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# DSEi UPDATE

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# Fighting tough on the frontline

## Combining the flexibility of fabric with the structural performance of concrete, an innovative new material has been developed which enables concrete to be used in a completely new way

The story behind its inception is somewhat unusual. Four years ago, two students, William Crawford and Peter Brewin, entered a competition run by the British Cement Association. At the time the pair had no idea that their entry for a rapidly deployable emergency shelter would result in the launch of their own technology development company called Concrete Canvas. Four years on and the concept has matured into a technology that has applications far beyond emergency shelter.

### DEPLOYABLE SHELTERS

The original concept was to create rapidly deployable hardened shelters that require only water and air for construction. The key to the idea was the use of inflation to create a surface that is optimised for compressive loading. This allowed thin-walled concrete structures to be formed, which are both robust and lightweight.

The University of Bath has conducted finite element analysis on the shelters, showing that the structures can withstand a high distributed compressive load, enabling sandbags, earth or snow

to be piled on top. This gives the shelters excellent thermal properties and protection against shrapnel, blasts and small arms fire. Concrete canvas shelters are specified to withstand 0.75m of wet sand on the sides (sufficient to stop 7.62mm rounds) and 0.5m on the roof (to protect against shell fragments).

### CONCRETE CLOTH

Concrete Cloth is a spin-out product developed as a result of the original concept for inflatable concrete shelters. The cloth consists of a three-dimensional fibre matrix containing a dry concrete mix. A PVC backing on one surface of the cloth ensures the material is completely waterproof, while hydrophilic fibres on the opposite surface aid hydration by drawing water into the cement.

The British Army quickly saw potential uses for this new material and started trialling Concrete Cloth as a method of reinforcing sandbag defences. This offers a solution to a problem they currently face with the degradation of sandbag walls in harsh environments like Afghanistan, where the combination of wind, sand and extreme

temperatures mean frequent repairs to frontline defences. Added to this, is the damage caused by incoming fire and out-going muzzle flash. Concrete Cloth is completely fire proof and has performed very well during range trials where it was tested with small and medium calibre weapons. As a result of these trials the UK MOD have awarded a contract to Concrete Canvas to supply 5500m<sup>2</sup> to the frontline.

The material comes in 10 metre rolls that are man portable, eliminating the need for heavy lifting equipment and plant machinery. The material is then simply unrolled over the sand bag wall, secured using battens and sprayed with water. 24 hours later the concrete has set providing a durable and hard wearing surface.

Key to the success of the material are the fibres which form a reinforcing matrix within the cloth. These provide a stable failure mode, absorb energy and help maintain the structural integrity of the concrete when impacted. This means that a ballistic projectile will pass through the cloth but crack propagation is limited and the sand is therefore retained within the concrete shell.

## THE SHELTER IS DEPLOYED IN FOUR STAGES:

**Delivery** – The shelter is supplied folded and sealed in a sack. The 16m<sup>2</sup> variant is light enough to transport in a pickup truck or light aircraft.

**Inflation** – once delivered, an electric fan is activated which inflates the plastic inner to lift the structure until it is self-supporting. The shelter is then pegged down with ground anchors around the base.

**Hydration** – the shelter is then sprayed with water. Hydration is aided by the fibre matrix, which wicks water into the cement.

**Setting** – the Concrete Cloth cures in the shape of the inflated inner and 24 hours later the structure is ready to use. Access holes allow the installation of services; water, power, air conditioning and heating units. The structures are designed as part of a modular system; units can be easily linked together enabling the space to be tailored to the application.

