

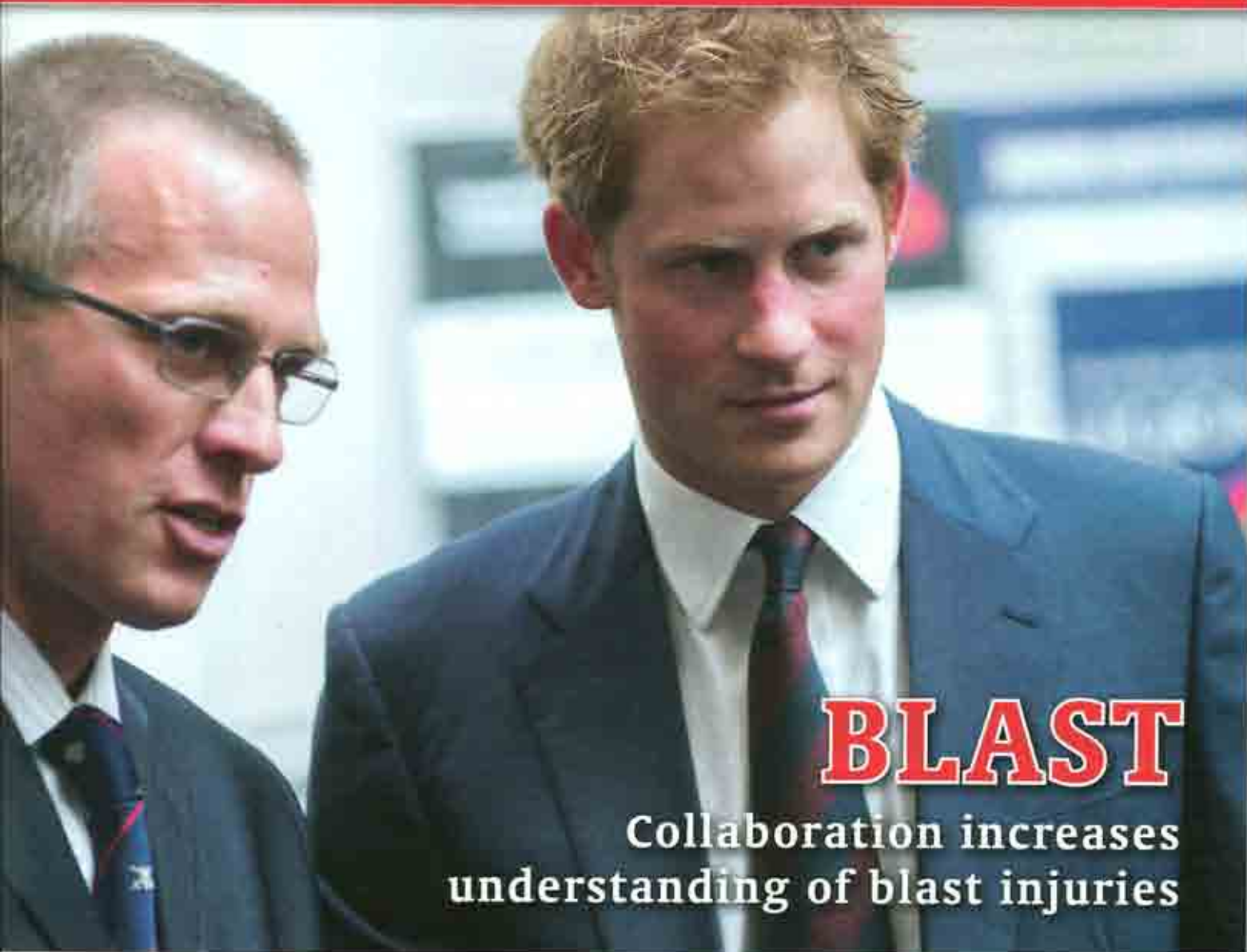
# Defence Codex

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# Tough technology that helps lighten the load

D3O first entered the military market when it was awarded two grants from the MOD's Centre of Defence Enterprise (CDE) – in 2008 and 2009 respectively. CDE backing was used to develop and test new products, including helmet liners and body protection for the Armed Forces. The company focused on developing comfortable, lightweight, flexible products with high performance impact protection and shock absorption. The CDE funding enabled D3O to dedicate Research and development (R&D) resource to explore and better understand the requirements for the military market.



