Innovations in breathing apparatus
Fit for the operational effectiveness of today and the future

Breathing apparatus (BA) has come a long way over the years. Some things however never change. Without breathable air, the danger to life is extreme and immediate. The use of self-contained breathing apparatus (SCBA) is therefore absolutely essential when it comes to keeping firefighters safe.

Before it, early fire fighters – often referred to as ‘smoke eaters’ – had to face the deadly effects of inhaling smoke and carbon monoxide with little or no protection, risking their lives every single day.

Safety specialist, Dräger, has been at the forefront of breathing apparatus innovations for the past 125 years and continues to pioneer advances in technology designed to protect firefighters around the world.

Here, Dräger’s Martyn Lamb, specialist in the fire segment market, looks at some of the key moments in the development of SCBA through the ages and considers the future of this vital piece of safety equipment.

An essential piece of kit
Without a doubt, SCBA is one of the most important pieces of personal protective equipment a firefighter on the front line wears. The equipment has the ability to protect against serious injury across the variety of different hazardous scenarios a firefighter faces on a daily basis.

Its overall purpose is to protect the wearer and ensure they breathe safely in an otherwise irrespirable environment – and it is one of the main risk control measures employed by brigades around the world.

As a result, through time, there has been a need to constantly innovate and develop in line with shifting Health and Safety regulations and increasing user expectations.

When it comes to breathing apparatus and the systems behind them, innovation never stops. New developments continue to be made as the fire
industry moves forward; incidents require new tactics and firefighting procedures change.

**Innovations through the ages – putting the user first**

Breathing apparatus has a history of innovation which takes into account the many considerations around fire fighter safety. As a safety manufacturer which upholds ‘Technology for Life’ as its guiding philosophy, Dräger has been at the forefront of many of these changes.

Fire service folklore recalls the days of fire fighters growing long beards to help them breathe in smoke and thankfully, BA innovations have come a long way since then.

The history of breathing apparatus is long and varied – from the 1904 introduction of the first reliable BA set, with a service life of up to two and a half hours, to the modern day launch of the telemetry in 2001.

The needs of the wearer have always played an important part in BA innovations, as it is vital safety is never compromised. Comfort remains a key requirement as this can have a major impact on a fire fighters’ ability to work safely and effectively.

As a result, comfort has been recognised through innovation for many years. For example, the Dräger model 1924 breathing apparatus was designed to be worn with a face mask, replacing the uncomfortable method of breathing inside a helmet.

Because of its weight, SCBA can put strain on the individual user causing fatigue, and, depending on cylinder capacity and the accessories used, SCBA has the potential to be heavy. As fire fighters are regularly involved in strenuous activity, developments in lightweight equipment are particularly important.
In 1929, Dräger developed light metal cylinders for respiratory protection and by 1998, technology had advanced to launch the lightest weight carbon composite cylinders, manufactured out of its Blyth, Northumberland plant – itself becoming the centre for excellence in BA manufacturing in 1980.

Wear and tear is another key consideration – particularly when thinking about the life-span of the equipment and cost implications for fire brigades. The introduction of state-of-the-art harness materials, moving from textile covered foam to a closed-cell rubber harness – specially designed to withstand the high level of impact on a daily basis – means today's equipment is more suited to extended wear and frequent use.

Resistance to chemicals found today is also very important, meaning less time away from being decontaminated by specialist cleaning service providers.

**Pioneering new ground**

Dräger breathing apparatus has also played a big part in ground-breaking historical milestones over the years, including the 1913 world altitude record for aeroplanes, set with the help of Dräger high-altitude breathing apparatus.

In 1931, oxygen devices developed by Dräger allowed Dr. Auguste Piccard to become the first person to fly into the atmosphere using a gas balloon.

And, Dräger BA sets helped the first men to reach the summit of Mount Everest in 1953. Sir Edmund Hillary and Tenzing Norgey reached the top of the world's highest mountain, with the support the company's breathing technology.

**State-of-the-art solutions for a new era of firefighting**

The BA of today is now more advanced than ever before and there are more options available to firefighters, according to their individual needs.

Technological advancements have enabled companies like Dräger to invest in state-of-the-art new techniques. The innovative pressure mapping technique for example, has created an optimised design which works
around the human form. It identifies key pressure points and uses advanced motion analysis techniques to help visualise how objects move in relation to each other, improving the harness positioning on the latest Dräger designs and giving the wearer comfort and stability.

