

Gwyn Winfield talks to the team behind the next-generation clothing demonstrators in the US

Suitably dressed

The suggestion that we are on the cusp of a change in personal protective equipment (PPE) has been mooted for a number of years without any real differences becoming apparent. The changes have been small, though notable, but there still has not been the breakthrough promised – it has either been too expensive or too impractical. The Defence Threat Reduction Agency (DTRA) and Natick Soldier Systems are hoping this time that change will be realised as they present to a variety of DoD Program Executive Officers (PEOs) four different ensembles that each offer a potential for future development.

What is made clear right from the start is that none of these are replacements for JSLIST or the M50. This is basic research into the old equation of thermal burden versus protection, and offers the potential for further R&D rather than a finished

product. Andra Kirsteins, Technical Lead at Natick, explained the concept. "The overall objective for the programme is not developing the next-generation ensemble," she said. "What we are doing for DTRA and the chem/bio defence community – like JPEO CBD – is investigating new technology that is coming out of the research programme and demonstrating it in a representative future warfighter ensemble, and demonstrating them in an operationally relevant environment. So the bottom line is to give information to the requirements and acquisition community to inform them for the next-generation ensemble – to provide data on deep technology that is coming out of research, on how they can improve capability and how they can mature them.

"One of the foci is improving thermal burden and finding how to do that through materials and design, and how

does thermal relates to chemical performance. Natick is the technical project manager for this, working with DTRA, and funds a number of different organisations like Edgewood Chemical and Biological Centre and other groups to support us on this programme, to attempt a new capability."

It is not just JPEO CBD that is involved, however; the demonstration will reach out to other PEOs, such as PEO Soldier. Equally, the demonstration is not about individual items but the ensemble – how the helmet, mask, suit, gloves and boots all fit together. So even though there are four main ensembles, they are composed of varying parts. Marc Mathews, the System Engineering Lead at Natick, described the various parts. "As we developed this, the needs we were looking at were: thermal burden, CB protection, head gear integration, sensor and network

Personal Protective Equipment



THE ULTIMATE PROTECTION

World Leader in the manufacturing and design of CBRN Personal Protective Equipment, AirBoss-Defense has built its reputation by supplying soldiers and First-Responders with superior Individual Protection solutions for over 30 years. Committed to providing the Ultimate Protection to our clients, AirBoss-Defense is continuously innovating using the most advanced technologies to offer products that meet the highest standards.



C4 Gas Mask

- Lightweight and comfortable.
- Shatter proof lenses.
- Available in 4 sizes and 3 colors.



AMG - AirBoss Moulded Glove

- Excellent grip and tactility.
- Ambidextrous and antistatic.
- 24 hours CW agent protection.



MALO - Moulded Light-Weight Overboot

- Latest generation.
- 24 hours CW agent protection.
- One piece Injection moulded construction.
- Ambidextrous: fast donning and doffing.

airbossdefense.com 1-450-546-0283

881 Landry, Acton Vale, Quebec, Canada

i-bodi

INNOVATIVE

TEST PLATFORMS

/ ANTHROPOMETRIC, ARTICULATED TEST PLATFORMS /
/ BREATHING, SWEATING, MOVING HEAD FORMS /
/ SOFT POLYMER SKIN-LIKE SURFACE / RUNNING MANNEQUINS /

i-bodi - Provide intelligent solutions for industry,
first responders & government organisations.



Tel: +44 (0) 1280 815300 Email: info@i-bodi.com

www.i-bodi.com

Suitably dressed



Prism is one of the variants in the technology trials ©ECBC

integration, compatibility and durability,” he said. “The systems were designed in a way to lower the thermal burden as much as possible while still retaining chem/bio protection – but to still be a chem/bio garment rather than a daily combat uniform with some level of CB protection.

“There are three main designs, and one with modifications of material types in it. We have what we are calling the Chem Bio Combat Uniform – the Army in-theatre ‘combat shirt’-type of uniform. This takes

into account the fact that the soldier will have the ballistics vest and a variety of materials that go under the vest to support moisture wicking, a reduction of thermal burden and increased evaporation, etc. So the Chem Bio Combat Uniform is based on that kind of design – looking at stretch materials that can go next to the skin in the chest and torso area, provide protection and separate materials having additional protection used in the arms which are not protected by the vest. There

are also various venting strategies – thermal reduction strategies – so when a soldier or user is in an open-type configuration and is not fully protected – similar to a MOPP 2 – they could open the vents, get in extra air to help with evaporation and cooling, and they have the ability to close them up when they go into a fully protective posture.

