

Kit builder

Military operations on a global scale tend to highlight problems of durability and performance with personal equipment that are not always evident on the home base. Earlier this year WSA's editor had the opportunity to visit the centre of the British Army's clothing and protective equipment development programme. In an interview with Colonel Silas Suchanek, leader of the Defence Clothing Integrated Project Team (IPT), we were given access to a way of thinking that may surprise many but that is refreshing in its frankness.

WSA: Given that the British Ministry of Defence procurement function is wide-ranging in its modern remit, it is perhaps surprising to note that it has the appearance of being afflicted with tunnel vision in the specification of Gore-Tex membranes in waterproof, breathable shell clothing. Why is this and has anything else ever been considered?

SS: In the Defence Equipment Research Agency (DERA) days, before the IPT was formed, when we were looking for waterproof, breathable garments I am led to believe that Gore-Tex was the only product on the market. Accordingly it went along with using the Gore membrane as its initial provider in terms of waterproof garments. That relationship lasted for some time. But, subsequent to that, the Agency wanted to bring in a competitive element to make sure it got the best value for money and that's when it started looking at Porvair membranes.

The waterproof market is in a very similar situation to that of the vacuum cleaner market and Hoover – people have got used to the Gore-Tex name and so they have begun to equate it with waterproof, breathable garments.

WSA: OK, so is this a case of sticking with that because that's the one we know?

SS: No, not at all. For some time we have procured both Gore-Tex and Porvair membranes for waterproof garments and some soldiers will swear blind that they're wearing Gore-Tex when in fact they have a Porvair product. There is nothing on the garment to indicate whether it is one or the other.

We are also looking at the world-wide market and when we did our supply base optimisation procurement strategy for tape-seamed garments we looked at a number of waterproof materials. We are well aware of what's happening globally and of the performance requirements out there. Currently our waterproof garment contract has been let to a partnership between Thistle Garments and Porvair. So we don't exclusively use Gore-Tex but Gore was the first company to produce the membrane for us.



Colonel Silas Suchanek, leader of the Defence Clothing Integrated Project Team.

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WSA: In the past military requirements appear to have dictated that comfort should take second place to function. But where do you draw the lines nowadays?

SS: On the question of comfort versus capability, I think one of the classic examples on this subject is when it comes to protecting soldiers on the battlefield – particularly in very hot environments. On the one hand, you want capability to provide protection from missiles, fragments and similar but, on the other hand, if you're fighting in close combat in very hot conditions sometimes body armour is removed to be more comfortable in order to fight properly. An example of that was Monte Cassino (World War II) when soldiers threw everything away and just retained their side-arms, grenades and their uniforms – and that was effectively it. They 'ditched' helmets and webbing equipment in order to fight more effectively in those very specific conditions.

So, where we can we do try to build in comfort and, naturally, soldiers will take a route to make it more comfortable for themselves when they are in certain environments.

Comfort versus capability is a constant dilemma we have. Take as an example combat clothing. In order to make it comfortable it has to be lightweight and have an open weave to allow air permeability. The trouble is those criteria make it inherently weak and, therefore, you require durability. Adding more durability in terms of a greater artificial content in the fibre can tend to make it less comfortable because a cotton-rich material against the skin is preferable to that where synthetic fibres are predominant. So, my technicians are constantly trying to create the balance of comfort, durability and protective capability by setting off one against the others.



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Snugpak Sasquatch Jacket often too warm for active use. This jacket is ideal for sedentary or range work.

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WSA: The history of nylon in military clothing has, until recent years, been one of acute discomfort. However, recent work by Invista in the development of lightweight versions of Cordura may well offer some interesting possibilities for greater comfort and durability. Are you currently looking at those - perhaps in knitted fabrics rather than woven?

SS: Yes we are - and apparently there are also aramids coming on to the market which are inherently much more durable and comfortable. They are also flame retardant at the same time.

Certainly one of the areas we want to get away from is the use of cotton underwear and cotton T-shirts. One of the big problems with the use of cotton is the risk of cold injury caused in both hot and cold climates where sweat is absorbed by the fabric which then requires body heat to evaporate the stored moisture.

That development was held up, to a certain degree, because there was a fear of artificial fibres next to the skin creating a melt/burn hazard and so people naturally veered towards cotton. We recently did some tests with the Institute of Naval Medicine on layered clothing using cotton, poly-cotton and totally artificial fibres next to the skin as a T-shirt base layer. There was no significant difference – the results were almost identical – in terms of burn rates, heat transfer, burn injury and ignition of those items. Hence, we are much more confident now in going to an artificial fibre next to the skin because it seems to be a bit of a myth that one sustains greater injury through wearing artificial fibre than through wearing cotton.

