RESEARCH INSTITUTES: UNIVERSITY OF LEEDS

In this brand new section, we look at the most interesting people, ideas and inventions to have to come from academic institutions around the world that devote themselves to performance textiles, starting with the Centre for Technical Textiles at the University of Leeds.

Ideas and action

Leeds, a thriving city in the north of England, has re-invented its economy in the last two decades, with the financial services, customer relations and retail industries propping up its prosperity in place of more traditional activities. And in Leeds, traditional industrial activity centred for centuries on the clothing industry.

Many of the mills that wove wool and cotton are still there, even if they are now redeveloped into executive homes and art galleries, but the influence of the textile industry lives on beyond architecture. Much more importantly, as far as this magazine is concerned, the city's main university is an important contributor to the technical textile industry and has been for some time.

Research to promote the advancement of the textile industry began in Leeds in 1874 (reflected in The Clothworkers' Court building, which is one of the most attractive on the main university site) and part of this legacy is that, today, the university has its own Centre for Technical Textiles (CTT), part of the School of Design. The centre has a mission "to achieve excellence in fundamental and applied research in fibrous structures", while promoting "interdisciplinary collaboration" in all science and engineering fields related to technical textiles.

For an explanation of this, Professor Stephen Russell, deputy director of the CTT says that the

Dr Mark Taylor indulges his passion for climbing. The university's technical textiles team is full of outdoor enthusiasts.

CTT/University of Leeds

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work he, his colleagues and the centre's undergraduate and postgraduate students engage in fits into a bigger picture, which is something he says has been of great benefit to all the major developments the centre has worked on. Being part of the bigger School of Design means expertise in design, technology and management all come into play in research projects. The range of expertise available throughout the school is a combination that Professor Russell believes allows ideas to develop more easily and for innovation to be "more rounded".

The school has people with expertise in all the relevant areas, which makes it possible for those focusing on technical textiles to operate a design process that is "truly three-dimensional". Working with and keeping happy a broad range of people, all with their own priorities and economic requirements, can make life challenging at times, but when it works, it's exciting, he says.

At the same time, he says many members of the team are actively involved in climbing, caving, biking, paddling, hiking, mountaineering and most other varieties of outdoor sports, and that this helps the centre's efforts to develop understanding of the composition and the structural properties of the textiles used to make the clothing, footwear and other equipment they take to the hills with them. Professor Russell makes it clear that the CTT's enhanced understanding must help the industry to develop new fabrics and new garments to "tackle the challenges that still exist".

Challenges ahead

Biomimetics is an area in which the centre is becoming increasingly interested, for example by looking at ways of simulating piloerection, or the way hairs on the skin rise up in response to environmental conditions to increase insulation when required. The textile industry is hugely interested in constructing systems that consistently mimic this aspect of what the body does, and the centre wants to make a contribution to helping companies achieve this.

One specific piece of research looked into the possibility of creating gecko-like biomimetic textile surfaces, based on understanding the way a gecko's foot adheres to surfaces. The team at the CTT wanted to develop its own way of making things stick, using fibrillated surfaces in structures of approximately five square millimetres.

Other examples of continuing challenges that spring immediately to mind for the deputy director are those of achieving better control of moisture vapour in the context of thermo-physical comfort, and designing thinner and more efficient thermal insulation fabrics. For the latter, in keeping with a particular research interest of his, he points to exciting projects involving not just fibre, but also non-fibrous materials such as nanoporous solids that have good thermal insulation properties. "I'm referring to materials such as aero-gels," he continues. "They are not available as fibres, but we can get them into a form that allows us to use them in garments if we use fibres as a carrier. This is certainly an area that we believe has potential. If you can improve thermal insulation—or offer the same level of thermal insulation, but with thinner fabric—it should be of great interest in areas such as protective fabric for gloves, boots and so on."



The Clothworkers' Court reflects the legacy of the textile industry at the University of Leeds.

CTT/University of Leeds

Opportunities involving nanotechnology in general are of interest. Nanostructures and nanofibrous materials seem to everyone at the CTT to have an important role to play in bringing new functionality to technical textiles. Nanofibrous materials are, for example, fibre-based membrane-type solutions (they look like a membrane but are really constructed from fibres). They offer a larger surface area than fabric on its own onto which you can add functionality (UV protection, anti-microbial properties, aromatherapy solutions and so on) using chemistry. The same phenomenon is also a way of improving a fabric's ability to transfer moisture vapour or heat away from the wearer's skin.

"We want to address the key performance requirements of textile companies," the professor explains. "We're very focused on that; we're not just looking at nano because it's in fashion—we know it's not the answer to everything." A specific solution he has been looking at though—with the support of the Bill and Melinda Gates Foundation—involves using durable, nanoporous surfaces on textile substrates, including warp-knitted meshes, that can protect the vulnerable against insects (and in this way contribute to the fight against malaria).

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In real life

All these observations serve to emphasise the point that the Leeds CTT is not just about pure research, but about applying that research to real life.