**D3O is based in Brighton, East Sussex and has developed and marketed a patented technology that is used to produce soft and flexible materials, with high shock absorbing properties.** The technology was first proven during the 2006 Winter Olympics, when it was adopted by the US and Canadian ski race teams and is widely used today across a range of products and applications, including American Football helmet liners, motorcycle protection, safety gloves and boots for industrial workwear, iPhone and tablet cases and blunt trauma protection for military and law enforcement.

D3O's technology is based on non-Newtonian principles. Their team of chemists and materials engineers has developed a range of patented smart materials; these contain a rate-sensitive dilatant fluid, which means its viscosity increases with the rate of shear strain; in its raw state the material's molecules flow freely allowing the material to be soft and flexible. Under impact, the molecules lock

together absorbing and dissipating the impact energy before instantly returning to a soft and flexible state. D3O polymer engineers use this dilatant to create a range of stable materials that retain these soft, flexible and shock absorbing properties.

## Military knowledge

The first round of CDE funding was awarded under the MOD Personal Equipment and Common Operational Clothing (PECOC) programme in 2008. D3O was awarded £150,000 to explore

improvements in helmet liners and knee pads for military operations. The PECOC programme aimed to develop a modular head-to-toe soldier system, suitable for varied operational environments that can reduce the load that soldiers carry and improve equipment in the field. Existing equipment was extremely heavy, cumbersome, uncomfortable and could restricted movement in combat. There is also risk of wearer compliance if the protective equipment hinders performance in the field.

Photo 1 – Phil Sheriff

Photo 2 –

Dr Florio Antolini

Photo 3 –

D3O technology

Photo 4 –

Smart Skin shorts

Photo 5 –

How the molecules work





This insight into real-life applications came mainly from Col. Toby Evans who explained the soldier's requirements and the importance of comfort and performance. These have remained at the heart of all of D3O's product developments for this market. Working closely with Dr Eluned Lewis from Defence Equipment and Support (DE&S), D3O's team were able to explore the use of its patented shock absorbing technology for use in tactical personal protective equipment which has been the basis of many new personal protective equipment (PPE) products today.

Dr Floria Antolini, D3O Chief Knowledge Officer, comments "The funding provided an excellent opportunity to unlock R&D resource for new product developments for the military market that would have been unrealistic without this backing."

### Growing the company

The second CDE funding was used to explore the use of D3O in body armour applications and to test early technology developments. Working with Dstl's Dr Simon Holden and with access to Dstl lab facilities, they were able to develop the

methodology, prove the concept and start to build awareness of the disruptive technology within the defence community.

CDE provided a platform for D3O to engage with the wider defence supply chain in both the UK and worldwide.

D3O is backed by venture capital companies and has grown by up to 400% in the last four years, rapidly expanded its range of innovative materials and products, including new materials for helmets and footwear, as well as innovative solutions that offer improved manufacturing processes for its global customer base.

### Export success

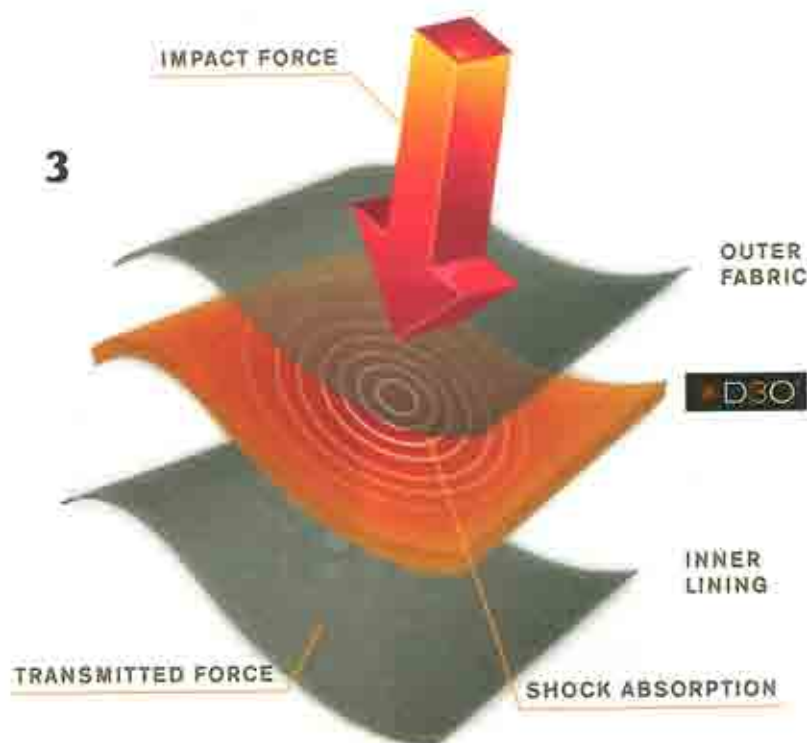
This year, D3O presented a brand new range of military products at the Association of the United States Army (AUSA) Conference at Washington DC and Milipol in Paris called TRUST, which stands for Trauma Reduction and Unrivaled Shock Technology. An integrated soldier system, the new TRUST range of products utilises D3O's new lightweight materials and provides soldiers with high performance, comfortable, flexible protection in the form of helmet pads, boot insoles, and a protective jacket

