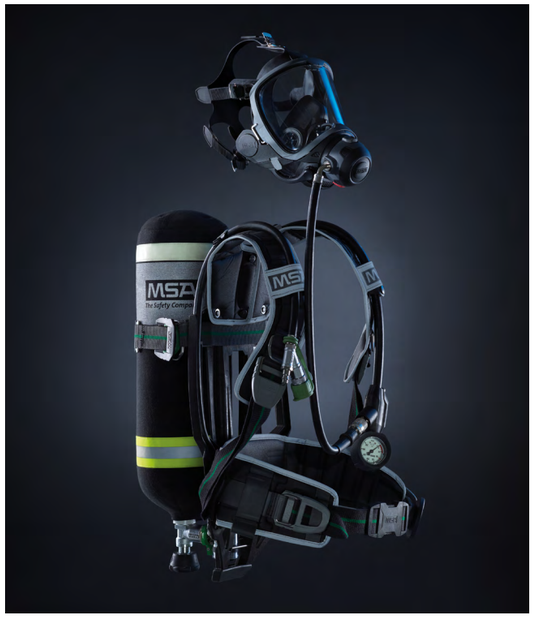
✓ User-centric product design

Successful products start with the end-user in mind – one size doesn't fit all. By actively engaging with a variety of end-users during design, prototyping and testing, manufacturers can better understand the demands of different sectors, firefighting scenarios and practical applications in use. Modularity is the future.

✓ A focus on simple, easy-to-use and fit for purpose

The easier and more intuitive equipment can be made, the more users will embrace it with confidence. From ensuring apparatus can be easily cleaned and decontaminated to keeping essential maintenance and checks clear and affordable, simplicity is key.

SCBA innovation in action: the M1 from MSA Safety



Three years in development and collaboratively designed side-by-side with firefighters, MSA Safety's latest modern-day Self-Contained Breathing Apparatus, the M1, represents an advanced, ergonomic and uniquely modular system.

Fully upgradable and easily reconfigurable in the field, the M1 shuns one-size-fits-all constraints to offer users the flexibility to configure variants of the apparatus to fit their needs and budget.

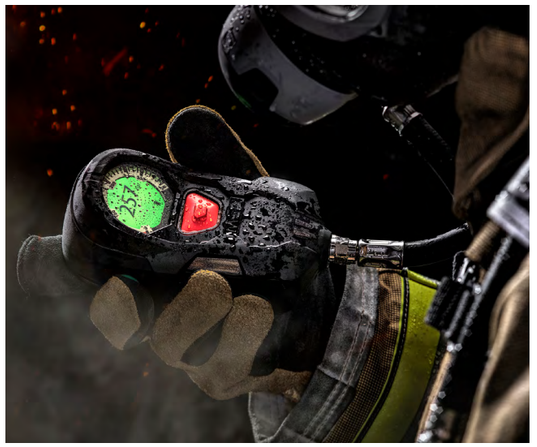
Featuring customisable components, the all-new platform enhances hygiene and improves ergonomics and comfort. The M1 padded harness is fully water-repellent, making the entire SCBA system machine washable without disassembly. The industry's lightest weight backplate offers simple one-handed height adjustment, whilst and an advanced hip belt distributes the weight of the SCBA evenly. A high-pressure cylinder connection supports rapid cylinder exchanges.

Modular features increase flexibility and reduce overall cost-of-ownership. Configurations offer the ability to include or exclude integrated electronics and telemetry and add an optional C1 headset with advanced voice communication to MSA's acclaimed G1 facepiece. All M1 components are field replaceable without special tools.

MSA takes customer experience and offering added value to the procurement process seriously. It provides extensive communication and aftercare support, as well as components designed for longer life and supported by a 10-year warranty.

The M1 is designed to meet the European Norm 137 (EN137) safety, health and environmental protection standards, as well ATEX intrinsic safety standards for usage in hazardous or explosive atmospheres. Unveiled in September 2018 at the 125th French Firefighters Congress in France, the company started shipping the M1 SCBA in Europe in January 2019.

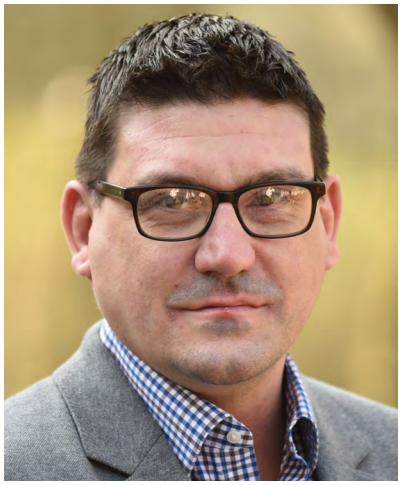
MSA will soon introduce a M1 solution specifically for the UK market which will be fully CBRN-certified and include a telemetry package combined with an innovative Control Module and unique Entry Control Board.



What's next for MSA Safety?

- ✓ **Further technological advancements around SCBA, including firefighter location technology**
- ✓ **Continued adoption of an 'eco-system approach': things works better together, connected working**

Explains Jason Traynor, MSA's General Manager for Global Respiratory Protection and Fire Helmets, "What's right for one fire brigade might not be right for another. We wanted to give fire servicemen and women an entirely new range of options in breathing apparatus technology at a cost and configuration that's right for them."



Jason Traynor
General Manager, Global Respiratory Protection & Fire Helmets – MSA Safety

To access MSA's webinar on fire safety, please click here to register: *https://gb.msasafety.com/fire-service-panel*

To sign up for MSA's newsletter, go to: *https://gb.msasafety.com/NewsletterRegistration*

To find out more about MSA's M1 SCBA, click here: *https://gb.msasafety.com/M1*

ABOUT MSA – THE SAFETY COMPANY

MSA is the world's leading manufacturer and supplier of high-quality safety products and gas detection system solutions to protect people from hazards. MSA's versatile product portfolio ranges from simple to high-tech solutions. The range of technologies and products offered is unique in the world. MSA has over 40 international affiliates and 15 manufacturing sites around the world. We protect people in more than 140 countries.

We accompany you in your mission in firefighting, emergency response and search and rescue.

MSA Safety
Hopton Park, Devizes
Wiltshire, SN10 2JP
United Kingdom
Phone +44 (0)800 066 2222
info.gb@MSAsafety.com

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