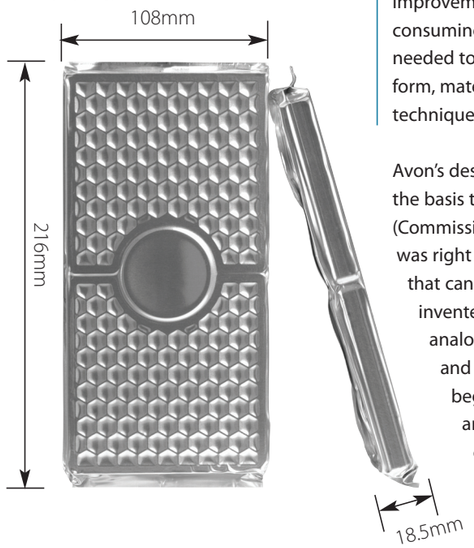
CUTTING EDGE PRODUCTS

The Personal Protection Equipment (PPE) industry is a highly regulated, safety critical market where quality and dependability are a must – not a target.

PPE is one of the vital systems that allows end users to carry out their assigned tasks in hazardous environments. Military teams, law enforcement agents and first responders for example, all carry out strenuous roles and demand the minimum burden from their PPE when delivering their tasks. They need the lightest, lowest burden devices to enable them to adapt to dangerous situations in challenging environments.

So begins our challenge – operational needs demand that designers think beyond conventional boundaries and extend their thoughts to lighter, smaller and more innovative solutions.

The market for PPE, particularly CBRN equipment (Chemical, Biological, Radiological and Nuclear) is changing quickly. As the level and type of threat to countries, governments and individuals change, designers and manufacturers of PPE must respond quickly to help equip those on the new front line.



Even when you think you are meeting customer demands, there are always new challenges in the R&D environment to stretch conceptions of what can be achieved using tools and techniques available to a designer.

Avon's recent programme for the USA Department of Homeland Security Science & Technology Group (DHS S&T) is an outstanding example where existing pre-conceptions had to be adjusted even before the project could start. Code named **EH15**, the customer defined a new requirement in Escape Hood technology – a super slim product capable of being stored in a suit jacket pocket whilst providing protection in a CBRN environment for a minimum of 15 minutes. The challenge for Avon's design team was to harness recent advancements in technologies and manufacturing techniques to squeeze a safety critical escape hood device inside a package no larger than 19mm (3/4") thick.

Avon's cross functional team set about putting together concepts exploring how to combine, eliminate or miniaturise bulky components found in traditional Escape Hoods to meet the size target. Although many good ideas were generated no single idea initially presented itself as the 'step change'. The method of using small, incremental improvements was ineffective and time consuming so a new direction was needed to help rethink the traditional form, materials and manufacturing techniques used in respiratory products.

Avon's design team began working on the basis that Charles Duell (Commissioner, US Patent Office, 1899) was right when he said: "Everything that can be invented has been invented" and so set about exploring analogous technologies, objects and products. Then the team began looking at pop-up books and by mocking up in card a couple of folding filters and some simple cardboard sheets to represent a pop-up design concept, our eureka moment happened.

Following extensive iterations of physical models, the geometry was eventually finalised and only then did the team begin transposing the design into a 3D computer model which was developed in just 3 days. The resulting 3D data was then used directly by the toolmaker to make the first prototype mould. Within 5 weeks the first products were successfully produced and placed into filter assemblies – they all folded and popped open exactly as intended.

A critical factor for an Escape Hood is its ability to withstand CBRN gases. Gas filtration performance is dominated by the filter depth – the deeper the filter, the longer the gases can be resisted. Using a novel composite cover plate (metal with plastic over moulding), Avon developed a unique ultra low profile filter with greater strength than a standard Escape Hood filter whilst maintaining the **EH15** product height limit of 19mm. Filter performance was assessed and honed using CBRN gases and nerve agent stimulant testing at Avon's specialized filter laboratory in Cadillac, MI, USA.

Product validation is the critical phase and the **EH15** proved its robustness by completing the full range of laboratory and user trials identified by the customer. The use of Avon's development facilities in the UK enabled immediate feedback on the main performance parameters of breathing resistance, re-breathed CO_2 and the ability of the hood to provide a sealed environment to protect the user.

Although passing specific laboratory testing enables the product to be considered suitable for field use - the real test is how it is received by its users. As part of the product development cycle, an independent user trial was conducted at the University of Maryland, USA, on ten selected subjects (two female, eight male) who assessed the **EH15** for performance, wearability, and comfort. After donning the hood, each subject was asked to perform three minute exercises in the following order: walk at a normal pace, enter/exit a sport utility vehicle, fast walk/slow jog, walk up/down along dimly lit corridors and go up/down the stairs. The final report concluded that *"Testing of human wearers indicates that the EH15 hood is comfortable, easy to use, and imposes little burden on wearers"* In any event, the **EH15** allows the user to continue to escape by whatever means available.

At the end of the programme, Avon had delivered the **EH15** prototypes on time and to the agreed budget. The customer Programme Manager Jalal Mapar summarised:
"The test data showed that Avon had developed an exceptional product that had performed well against the specification"
and this statement epitomises the view of the product within the customer base.

Before the development of the EH15, Escape Hoods were devices that were carried on a belt or stored in cupboards. The EH15 is a truly portable device which meets all the exacting requirements of the DHS S&T. So as designers, this project reinforces the adage that challenges generate inspiration and without those challenges, the designers are sometimes left bereft of ideas.

EH15 *is now being further developed by Avon with DHS S&T funding to meet the requirements of National Institute for Occupational Safety and Health (NIOSH) Statement of Standard for Chemical, Biological, Radiological, and Nuclear (CBRN) Air-Purifying Escape Respirator (APER).*

"The EH15 programme is a great example of our ability to delight our customers by delivering innovative solutions to their requirements. The UK team challenged conventional thinking about how an escape hood should be designed and packaged and we are very proud of their success."

Mike Harral
Product Development Director

artis
stretching the limits

Avon Dairy Solutions is currently using ARTIS to explore the way that silicone milking liners change during service. Using a programme of unique tests to evaluate the physical and chemical changes in the liner during service, the understanding gained will allow development of the next generation of silicone liners.
This methodology has already been applied to a major study looking at the way the design and materials used in conventional liners can improve animal health and milking efficiency.

ARTIS used a prototype silicone dairy milking inflation to test for insertion force. Milk liners are used in a very demanding environment. Milk contact, fatigue and exposure to cleaning agents are key factors affecting milking performance and longevity. Tests such as this help Avon to develop new and improved material solutions,ensuring our milk liners remain competitive in the marketplace.