against blunt impact trauma. The protectors have been designed to be compatible with existing combat uniforms for ease of integration.

The company is committed to developing improved helmet protection solutions for soldiers and athletes using its patented shock absorbing technology. Last year, they entered into a partnership to provide liners for baseball batting helmets and American Football helmets.

The helmet design offered a good platform to base the new TRUST military helmet liner, constructed using D3O's newly engineered Decell material. The seven-pad system provides comfortable, high performance protection that exceeds the required level of protection by 33% in the Advanced Combat Helmet (ACH) tests at 10ft/sec.

Each helmet pad features a unique geometry that fits the shape of the head and offers superior deceleration under blunt impact tests. The pads are also lined with technical wicking fabric on one side and a hook and loop system on the other, allowing the pads to be retrofitted directly into combat helmets.



Further military helmet developments are underway with partner brands in the USA to develop helmet liners that meet the 14ft/sec tests. D3O has appointed a network of agents across Europe and the USA to distribute the TRUST line.

Outside of body protection, D3O has entered into a partnership with TEK Seating to create shock absorbing solutions for crew seating. This is the first application for D3O in military vehicles. A thin layer of D3O is being used in the seat-pad for vibration dampening during transit. This is also applied to seatbelts and head and neck restraints for shock absorption against impacts.

#### Future developments

In addition to the new military protection solutions, D3O has brought six new materials to the footwear market. These offer shock absorption, cushioning and energy return in a range of different types of footwear from athletic mid-soles, insoles and inserts to highly durable and efficient military boots. As a rate-sensitive technology, D3O reacts differently depending on the amount of force applied and recognises walking, running or jumping. Improved impact protection in footwear such as the midsoles has been linked to a reduction in lower limb injuries and D3O's new absorption range helps to reduce the impact trauma that commonly causes knee and hip injuries.

D3O Material Development Manager Phil Sheriff says: "We have been able to bring our expertise in polymer engineering and enhanced chemistry to the footwear industry and developed a superior cushioning offering compared to materials currently found in the marketplace."

D3O worked with key suppliers, testing facilities and conducted end-user trials to develop a suite of materials where each grade is targeted at a specific footwear need or application. The new suite of footwear materials is the result of 18 months of research, experimentation, advanced chemistry and development, and offers highly durable, efficient and effective solutions which perform across a wide range of impact energies. The range offers solutions suitable for running, hiking, trail running, racquet sports as well as military and industrial markets and is compatible with a wide range of underfoot applications, including inserts, insoles, mid-soles and strobel boards.

#### New products

The D3O Lab in Brighton is the home of all product and material developments, and features a rapid prototyping facility and test lab. One of the latest developments from the R&D department, called D3O Smart Skin, is a response to the growing trend, seen across all of D3O's core markets, that protection needs to be thinner, lighter and more flexible. Traditionally D3O components are integrated into garments by cutting and sewing into place, whereas D3O Smart Skin encapsulates the protective materials in a thin protective TPU film that can be heat-bonded direct to garments, offering the wearer an even closer, more low profile fit.

D3O have proved that protection doesn't have to be bulky and uncomfortable to be effective. They continue to lead and challenge the world of impact protection and shock absorption with innovative pioneering solutions across the motorcycle, sport, footwear, electronics, workwear and military sectors. \*



Photo 6 –  
Karrimor shoe

Photo 7 –  
Trust vest

Photo 8 –  
Deceit illustrated