Breaking new ground in body armour

by Mark Abernethy

Local businesses are closely involved with defence contracts, such as Quickstep Technologies on the C-130. CPL David Said

Australia's place in the global defence complex relies on "prime" contractors and large projects, but smaller Australian businesses are becoming involved with home-grown ingenuity.

In Adelaide, Xtek Ltd – a composite materials business – has been working on lighter, stronger materials for ballistic vests, and has proved so successful it is currently in a Foreign Comparative Testing (FCT) contract with the US Army, expected to conclude in 2017.

"Soldiers in the field are required to carry more equipment than ever before," says the managing director of Xtek, Philippe Odouard. "There's a limit to what they can carry so armies have to minimise the weight and maximise the effectiveness of the armour they use.

"We have developed an industrial process that means we can create lighter, stiffer materials for ballistic vests, which give the same or greater protection."

The innovation that has the Americans wanting to know more is not so much a product, as a patented process – a high-tech hydroclave which Xtek calls an 'XTclave'.

Odouard says the XTclave is a pressurised chamber inside of which liquids and fibres are pressed into products at 300 bars of pressure. The materials produced from this process are very light and very strong.

The XTclave has come to the attention of the US Army because its unique design allows for complex shapes to be moulded, more accurately than in equivalent processes, meaning ballistic vests can be made lighter and at a higher quality. When soldiers carry less weight in their protective vests, they are able to load-up with other weapons and technologies.

"Typically, a ballistic vest uses Kevlar in the vest itself and inserted in the vest are ceramic plates designed to stop projectiles," says Odouard. "In a standard vest there are usually gaps where projectiles are not stopped. With the XTclave we can exert even pressure over the materials we compress which means there are no areas of weakness.

"The process allows us to make shapes that are not feasible with other technologies, and the materials still retain their strength."

Many applications

From the small laboratory and factory in Adelaide, Xtek has already sold one XTclave to a Sydney manufacturer of body armour and is testing other applications that could be produced out of the XTclave.

One of those is aerospace parts that are currently made of metals.

"As more equipment and systems are carried on military aircraft, the manufacturers are looking for ways to eliminate weight," says Odouarde. "With the XTclave we are making some very strong, very light aerospace components that could replace heavy parts of the aircraft, for instance landing gear."

Odouard says the defence industry is so large and so demanding of new technologies that small high-tech companies in Australia can be part of large supply chains by occupying a niche.

"We don't have to own an entire project," says Odouarde. "Defence is a large, global business. With the XTclave, we have developed a better industrial process which could be bought by or licensed to large manufacturers."

He says Australia is at the forefront of materials research and development and the company has done a lot of work using composites to make better, lighter weapons.

An example is the Blaser Tactical 2 sniper rifle that Xtek developed from a German hunting rifle design. The subsequent weapon has been accepted by Australian special forces.

"We worked with Australian special forces to develop that weapon," says Odouard. "The only part of it that stayed the same is the bolt and the barrel."

He says that operating on the basis that armed forces want better, lighter more resilient weapons, Xtek's Tac 2 sniper rifle replaces major weight-contributing compounds of the rifle, such as the previously wooden stock and grip. The Xtek version of the weapon has a composite material folding stock, which folds both ways. "We spent time with soldiers and realised that the left-handed soldiers don't want the stock folding the same way as the right-handed soldiers."

Material benefits

The emergence of materials technology in Australian defence contracting is also evident at Quickstep, a maker of high-tech composites that are included in the vertical tail assembly of the F-35 5th generation stealth fighter being developed by the US, with eight global participants including Australia.

Quickstep Technologies – which also makes composite components for the C-130 – has a facility at the technology precinct of the Deakin University Waurn Ponds campus in Geelong. Also at the materials technology precinct is CSIRO manufacturing and Global Revolution, a maker of high-end carbon fibre aftermarket parts for car marques such as Porsche, McLaren and Lamborghini.

The Deakin University Institute for Frontier Materials is also at the Waurn Ponds technology precinct and sits at the heart of what is a future industry, in all industries, says professor of composite materials, Russell Varley.

"We work with the Defence Materials Technology Centre," says Varley. "The defence industry is always looking for ways to make things lighter and stronger and better, and we have domestic materials programs that can meet that need."

Varley says that there was not one single reason for Australia moving to the leading edge of global materials research, but he says the involvement of universities, designers, engineers and industries such as automotive, defence and aerospace had put Australia among the leaders in composites, carbon fibre and developing materials such as nanotechnologies.

"With carbon fibre technology, we're seeing an ongoing evolution, from its first use in sporting goods 30 years ago to the point where it is used in cars and planes."

He points to the features of carbon fibre and composites, that are on display when a TV network does ultra-slow motion footage of a Formula 1 car going through a corner.

"When you see all those stresses and twists and vibrations of those cars while they're doing 150 miles per hour, you see why defence industries want to use this technology," says Varley. "It isn't just the lightness and strength but the flexibility of how you can use it."

He says carbon fibre technologies are attractive to defence forces and defence industries because they are strong, light and they do not corrode. However, he says carbon and composite materials technologies are also being favoured because of their "design flexibility".

"There are teams of engineers and designers who are rethinking industrial designs at a fundamental level because these materials set them free to a certain extent," says Varley.

He says Australia's pre-eminence in materials technology owes a lot to the cluster concept, where universities, industry and government are co-located. He says not only Deakin University but also Swinburne University had understood the need to keep university R&D teams in step with industry and government agendas.

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