"Design is based on form and aesthetics, but it has to function," he continues. "We want students to have a full understanding of the design requirements they will have to work to. Historically, in textile or garment manufacturing companies, two separate people have had responsibility for aesthetics and function. But, in the future, it's entirely possible that one person will have to take responsibility for both."

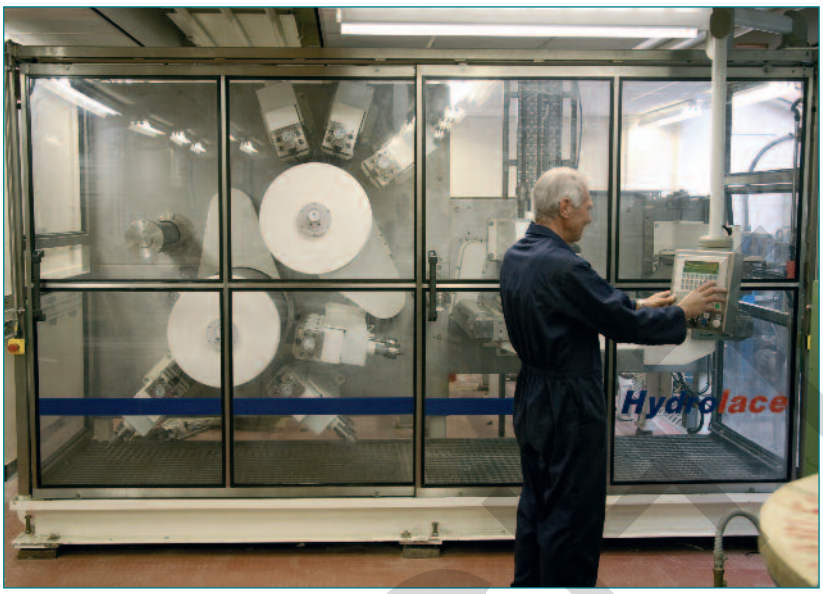
His colleague Dr Mark Taylor, as a research fellow in performance clothing, has been heavily involved in materials research specifically for the sports and outdoor arena for a number of years. He believes that highlights the CTT has achieved over the last decade include the work it has done on examining the role of the human body in pushing moisture vapour out, feeding developments in hydrophillic membranes. "We've had three PhD students looking specifically at this in recent years," he says.

Another PhD student, examined only in December, has already presented some of her findings at an international textile conference. Her area of interest is the 'bellows effect', in which movement causes air to be pushed out through openings in what we wear, providing cooling and ventilation. In the specific case of soft-shell garments, she found that loose-fitting clothes, which make it easier for the 'bellows effect' to occur, offered a higher level of comfort than many of the body-hugging styles of which shops and new collections from brands are full.

He also points to improvements to shape, size, design and performance in the field that sleeping bag manufacturers have been able to implement thanks to research that took place at Leeds, and he himself has been working on miniature sensors to measure the levels of humidity and heat that can build up inside clothing, footwear or protective headgear.

Then there is the Survival Conference, an annual fixture on the technical textile calendar, which this spring will celebrate its thirtieth anniversary. The event will take place on April 7, with the city's Village Hotel as the venue. The team has taken on board feedback from previous years that delegate fees for the conference could be more affordable and is committed to making sure places at the event will cost less than £100.

Speakers will include Dr Robert Lomax of Baxenden Chemicals, who will talk about textile applications from the space industry that have filtered through to everyday life (on earth), and Don Gladstone of Peopleworks, who will talk about ways to reduce waste and build a cleaner future for the industry. Dave Brook, a contributor to *WSA* who recently retired from the university, will give the keynote presentation, with the history of performance clothing as his subject, using the expertise he built up over years of research to look analytically at applications that, for him, have stood out in the 30 years since Survival started.



New hydroentanglement machine at the Centre for Technical Textiles.
CTT/University of Leeds

Working life

This brings things full circle. Professor Russell sums it up by saying: "We're research-led and our philosophy is to embed research in the teaching we do. But we want that research to have impact. We want our students to understand that and take it with them into their working lives. We talk about performance textiles. Well, structure and composition influence performance."

It would be one thing to draw this conclusion in the classroom and allow students to leave for the world of work with only the theory firmly implanted in their minds. However, the set-up at the CTT means that, in the case of the team at Leeds, this goes beyond theory. This is partly because of the active participation of so many members of the team in so many outdoor activities, as mentioned. The city is well positioned for that, being on the doorstep of the beautiful Yorkshire Dales and, a little further on, the Lake District. But it's also because the centre itself is equipped for putting ideas into practice.

"Here, we can build a model in the lab and experience how it works in the field," the professor says. "We can manufacture everything from a polymer to a finished garment, even if only on a pilot scale, and carry out our own field trials in the Dales or the Lake District, where the university has huts of its own. There is a link between theory and practice, between research and the real world and it's a linkage that we at this university are acutely aware of."

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