What this has allowed us to do is to go for completely artificial fibres because we want a wicking fabric to remove the sweat from the body and provide more comfort for the wearer. We can also then introduce processes such as anti-microbial and Teflon coatings to reduce the skin 'grab' factor. Thus socks, underwear and T-shirts become much more comfortable in wear.

It is interesting to note that the Norwegians – and we took on the Norwegian polo-neck shirt – are going away from cotton to a mixture of wool and polyester in undergarments for their Army.

Our other attention in terms of 'clever' textiles at the moment is being directed more towards the ballistic. What we are looking for are better levels of ballistic protection but with lighter garments and we are examining the clever aramids out there which will provide the same level of protection from a much lighter weight than Kevlar.

WSA: the American procurement function appears to be 'specification-led' in that it will contact a supplying company and say 'this is what we wish you to produce. Now go thou and find.' To what extent does that work in this country?

SS: In terms of specifications what we are leaning much more towards are 'cardinal point' specifications for operational clothing. Therefore what we will specify are the performance characteristics and then it is up to the industry to provide the solution to meet them.

On the other hand, if you're looking at ceremonial parade wear we become much more specific about the material that is used, the design, the look, the handle and everything else.

But, certainly for operational clothing, it is a case of 'this is the capability we are after. Come to us with a solution or we can develop a solution with you.' So it could be termed to be along the same lines as the US, but we don't specify any particular materials to be used. British government rules say that we must achieve best value for the tax-payers money and that is best done through the medium of competition and competitive procurement. It's only where there is a particular material with specific qualities for a particular capability, that we will specify because there is nothing else in the world that can meet the requirement. But if there is an alternative, then we follow the competitive procurement route.

WSA: Are you able to tell us where you are going with developments at the moment? What sort of interesting projects are coming forward or are in the process of being put together?

SS: Up until now operational clothing has been procured in a rather piecemeal fashion – so we require new helmets, we require a new combat jacket, we require this or that. It has generally been the case of replacing an item with something better without necessarily joining together the system.

The Director Equipment Capability (Ground Manoeuvre) is the person responsible for laying down the requirement for future operational clothing. They have recently taken on ownership of operational clothing – what we call the post Customer One – and are undertaking operational analysis to see what sort of capability our system has to have.

At the same time we have the FIST (Future Integrated Soldier Technology) project underway. FIST also has a sister project called PEACOC (Personal Equipment and Common Operational Clothing). The two run in parallel: FIST is the soldier's hardware, ballistic protection and load carriage; PEACOC is the personal equipment and clothing side of things. So the analysis currently being undertaken will inform both programmes and when the capability requirement has been decided we shall see a revolutionary 'jump' in operational clothing.





(left) Combat 95, the British Army's current clothing and kit package is capable of further evolution and embellishment.

(right) A development of the standard NBC suit that is intended to cater for maximised threats.

UK Ministry of Defence

For the moment our remit is merely to further evolve Combat Soldier 95 (the current clothing and kit package) to make it more comfortable, to make it more durable - perhaps to make it fire retardant. It's when we come to the PEACOC/FIST programme that we shall make a step change in the sort of clothing we'll wear. The current thinking is that the combat clothing of the future will be rather similar to an airman's flying suit in that it will be a very specialised piece of kit. It will be hanging in the wardrobe and it will only be worn for operations; as we speak, of course, we wear operational clothing in barracks and in the field. So, it is at that stage - although it is beginning to happen already - that we investigate very specialist materials which could contribute to the capability of future clothing.

Perhaps they will take the form of some sort of 'chameleon' cloth that can change colour to match one's background, or possibly textiles that carry wiring for power or situational awareness systems. In the latter case, if a soldier is struck by a bullet a signal is sent indicating the position and seriousness of the wound, and the location on the ground to facilitate possible casualty evacuation.

The requirement analysis has shown that the ideal all-up combat load is 27 kilograms – there was a 'budget' between 25 and 30 and we averaged this at 27 – and that figure has been adopted by most NATO countries. The problem we have with FIST/PEACOC is that if a soldier is going to carry a personal weapons system, a head-up display, a personal radio, etc., how do we come to that budget of 27 kilograms or thereabouts. This is where nano-technology, very lightweight materials technology, comes in to play in providing a soldier in a single layer with thermal control, ballistic protection, camouflage, heat management and protection from NBC (nuclear, biological, chemical) threats by combining the NBC suit with the operational clothing and adding some sort of respirator into the helmet.