“The next one is an undergarment – the Chem Bio Undergarment (CBUG), which is a stretchy chemical protective material that you can wear underneath your combat uniform to provide protection. It provides lighter weight protection that you would get in a current base line system, and you could wear it with your combat uniform over the top of it. The third concept is an enhanced Flame Retardant Army Combat Uniform (eFRACU) concept, taking very similar designs to the flame retardant army combat uniform and modifying that design to have enhanced chem/bio closures as well as integrated CB protective materials. It turns out that this garment is similar to a combat uniform – with some closures that are at the waist – changing from buttons to zippers and adding a chem/bio protective material as the material barrier. The enhanced FRACU would be worn over the chem/bio undergarment.

“Those three are the main ones,” Mathews continued. “The fourth one is another Chem Bio Combat Uniform concept that uses different materials to those in the Chem Bio Combat Uniform – these materials come out of the Integrated Protective Fabrics Programme that DTRA funds. We have two headgear systems that we have matched up with them – one is the Chem Bio Protective Integrated System mask (CB Prism). It is an integrated headgear system where the mask and the headgear are intimately integrated to each other so they provide connection to each other, though the mask can be donned without removing the helmet. CB Prism has the filters in the helmet liner and that connects to, and is worn with, the CB Combat Uniform which has a cowl neck so it can be integrated directly to the lower part of the mask as our neck integration solution.

“The other, CB Rail Attaching Mask (CB Ram), is designed with a rail attaching mechanism on the helmet, and is a modular head gear system where you have a facepiece and a helmet. The facepiece is



THE FIRST LINE OF DEFENSE FOR THOSE WHO SERVE

RSDL®

**Neutralizes or Removes
Known Chemical Warfare
Agents From The Skin.**



FAST • SAFE on SKIN • PROVEN ASSURANCE*



RSDecon™
THE FIRST LINE IN CHEMICAL DEFENSE

IMPORTANT SAFETY INFORMATION: For external use only. Contact with eyes and mucous membranes should be avoided. In emergency conditions, RSDL does not require immediate removal from the skin and can be left on under protective clothing, but should be rinsed as soon as it is safe to do so. An ingredient of RSDL is absorbed. Studies with RSDL left on the skin for 24 hours showed minimal adverse effects. Avoid prolonged skin contact.

* U.S. Army Medical Research Institute of Chemical Defense (USAMRICD); E.H. Braue Jr. et. al.; (2008); Efficacy Comparison of RSDL, M291 SDK, 0.5% Bleach and 1% Soapy Water Challenged with Soman, Cyclosarin, VX, and Russian VX (VR)

Additional information is available at:

www.RSDecon.com

107 College Road East, Princeton, NJ 08540 USA Phone 1.888.773.3266 • Int'l calls 1.631.226.2090
RSDecon is a Business Unit of Bracco Diagnostics Inc. ©2010 RSDecon.

Ref No.: 01-773-0004

Suitably dressed

used for protection, and that hooks onto the rail of the helmet and also uses the chin strap on the helmet to provide a four-point connection between the mask and the helmet, once donned. This provides the integration between the mask and the helmet, so that both of them work together to keep the seal of protection. The CB RAM is worn with a CB Balaclava; this provides the protective seal around the mask without putting a hood on the mask, integrates with the CB RAM mask, and fits under the helmet. This is also a system that you put on without removing your helmet. CB Ram is worn with the undergarment concept and the enhanced FRACUC concept.

"Finally, there are a couple of different boot and glove configurations we have looked at. We see the boots as a new concept – an innovative CB Boot that has a direct integration to the trousers through a direct integration ring on the boot. So, instead of the trousers coming down and velcroing onto the top of your protective boot, you can create an intimate interface and offer blousing for the chem trousers into the boot to provide the additional level of protection," Mathews concluded.