One of the biggest issues faced by fire fighters wearing breathing apparatus is communicating effectively whilst in a hazardous situation – heightened by the number of well-documented communication failures through the years and missed messages contributing to fire fighter fatalities. Often, a fire scenario will take a fire fighter out of sight and communication and monitoring plays a vital role in protecting teams on the front line.

With many years’ technology behind it, Dräger has developed the advanced PSS Merlin System to support the needs of fire fighters and it is currently the only telemetry system in operation within the UK fire sector. The system is a fully automatic, electronic breathing apparatus monitoring system, designed to enhance the safety of the fire fighter during active fire-fighting duties, maintaining a disciplined entry control procedure and the accountability of all team members.

The system goes hand in hand with its Bodyguard 7000 – an electronic monitoring unit which provides continuous monitoring of personal information and operational status, including most importantly an accurate calculation of remaining air time which is updated every second and is based on current air consumption. An integrated system, designed with optimum comfort at the forefront, is then shared and monitored via the Entry Control Board, allowing the BA Entry Control Officer to monitor the exact status of up to 12 individual team members. Used alongside the new Merlin PC Modem, user monitoring has advanced from single Entry Control Point to the monitoring of an entire incident.

As a result of innovations like these, the concept of improved safety is one which has been welcomed by brigades, who trust that their workforce is well looked after. Remote monitoring through the telemetry system means teams can react immediately in the event of an emergency.
One of the key aims for Dräger within the context of the fire service, is offering Fire Authorities a total system solution where the total sum of the parts equates to the safest possible solution for fire fighters. All the elements need to fit together with precision giving fire fighters the ultimate protection in every situation, whilst demonstrating cost efficiencies.

The breathing apparatus of tomorrow will continue to be driven by technological advancements, user needs and regulatory changes. With chemical, biological, radiological and nuclear concerns in today’s society, fire fighters must be equipped to face a range of different hazards. New standards are being implemented regularly around the world.

As the sector continues to face new challenges, continuous innovation means that whatever the future holds, fire fighters will be fully prepared for any situation they may face.

**Box out – Timeline of Dräger BA innovation**

1889 – Patent for Lubeca valve delivered to Johann Heinrich Dräger, making it possible to control the removal of carbon dioxide from high pressure cylinders.

1900 – Oxygen supply device for high-altitude flights developed.

1904 – Model 1904/09 is the first reliable long-term BA kit, with service life of two hours.

1913 – World altitude record for airplanes is set with the help of Dräger high-altitude BA.

1915 – Dräger goes into mass production of respiratory protection masks in Germany.

1924 – The model 1924 BA can now be worn with a mask, replacing the uncomfortable method of breathing inside a helmet.
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1929 – Dräger light metal cylinders for respiratory protection are developed.

1931 – Oxygen devices developed by Dräger allows Dr. Auguste Piccard to be the first person to fly into the atmosphere using a gas balloon.

1953 – Summit of Mount Everest is reached for the first time by Sir Edmund Hillary and Tenzing Norgay with the support of Dräger breathing technology.

1953 – The PA 34 and DA 59 self-contained breathing apparatuses are developed.

1965 – Breathing apparatus manufacture moved from Germany to Blyth, Northumberland, UK.

1965 – Plastic high pressure gas cylinders are developed.

1966 – BG 174 BA using 200 bar cylinder pressure is made possible by the use of high alloy steels.

1969 – Dräger is the first company to use 300 bar technology self-contained breathing apparatus.

1969 – The Model PA 54 becomes the European standard.

1975 – PA 80 becomes SCBA international standard and the Panorama Nova full facemask is developed, combining comfort and quality. This is still one of Dräger’s most popular respiratory protection masks.

1980 – Dräger in Blyth, Northumberland, becomes the centre of excellence for BA manufacturing.

1992 – PA 94 SCBA and Futura respiratory protective masks are launched.

1997 – Draegerman PSS 500 SCBA is launched and the PA 93 Plus, developed in Blyth, Northumberland.
1998 – Draegerman PSS 100 SCBA is launched. Carbon composite cylinders developed in Blyth.

2000 – The first Merlin telemetry prototype and LDV developed in Blyth, Northumberland.

2001 – PSS Merlin telemetry board is launched which provides an overview of those wearing respiratory protective devices, thereby increasing safety.

2006 – Bodyguard 7000 is developed in Blyth, Northumberland.

2008 – Bodyguard 1000 and PSS 7000 developed in Blyth, Northumberland.

2010 – PSS 3000 and PSS 5000 SCBA are launched and the Merlin telemetry modem is developed in Blyth, Northumberland.

2013 – The integrated wireless variant of the Bodyguard 1000 ADSU, the Bodyguard 1500 launches to the market.

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