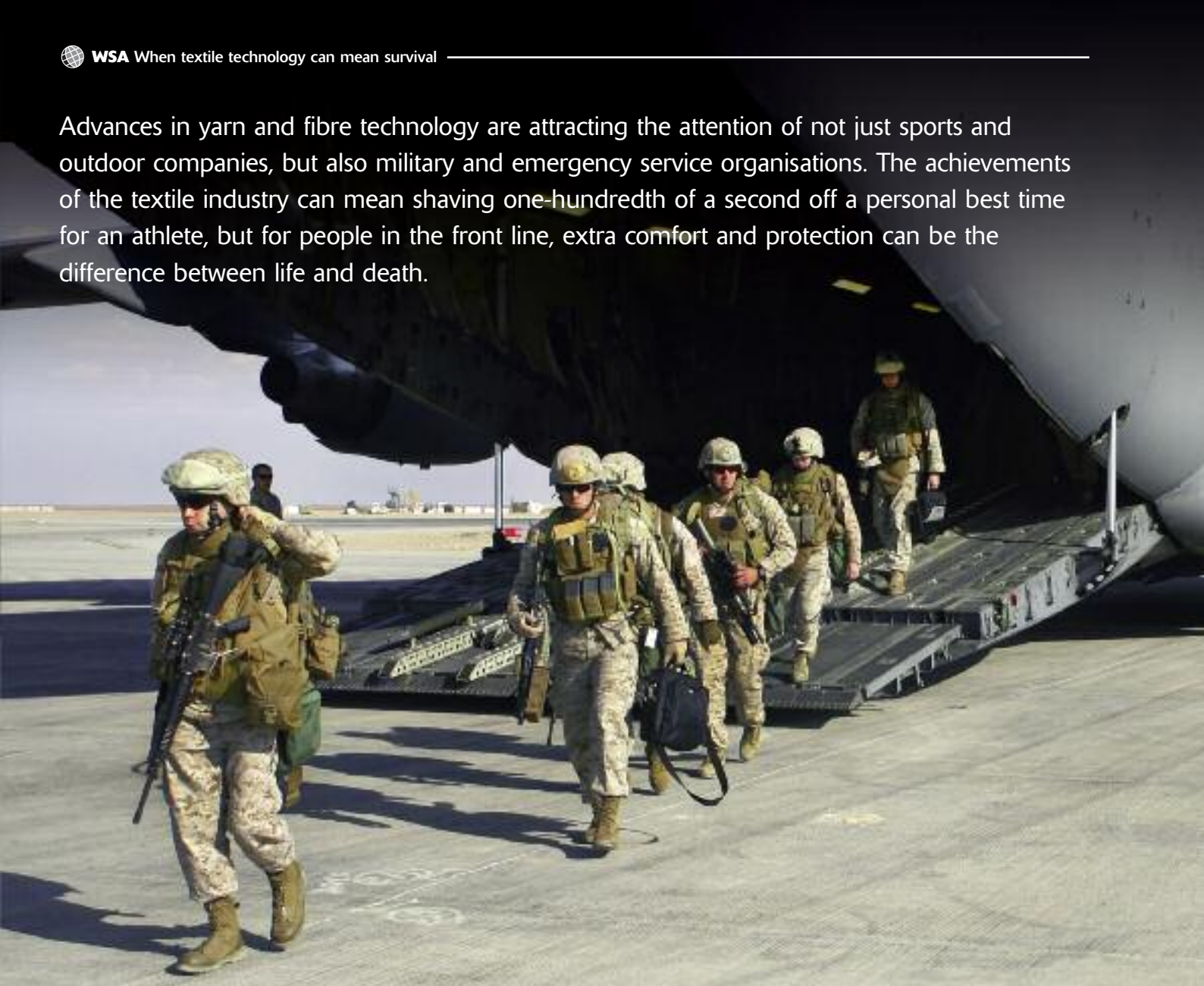
Advances in yarn and fibre technology are attracting the attention of not just sports and outdoor companies, but also military and emergency service organisations. The achievements of the textile industry can mean shaving one-hundredth of a second off a personal best time for an athlete, but for people in the front line, extra comfort and protection can be the difference between life and death.



When textile technology can mean survival

Clever developments in textiles are helping to save the lives of police officers, firefighters, workers who come into contact with hazardous materials, soldiers and others whose work sometimes means putting lives on the line. Recent developments in yarns, fibres and compound materials are providing better protection and comfort than ever before to people in uniform. And because contracts with government departments are often lucrative, textile technology providers are keen to keep trying out new ideas in these markets.

TenCate Protective Fabrics, for example, chose the Milipol exhibition in Paris last November to launch a series of new products in a category it has had in place for some time for defence clients, Defender M. Milipol is an event devoted entirely to homeland security; the 2010 show will take place in October in Qatar.

The Defender M range is in use extensively in protective clothing for special police units, such as riot police and arrest squads. The fabrics are inherently heat- and flame-resistant as well as being comfortable to wear. DM 9180 is the latest addition to the collection. It is a lightweight fabric with antistatic characteristics, weighing 180 grammes per square-metre. The material is best suited for use in the protective clothing of air-force pilots. The Defender M fabrics are also now available in two- and three-layer PTFE

The US Army has chosen to use Defender M fabric from TenCate and Lenzing in its new combat uniforms.