There are no doubt elements of the existing ensembles that can be better engineered as more accurate testing becomes available, yet what is the fabric/membrane/liner that is going to take this to the next level? Does the venerable activated carbon have a role to play? Mathews agreed that it did. "Some of them are activated carbon-type materials, and one system is a combination of membrane and carbon," he said. "We found some good performance with the lightweight stretch carbon-protective materials, and those are in the areas where you need a little bit more stretch or lighter weight performance for the feel, wicking, etc, but still need CB protection. We also looked at around 40 materials that we had a Request for Information on; we had materials from all over the chem/bio and military textile industry, and we looked at the possibilities. We looked at the properties of these materials in terms of programme goals and took a decision-analysis approach to selecting materials for garment design, versus taking a design and then choosing a material. We tried to do both together."

Kirsteins agreed, and described the next-generation fabrics they had used. "The Integrated Protective Fabric System

is a research programme for new chemical protective material, and there were two basic materials we were working with that came out of IPFS," she said. "One of them is comprised of a membrane and is treated with a reactive coating that has shown promise in reacting with CWA to neutralise them, as well as some anti-sporicidal properties. The second material coming out of the programme is a carbon stretch material that is treated with a reactive material in addition to enhanced aerosol protection."

Dr. Heidi Gibson from Natick Soldier Systems Center states that the Integrated Protective Fabric System programme is conducting basic research and development to further new materials concepts by incorporating additional CWA neutralization chemistry into the membrane, broadening the neutralization in the carbon layer, demonstrating the utility of novel advanced adsorbents to replace or augment the standard activated carbon materials, incorporating superoleophobic liquid repellency in the cover fabric, and diminishing under-garment airflow issues through the use of novel venting strategies supported by foundational air and vapor transport modeling.

The team is keen to suggest this is not a case of four finished designs being presented to the acquisition community; rather, it is a case of looking at how the ensemble components work individually and collectively. "The concept is to investigate alternatives," said Kirsteins. "We are not looking to develop something that will be the next generation – we are trying to understand the trade-offs. If we maximise thermal performance, what are the trade-offs in chem protection?"

These trade-offs are to be made apparent in the September demonstration, as Lieutenant Colonel Crigger, Program Director at DTRA, explained. "There is a variety of thermal burden and CB protection in each of the systems, and we are still testing to find out exactly where they fall in each of the range of those variables," he said. "Our final versions of the systems are now in the process of being tested, and when combined with the operational demo it will tell us where they fit. Based on our early testing it will be a combination of thermal burden and protection, but we are not sure where as yet. Some of them

have good thermal burden, some of them have good CB, but there are so many different variables that we will only be able to see once we get the data."

Yet it is not just thermal and CB protection that are on the axis, though the demonstration is skewed that way; it is also providing situational awareness in a CB environment. "That is a large novel piece," said Mathews. "We are approaching the system development by also looking at CBRN sensors and integrating them into the technology for on-soldier comms, inter squad radios and the ability to send NBC messages digitally up to the command element that can make the information translated into what the common operating picture (COP) looks like, and additionally the ability to send that information down to the soldiers that need it immediately."

That data is not necessarily designed for the CBRN professional. This is aimed squarely at the ground tactical warfighter – the people who find themselves in a chemically contaminated environment and have little or no time to change uniform. Currently, the system varies between TRL four and six (depending on the components), with the focus on providing data and understanding the trade space, so that the requirements community can develop informed requirements.

It is difficult to offer any conclusions without the findings of the demo – which I hope to do at a later date – but it is useful to see the way the trend is going. Certainly the CB Prism and Ram respirators are a novel approach, and it will be interesting to see what operational testing makes of having filters in the liner of the helmet. This has obvious advantages in terms of losing the canister weight which can deform the mask seal, and allows a freedom of design, but it does also raise a concern over what effect rounds striking the top of the helmet – that might be above cover – might have on the ability of the warfighter to operate in a contaminated environment. Equally, there would seem to be concerns about wind-blown agent on stretchy carbon fabric, so it will be interesting to see how it copes with the testing on that. As several other ministries and departments of defence suffer research and development cuts, opportunities like this quadripartite demonstrator will come around less often. We hope we can keep you informed.