Protecting our assets

Defence Journalist **Liz Moscrop** addresses the dilemma over providing protective clothing and equipment while still allowing today's soldiers movement and flexibility…

There is good and bad news for today's soldier on the ground. The good news is that there are vast resources and many national programmes underway to help with dismounted close combat; the bad news is that each improvement adds to the burden of clothing, equipment and information.

Today's soldier is likely to carry or wear kit comprising of at least the following: sophisticated ballistic vests, including side-plate body armour; helmets; ballistic eye protection; hydration systems; gloves; knee pads; elbow pads; bed insect netting; insect repellent; and reflective vests. Additionally, he has to carry food and beverages and frequently a power supply too. It is estimated that at least 67% of a modern soldier's weight comes from his kit.

Aware of this, governments throughout the world are developing equipment via the Future Soldier multi-nation military project, which kicked off in the late 1990s. The project is aimed at kitting out the average ground-based combat soldier of 2025 with an integrated set of hi-tech uniforms and equipment linked to real-time and archived battlefield information databases. Soldiers will be equipped with improved versions of today's equipment (rifle, pistol, knife, helmet, armour, clothing, etc). What seemed a decade ago to be outlandish visions for the future, such as exoskeletons, micro robot vehicles, surgery-enhanced vision and invisibility shrouds, either exist or are in development today. The US's future 'Objective Force Warrior System', scheduled to be fielded in 2008, features a helmet-mounted display and a monitor showing maps and other images that the soldier can view, either via a thermal weapon sight or via a daylight video sight mounted on the M4 carbine derived weapon system. A computer mounted on the soldier's back integrates the entire system. Other parts of the equipment include the Land Warrior assault helmet and the Interceptor body armour vest.

The helmet contains night-vision goggles, thermal sensors, day-night video cameras, and chemical and biological sensors to help soldiers make a positive identification and prevent friendly-fire casualties. Head-Up Display (HUD) technology, such as that used by pilots is already available, improving a soldier's ability to move, find and engage in combat, while also increasing survivability. One such helmet in use today is the SO-35 developed by the microsystems technology office of the US military's Defense Advanced Research Projects Agency (DARPA), which directs research and projects for military roles and missions.

Manufactured by Rockwell Collins, the SO-35 is a light, rugged, powerful Helmet-Mounted Device (HMD) with a SVGA monitor. It is 2.2 inches tall, 1.9 inches wide and 1.6 inches deep and weighs 11.1oz. It is capable of handling up to 131°F and down to –35°F and up to two hours in about a foot of water. It can also receive several types of video signals. Soldiers viewing video captured by a remote-controlled, camera-equipped robot that was sent into caves, have used the helmet in Afghanistan, and have also used the SO-35 in conjunction with a gun-mounted camera to look around corners and over walls.

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Costing $10,500, the display is operated by a 6.4oz controller, which processes different types of video signals. It can be powered by in-built batteries or separate packs and the signal can come from a wireless source, a body-worn computer or another computer source. There's an auto-shutdown feature to save power when the display is not in use.

And when soldier's are not consulting their HUD, they are reliant on sophisticated eyewear to both protect them and aid their movements. Defence organisations have been quick to adopt the new technologies available and many are already in use. For example, Revision Eyewear, developers of special purpose-built military eyewear, has signed a contract with the US Army to supply 100,000 sets of their Sawfly spectacles, which have interchangeable, high-impact polycarbonate lenses giving an undistorted, unrestricted field of view and 100% UV protection. Compatible with helmets, night vision gear, weapons sights and binoculars, the Sawfly can also be customised for prescription vision correction.

Battledress

Of course all the advance warning in the world can only offer information – which is useless without some kind of protection. Combat forces both today and in the future will

benefit from the Interceptor body armour concept. The US Interceptor Multi-Threat Body Armor System is made up of two components: the outer tactical vest and small-arms protective inserts, or plates. The unisex garment comes with removable throat and groin protectors, as well as front and back removable plates, which can stop 7.62mm rounds. It weighs 16.4lbs in total. Each of the inserts weighs 4lbs, and the outer tactical vest weighs 8.4lbs.

The outer vest is made of Kevlar weave that is capable of stopping a 9mm bullet, plus the webbing on the front and back of the vest permits adding other small pieces of equipment. The small-arms protective inserts are made of a boron carbide ceramic with a spectra shield backing; that's an extremely hard material.

And we may complain about global warming during heat waves, but spare a thought for troops based in desert conditions such as Iraq and Kuwait. These people routinely work in temperatures above 120°F. To compound their misery, they must perform their tasks wearing heavy body armour.

The US Army has developed a method of potentially reducing heat-related casualties with a new technology called Body Ventilation Systems (BVS). The BVS weighs less than 5lbs and can be worn under body armour. Air circulates inside the vest to increase comfort and performance in hot-dry climates by significantly increasing the evaporation rate.

The two primary components of the BVS are a Ventilation Unit (VU) and an air distribution garment that looks like a vest. The VU, or blower, is a battery-operated fan that can be attached in a variety of positions depending on the soldier's need. The filtered blower system fits neatly into a pouch, which can be worn around the waist if necessary. The BVS operates for approximately eight hours with commercial lithium rechargeable batteries, with a recharge time of four to five hours. The main maintenance necessary is on the filters.

Other elements of the future soldier's uniform will contain physiological sensors that allow soldiers, their commanders, and doctors to monitor their blood pressure, heart rate, internal and external body temperature, and caloric consumption rate. Thus, many injuries – such as those due to heat and cold – could be prevented. And if a soldier is injured, doctors can make a diagnosis before they even arrive at the scene.

The uniform will contain a selective permeable membrane – which allows heat and vapour out while preventing anything microscopic from coming back in – that will protect the soldier from biological and chemical weapons. The material is about the same thickness as cotton, thus doing away with the heavy, hot, charcoal-based garment that soldiers now have to carry in their backpacks.

The uniform also will contain its own microclimate conditioning system. A special fabric will blow hot or cold air through the system. The system is powered by nickel metal hydride fuel cells – a super version of cell phone batteries. And, importantly, the uniform will weigh no more than 45-50lbs. A ground troop in Afghanistan typically carries 92-105lbs of mission-essential equipment, including ammunition, chemical protective gear, and cold weather clothing.

Power

Today's soldier needs more than just clothing. Using the equipment successfully rests on having enough power to make it work. For the time being designs are based on advanced lithium ion battery technology. However, that will change as emerging technologies such as fuel cells and fuel cell chargers become more mature.

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The UK MOD has a bilateral information exchange agreement with USA, covering development of power sources, power management, fuel cells and batteries. To that end, the MOD is funding the development of a handheld fuel cell for recharging conventional batteries by an industrial team including Black and Decker, Ineos Chlor, Intelligent Energy, and QinetiQ.

QinetiQ is also investigating the application of its ammonium borate hydrogen generator to generate power. Fellow UK company ABSL Power Solutions Limited has produced a power system, which includes two lithium ion battery packs, each integrated in the SA80 rifle magazine pouch and connected to the Power Management Unit (PMU). The PMU provides power for the GPS receiver, the situation awareness computer, thermal imaging and image intensification sights, and voice/data radio.

So there is good and bad news indeed for today's soldier as technology advances. And as development programmes and sophisticated systems develop rapidly, so too must users in order to take full advantage of the equipment with which they are issued.

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