US Department of Defense

(polytetrafluoroethylene) laminate, weighing either 220 or 280 grammes per square-metre. Some of the fabrics in the range have waterproof and water vapour permeability capabilities as well as being flame-resistant and antistatic.

Natural comfort

In making the products, TenCate Protective Fabrics used some new technology from Austrian cellulose fibre producer Lenzing, its FR fibres. Lenzing vice-president Dr Dieter Eichinger, who is the business unit manager for textile fibres, points out that the qualities of the FR fibres mean they also hold high levels of promise for protective wear for firefighters. "I'm not only saying that because of their flame-resistance capability," he continues. "Many fibres in the market are flame-resistant but, in addition, ours have all the positive attributes of a cellulosic fibre."

People fighting a blaze in a building or in a forest desperately need the breathability properties of fibres like the ones his company produces, Dr Eichinger argues. Firefighters can find themselves facing temperatures of 200°C (392°F) and his contention is that it's not just the material in their protective suits that need to withstand that—it's their bodies too. "The breathable properties of FR fibres mean firefighters will be able to survive those conditions for longer," he says. "This makes a real difference: firefighters do not usually die from burns, but from heatstroke. The temperature is one obvious danger, but this is also about the combination of temperature and humidity. If you are sweating, the conductivity levels are higher and you will suffer more from the outside temperature."

In the military sphere, he reports that the TenCate-Lenzing partnership has already won favour with the US army, which tested 20 different possible materials for new uniforms for its soldiers before choosing. The soldiers like it, Dr Eichinger says. They appreciate all the extra comfort they can get in an environment in which they have to carry a full pack in temperatures of 40°C (104°F). The application he's talking about is a combat uniform made from 65% Lenzing FR, 25% Aramid and 10% nylon. It works as a two-piece or one-piece.

"The durability is good and the reports from the field are that the Defender M combat uniform is the best they've ever had," the Lenzing vice-president goes on. "But there is another element to the comfort properties, which is the washability of the material. If you use synthetic fibres in an environment like this, the smell can be very strong. Defender M is less odorous."



The main aim for d3o is to provide effective protection without affecting comfort or freedom of movement.

d3o

Hassle-free protection

Although d3o's main focus is on the sports market, around 40% is devoted to the military. The concept behind everything it does is the same: providing protection without limiting freedom of movement or ability to complete the task. Of course, when it comes to military applications, there are some very specific requirements the company must bear in mind; however the design process works in more or less the same way.

Company founder and CEO, Richard Palmer came up with the idea of d3o while running a design consultancy developing future products. "We were looking for opportunities that matched up technologies and human needs," he says. "This development I chose to keep to myself." The product is a specially engineered material made using "intelligent" (and top secret) molecules. They are designed to flow with the wearer as he or she moves and then lock together to absorb the impact energy should any form of collision occur. Rather than hardening when hit, the molecules lock together acting a bit like a net to absorb and spread the force.

This works across a range of applications including sport, medical, military and first responder gear. The technology can also be used in an array of products from racing suits for skiers, to shoulder guards for lacrosse players, high protection work boots and even accessories such as watches for law enforcement agencies and the military.



Carrying a heavy pack in difficult conditions means soldiers are glad of any extra comfort they can get.

US Department of Defense

Understanding the need

The UK-based company currently has three military contracts. The first is to provide helmet liners for the UK's MOD. According to Mr Palmer, the key here is to make sure the helmet is really able to absorb shock. Contrary to what people might expect, the aim is not to resist penetration from sharp objects, he says.

The second contract is to provide elbow and knee protection for special forces in both the UK and the US. The product it is creating here is still a work in progress as the problem is a complex one. Protection needs to be integrated and must be able to protect the wearer against sharp objects such as glass and barbed wire. According to d3o, the knee pads that are around at the moment simply aren't up to the job.

"The knee pads are usually strapped on and the guys move them down to their ankles when they're not kneeling," explains Mr Palmer. "Then when they want to kneel they have to pull them up with their backpacks on, which isn't easy." The objective for d3o, then, is to produce a high-performance pad that can be worn in the right position at all times without having any impact on the soldier's other actions and requirements. "This is the kind of thing that makes things difficult," Mr Palmer continues. "Our job is to understand the product, not just the technology. To grasp exactly what it is we are trying to achieve. To do this we work closely with members of the military."

The third contract the company has is also with the UK's MOD. It is looking at providing ballistic protection using hard shell, ballistics fibres and d3o. "It's working out how to make them work together," Mr Palmer says. "You need protection at various points of the body to avoid limb loss and damage to major organs. Even if you're shot in the leg you can die due to blood loss."

One of the main considerations here is added weight. Because many soldiers are already carrying a huge amount of supplies, munitions and equipment, any extras need to be as light as possible. "We're looking at what we can do but they're already carrying 60-80 kilos (132-176lbs)," Mr Palmer points out. "You could make them invulnerable, but you might as well park them in a shed! It's all about fine tuning it."

