Variable geometry fabrics

As one of the opening speakers at the UK's University of Leeds' Survival 2004 conference, Neil Saville - of N and MA Saville Associates - led his audience down diverse paths as he presented his company's recent research developments with variable geometry fabrics. The following paper is a précis of his presentation under the conference theme 'Thermal Management in Clothing':

'The development of adjustable three-dimensional fabrics should be regarded as providing exactly what the title suggests. There are many forms of three-dimensional fabric structures, but very few are capable of adjustment as a means of improving their performance. In other words, variability is not an option.

In particular those working closely with the various military equipment research centres have sought to create levels of still-air insulation for use in clothing, tentage and hardware protection. The result is what is known as spacer fabrics, where two faces are held apart by mechanical means and the air captured between them provides a barrier to the passage of heat from either direction.

When working on the developments, we operated from a simple premise: that a Variable Geometry Fabric (VGF) is a structure where dimensions can be readily altered. VGF structures become three-dimensional but most three-dimensional structures cannot be considered variable.

What we eventually produced was a prototype as shown in Figure 1, which enabled us to suggest that jackets, trousers, windcheaters, waterproof walking clothes, tents, curtains, room dividers, roof insulation and other portable materials can benefit from being made of a variable geometry structure where insulation or tog rating can be varied at the will of the user without increasing the weight.

Such an easily stowed variable geometry structure could, for example, be impregnated with anti-microbial agents that would not be in direct contact with the skin because the multiple folding of the centre fabric or fabrics reduces that possibility.

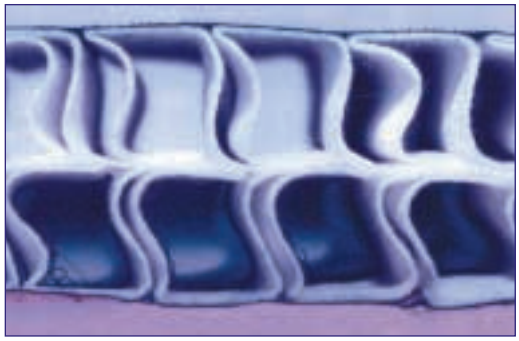


Figure 1. Saville Associates

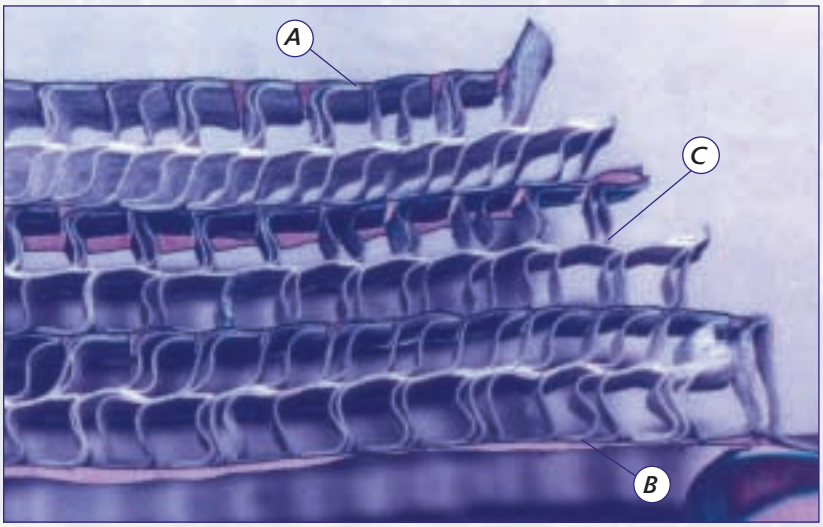


Figure 2. Saville Associates

They in turn could be effective in preventing any growth of bacteria within the structure - a factor which could be beneficial in the development of the next generation of Nuclear Biological Chemical (NBC) warfare clothing for military and/or emergency services use. Again, the folding reduces the likelihood of nerve or chemical agent penetrating the complex structure, rendering it doubly effective.

Further development of the basic VGF led us to the situation illustrated in Figure 2, a more complex structure capable of greater variation in insulation power. By deploying small pull-tabs at each level of the structure it is possible achieve infinite adjustments of the overall density. Once again, in the case of NBC suits the central fabric could be impregnated with activated charcoal which would not be in direct contact with the skin avoiding any irritation from the active ingredient.'

Neil Saville suggested a number of alternative scenarios:

'What if the central fabric or fabrics in a variable geometry structure contained super-absorbent fibres? Then the structure could change in dimension - allowing the maximum water uptake without the external surfaces becoming unduly wet. Or aluminised materials could be laminated to fabrics "A", "B" or "C" in order to reflect heat in either direction to keep the body or protected objects cool or warm as required. Similarly, the aluminised coatings might be used to significantly attenuate microwave or any other radiation for the protection of personnel and equipment.

The centre fabric or fabrics might be impregnated with intumescent materials while all the related fabrics used were fire resistant. In the case of a fire the intumescent material would rapidly expand, blocking radiation, conduction, and convection without releasing the particles of graphite.'