



# Less is More – Light Weight Body Armor

New materials, modular systems – Soldier Modernisation takes a look at the latest R & D into creating lighter body armor

Ever since the clanking days of Medieval Knights, when it came to protecting the warfighter, there has been a constant trade-off between personal protection and weight. With the introduction of firearms in the 1500's, for centuries it seemed like body armor had become useless because of this trade off. There were few if any materials light enough to be manoeuvrable, yet strong enough to stop bullets. As muzzle velocities increased, and guns and ammo became more accurate and more powerful, it seemed like body armor would be destined to remain ancient history.

It wasn't until the introduction of Kevlar in the 1970's that the full value of "soft" anti-ballistic body armor could once again be seen on the battlefield.

Today, with the prevalence of "irregular warfare," where troops are all too often the target of small arms fire in Close Quarter Battle (CQB) and Improvised Explosive Devices, (IED) the need for lightweight yet highly protective body armor, is greater than it has ever been.

There has been a lot of experimentation with new materials and integrated systems. In 2010, UK based BAE rolled-out for the first time its Ultra Lightweight Warrior (ULW) system. The company says the ULW was specifically designed for the way troops fight today, offering "adaptable protection and dramatic weight savings for soldiers."

The ULW is made up of separate individual elements, such as a helmet, soft body armor, load-carrying systems, hard body armor and an integrated power system that is worn within the ballistic vest. The concept was to provide the warfighter with a customizable solution that would also provide significant weight reduction, regardless of the chosen configuration. According to BAE, the ULW can give soldiers the protection they need with weight savings of up to 35 per cent.

The system as a whole has been tested by the US Military since its public debut at military trade shows in 2010, but to date no orders for the ULW have been placed. However BAE did recently receive a four-year contract from U.S. Defense Logistics Agency (DLA) for the delivery of soft-armor tactical-vests that use materials developed for the ULW. The four-year contract covers the production of Outer Tactical Vests and Improved Outer

Tactical Vests, and associated components.

In a company Press Release announcing the award, Don Dutton, vice president and general manager of Protection Systems at BAE Systems Support Solutions said, "This award reinforces our



Interceptor Armor – Photo: Courtesy US Army/PEO Soldier

position as a valued partner in the body armor market. As well as [the recognition of] the value and quality that all of our equipment affords.”

The initial order valued at \$48 million was completed earlier this year. The total value of the contract could exceed \$260 million over the next four years.

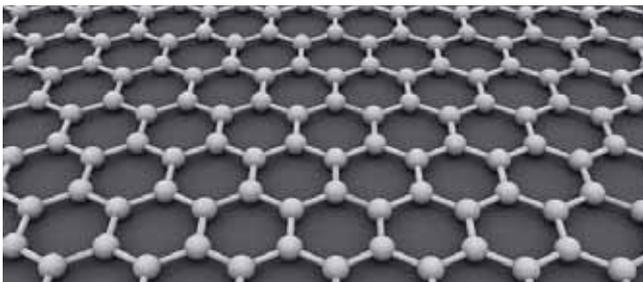
#### A Different Approach?

While BAE and other companies such as Point Blank Body Armor, ArmorWorks, Protective Products Enterprises and H.P. White, all look to develop lighter, stronger armor through the development and eventual use of breakthrough materials, the US Navy says it cannot wait for such developments, and suggests another approach. U.S. Office of Naval Research (ONR) suggests that existing body armor systems may be heavier and stronger than they need to be, because of the changing nature of conflict since their original design. ONR’s “Lighten the Load” Initiative has been implemented to reduce the overall load burden on U.S. Marines. The Initiative has turned its sights clearly on body armor, as it is the single largest element of the load. “We are taking multiple approaches to reduce the weight of PPE (personal protective equipment),” said James Mackiewicz, program manager in ONR’s department of expeditionary warfare and combating terrorism.

While Mackiewicz admits there are some promising new materials on the horizon, what is currently available to the Navy could maybe cut weight by 10%. However, reevaluating armor per mission critical standard, and using more appropriate armor levels, could save 30% or more. A 2012 Rand Corporation study would seem to agree with ONR’s assessment. That study found that troops in Iraq and Afghanistan were bogged down with armor heavy enough to stop much more powerful rounds than they were facing. The threat has been shrapnel and 7.62-mm rounds. “Current body armor provides excessive overmatch against those threats,” the Rand study stated, and concluded with suggesting modular armor with different protection levels. That conclusion would concur with the ULW approach.

#### Future Tech

Most of current research into body armor is closely following the developments of so called “meta-materials” and that no longer sci-fi buzzword – nanotechnology. The most practical application of which thus far seems to be carbon nanotubes (CNT). A CNT is a single sheet of carbon atoms rolled into a tube. Each tube is extremely strong, but very lightweight. The idea is if you can string enough nanotubes together, you can make a material many times stronger than steel, but lighter than titanium, or aluminium. One



*Molecular Structure of Carbon Nanotubes.*



*Artist's concept of Graphene Body Armor.*

material thus created has been called Graphene. The applications for Graphene sheets in warfare, from armored vehicles to airplanes and ships, would be astounding. But the problem is, this would require the ability to create very large CNTs cost-effectively in mass quantities, which is not yet possible. However, smaller CNTs that could be incorporated into armor, can be produced in bulk.

Other nanofibers are being developed from some rather unusual sources, such as algae for example. Cellulose is the natural fiber that is in wood. As a natural substance wood is pretty hard, and light weight, but not too practical as armor. However, when you compress cellulose down to the nano – or single molecule level, some interesting things happen. It turns into a fiber that can be forced into polymer chains that have a tensile strength greater than steel, and can even conduct electricity. And, it can be created simply by feeding certain types of cellulose to blue algae.

#### Market Trends

In any case, whether Next-Gen body armor will come from breakthroughs in material sciences, modular integration, or both, one thing is clear, the industry is strong and paced for growth. According to a report entitled *The Global Body Armor and Personal Protection Market 2012-2022*, published by ICD Research Solutions, “The demand for body armor and personal protection equipment is anticipated to be driven by internal and external security threats, territorial disputes, modernisation initiatives, technological innovations, and a general shortage of body armor across the world. Cumulatively, the global market is expected to value US\$19.4 billion during the forecast period.” ■