On top of all this, the heat burden must also be taken into consideration. According to WL Gore, heat stress is one of the biggest threats to life on the front line. Not only can it lead to dehydration, putting the body under a high level of stress, but it also has a direct impact on performance, the company claims. Therefore, the protective gear d3o comes up with must be light, comfortable and breathable so as not to cause the wearer to overheat.

Effective product

When it comes to designing military gear, he claims the design process is almost identical to the design model within the sports market. "There's a group of decision makers at each stage of the process," says Mr Palmer, "and the end user is probably the most valuable." It is the



There are lots of materials around that can withstand the high temperatures firefighters face, but the firefighters are human beings and their bodies need to be able to breathe or it can prove fatal.

US Department of Defense

end user, he explains, who is really looking for innovation. "Procurement officers and retailers tend to look back at what sold best last year. Suppliers need to want to make a difference. A lot of large brands don't want innovation; they're very comfortable as they are. But we're trying to understand and change people's opinions," the company founder explains.

The firm's most important aim is to bring out products that not only protect, but that actually will be worn. If the item is uncomfortable to wear or prohibits movement, it will simply be discarded, Mr Palmer claims. "Some special operations guys won't wear a helmet because they think it's ineffective," he says. "They're more interested in mobility than protection. That might sound surprising, but the primary form of protection is to get out of the way." He adds: "At one time we discussed the product with the Secret Service, but their point was that if they're being shot at they've failed already."

Whether the protection being created is for the military, first responders, medical workers or sports enthusiasts, the concept is the same. "It's providing protection for people in the event of unforeseen incidents without spoiling the action," says Mr Palmer. He explains that, over time, protection has often dictated the way people play sport or carry out active roles. American football, for example, has changed substantially because of the use of protective apparel and equipment.

Mr Palmer gives boxing as a slightly different example. The difference between boxing and bare-knuckle fighting is very minor in terms of the damage done to your opponent, he claims. The big difference is in the damage done to yourself. "The objective of protection is to provide the wearer with an advantage; it should be about self-preservation rather than altering the nature of the sport," he says.

The company's objective is to protect the individual and to increase the level of comfort. "We try to make the most unobtrusive, freedom-of-movement enabling product so that we don't prohibit the wearer from doing what they do," he says. The important thing to remember is that while its products are there to protect the user and to allow them freedom of movement it doesn't make them completely invulnerable, he adds.



Ironclad and 5.11 Tactical will be working together to produce high-performance gloves for people in vulnerable situations including law enforcement officers and fire fighters.

Ironclad

Fighting fire with fire

Gloves are another really important way of protecting people working in dangerous situations. Workers who come into contact with hazardous materials, dangerous objects or bare the brunt of the elements need the very best protection for their hands.

Recognising this, the Indianapolis Fire Department (IFD) recently purchased nearly 1,700 pairs of Southcombe Brothers' Firemaster IV Kovenex gloves to protect its fire fighters. The gloves combine Kovenex's inherent flame-, tear- and cut-resistant properties with Southcombe's patented water- and chemical-resistant Pyrohide leather to maintain the gloves' NFPA 1971-2007 certification and EN659 rating, as well as to increase dexterity, safety and performance.

Mark Holmes, quartermaster at IFD, said the gloves were picked following nine months of rigorous testing. The gloves were chosen over four other possible options because of the high-quality Pyrohide leather used, the dexterity the gloves allow, and their ability to resist water and corrosive chemicals.

"It is rare that we have the luxury of having so many of our actual firefighters thoroughly test vital components of their personal protective equipment," said Mr Holmes. "After extensive testing, it was clear that the Southcombe Firemaster IV Kovenex gloves gave our firefighters the best chance to protect patients and victims, and safeguard themselves during dangerous rescue situations."

Handy protection

Meanwhile, first responders in the US are among the first end-users to benefit from a new agreement between Ironclad Performance Wear Corporation and 5.11 Tactical. 5.11 Tactical, which creates and distributes products designed to enhance the safety, accuracy, speed and performance of law enforcement, fire fighting, emergency medical and military professionals, recently entered into a long-term agreement with high-performance glove and apparel firm Ironclad's technology.

Under the terms of the agreement, Ironclad has exclusively designed and manufactured a full line of task-specific gloves to be sold, marketed and distributed worldwide by 5.11 Tactical. The gloves will carry the 5.11 Tactical brand, and will also be co-branded as 'Built Tough By Ironclad'.

The gloves must offer a range of attributes depending on their end use. Gloves for law enforcement, for example, must offer dexterity, breathability and puncture resistance, while gloves for fire fighters must also be fire resistant, heat dissipating and durable. Design and production of the gloves is already underway, and are available now.

"Hand protection and grip enhancement are very important needs for police, fire, first-responders and the military," said Ed Jaeger, Ironclad's founder and head of business development. "By combining Ironclad's technical expertise in designing task-specific gloves across a wide range of industries with 5.11 Tactical's superior understanding of the end-users' needs and industry requirements, we will be bringing the best, most advanced products to this market."

It's a market that is hungry for textile innovation.