WSA: But surely the NBC suit is not included in the 27 kilograms?

SS: It is, but at the moment the soldier has to carry the NBC suit as a separate item attached to his body. That is part of the 27 kilograms all-up weight but, if we can combine his combat clothing with the NBC suit, then he does not have to carry anything extra. It is all about the provision

of the greatest range of protection for the soldier with the least amount of clothing he has to carry.

When we come back to the flame retardant factor, protection from flame is brought about by wearing layers of clothing to provide the most effective air insulation. So, the challenge in desert conditions in particular, where soldiers wear just one layer of clothing, is how to actually provide that protection. If you provide a flame retardant coating on a single layer the soldier will still burn by heat transfer.

Clothing in this context does have a major part to play but, on the other hand, as much if not more is achieved by the application of training and procedures. We have some very dramatic photographs from recent operations where soldiers were set alight with petrol bombs but were not injured. The reason was that there was someone on board (the troop carrying vehicle) with a fire extinguisher which put out the flames very quickly. If we have a process or training which extinguishes flame very quickly, you do not have to rely entirely on flame retardation.

There is also the danger that by making clothing too flame retardant it is possible to influence the soldier into putting himself unnecessarily at risk because he believes that he has greater protection than is perhaps the case. The training and the process is very important here because we should always ask the question 'can you diminish the threat by other means'.

On the design front, we found ourselves with a dilemma in respect of body armour and webbing equipment when worn together. When a soldier is lying down and the bullets are flying a few inches overhead he needs to be as flat as possible. But the coincidence of body armour and webbing systems where munitions pouches are worn on the front can raise the upper half of the body into the danger zone. Therefore, it should be possible to wear the load carrying sections at the back in order to achieve a low silhouette. But the type of webbing where everything is carried in front is very popular – particularly so when patrolling in vehicles with the necessity to keep jumping in and out. Thus, we have perfectly logical dual requirements from one design where perhaps we can change the configuration to meet them.

What we are looking at is a multi-purpose webbing system where the wearer can change the configuration to match the activity and avoid the necessity to carry around two sets of load-carrying equipment.



Special Forces sleeping bag is a multi-component sleeping bag flexible enough for use in the warmest and coolest climates.

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In Afghanistan we found that a soldier has to change his role very quickly in the space of an hour so he can be located on a hot, dry plain and, within a few minutes, he can be up in the cold of the mountains. The challenge there is to provide him with clothing which he can switch very quickly from one role to another.

WSA: May we turn to sleeping system development? Obviously it's in a state of almost perpetual progress but where are you now?

SS: Our most used sleeping bag, the so-called 'Bouncing Bomb', is a very good performer and it protects you at quite a low temperature but, in order to be effective in those temperatures, it has to be quite large – which is how it earned its nickname. We've had customer observations to the effect that we need something smaller that we can fit into our armoured fighting vehicles where space is at a premium. We need something smaller so that we can carry it around reasonably easily and in a hot or temperate climate we do not need something with that level of thermal performance.

We do have a lightweight jungle sleeping bag which has been on issue for some time and one of the projects we are about to complete is a twin bag. This consists of a jungle-type bag, a denser temperate climate bag and the facility to zip the two together to make a winter system. That's been trialled with one of the Commando units with favourable reports coming back. The double bag concept will be going into service fairly soon.

We're also looking at a 'dressed for sleep' concept because, if the soldier uses the bag whilst wearing a layer of clothing, then it is possible to use a lighter product.

WSA: Are you staying with a down filling?

SS: Yes, but we are tending to consider artificial filling as an option because of the hygiene factor and the ability to launder or clean it under field conditions. And we have found that artificial fillings are just as good as down and feather in terms of performance.

What we have looked to and continue to draw from is the commercial market, which in many ways now is driving the performance in clothing textiles. Many more people have sufficient leisure to be able to climb mountains or indulge in extreme sports, they require the appropriate equipment and so we draw on the developments in cold-weather clothing, sleeping bags and waterproof garments.

I believe also that the effects of what we are doing are beginning to be felt. There was a feature in an earlier edition of the Army's 'Soldier' magazine in which a soldier was commenting most favourably on the suite of desert combat clothing with which he had been issued. My staff were really pleased about that because, at long last, they are beginning to receive some plaudits for the great work they carry out in providing the UK's Armed Forces with truly excellent clothing.



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