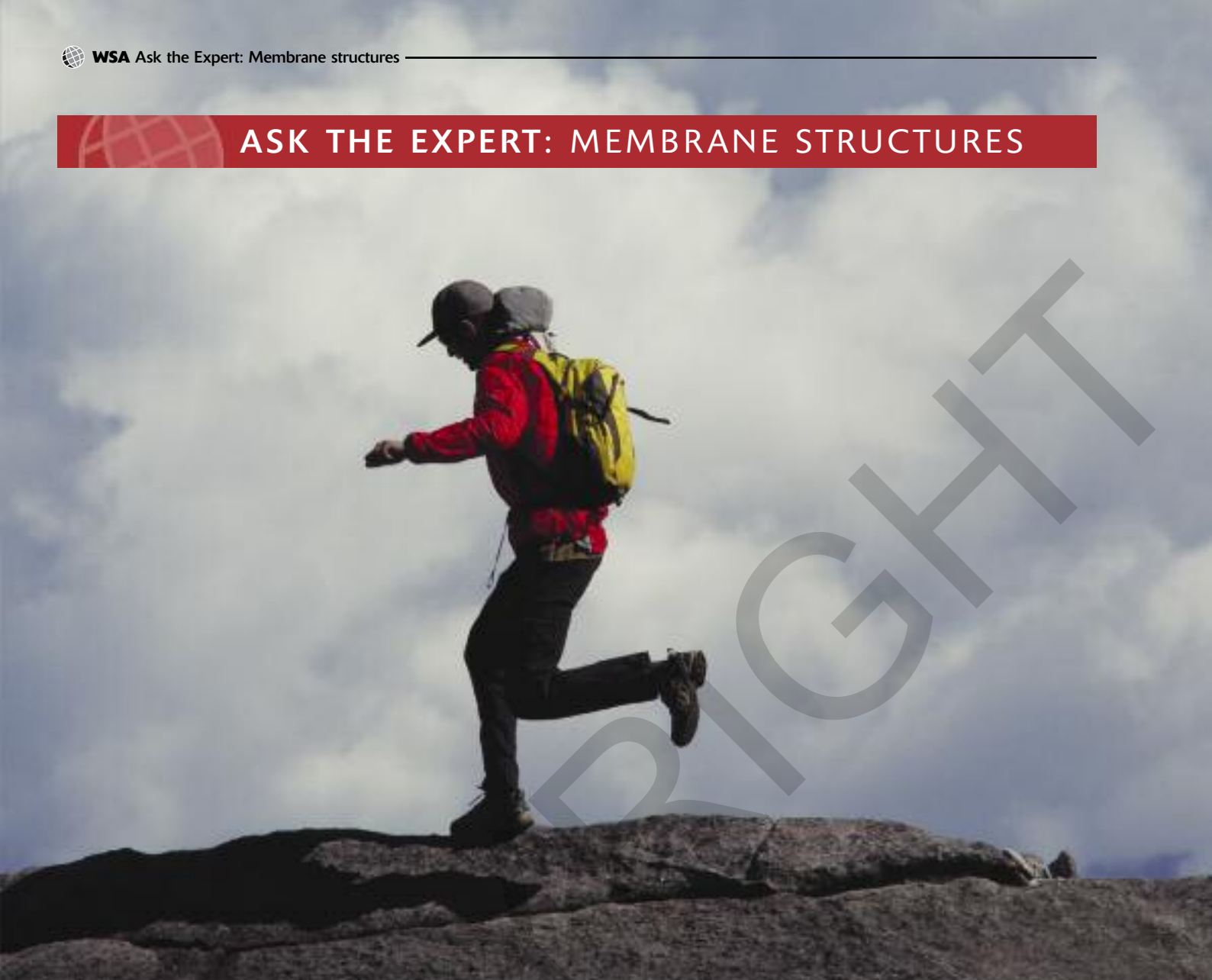
## ASK THE EXPERT: MEMBRANE STRUCTURES



Our series asking industry experts questions on key textile and apparel issues continues with Dr Phillip Gibson, materials research engineer at the Natick research, development and engineering centre.

# A question of comfort

A specialist in breathability and air permeability in fabrics, Dr Gibson has worked for the last 23 years as a materials research engineer at the US Army's research, development and engineering centre in Natick, Massachusetts. Here, he answers a series of questions about membrane structures in fabric and clothing.

**Question:** How would you sum up the contribution that membrane technology has made in recent decades to help clothing manufacturers offer wearers all-condition comfort?

**Answer:** Clothing and textile manufacturers have been very innovative in applying many types of films and coatings to fabrics. Textile manufacturers have tried solid films, bi-component films, perforated films, and microporous films made by many different methods including foaming agents in solvent-cast films, nanoparticle composites, mechanical stretching, and electro-spinning. Manufacturers have been successful over the years in developing very durable waterproof membrane laminates that hold up well to laundering and abrasion.

*Fresh air thinking. It would be good to combine the testing of breathability with air permeability.*

The North Face

**Q: Nevertheless, we hear manufacturers say frequently that they would still like further improvement in making fabrics more breathable and more water-resistant. What do you think the main reasons are for this desire to achieve more and what are the main possibilities you see for further improvement?**

**A:** Despite the progress over the past 30 years, rain jackets are still perceived as trapping sweat at high exercise levels. Manufacturers continue to work hard to address this deficiency in rain gear as expressed to them by their customers. Manufacturers respond to some of these shortcomings with new hybrid garments (different materials in the same garment), further incremental improvements in membrane and laminate technology, improved water-repellent treatments on the outer clothing layer surface, and improvements in moisture management properties of the liner fabric that picks up sweat from the wearer's skin.

**Q: Which aspects of testing that clothing brands and their suppliers carry out on their weatherproof breathable products are you satisfied with and which would you like to see companies pay more attention to?**

**A:** There does not seem to be an easy way to combine the testing for the separate properties of water vapour diffusion (breathability) with air permeability. Test methods that have been developed to simultaneously test for both properties are quite confusing to use and evaluate. The current standard air permeability test methods and water vapour permeability test methods are all well accepted and valuable, but it would be good to have a better way to show how the two measured properties interact to increase the comfort of air-permeable membrane laminates over nonporous membrane laminates.

**Q: Without expecting you to name names, could you say what advantages and disadvantages you see in the principal membrane technologies we find in the outdoor clothing market, including in terms of structure, where the membrane is positioned and so on?**

**A:** Nonporous membrane laminates are not able to provide the extra ventilation possible with air-permeable porous membranes, so they will probably always be less comfortable at high human exertion levels. However, they are reliably waterproof, and are the best choice where weather protection is the most important factor. If the clothing requires large recoverable stretch, then there are more options available in nonporous elastomeric membranes combined with stretch fabrics. Porous membrane laminates will be much more comfortable than nonporous membrane laminates in nearly all conditions, but rain protection can be compromised by contamination of the porous membrane by substances such as body oil, sweat, insect repellent, and food or drink spills. Porous membrane laminates can also be less durable to laundering because surface treatments can be washed out, or the porous structure can act as a filter and capture solid particles from the wash water that are retained in the membrane pores.



*Dr Phillip Gibson, materials research engineer at the Natick research, development and engineering centre.*

*Phillip Gibson*

**Q: Finally, if there is a trade-off between weather protection and air permeability, how do you think companies should decide what their priorities should be?**

**A:** The companies must rely on the knowledge of what application their rain gear is designed for, such as expected weather conditions and human exertion levels for various activities (golfing, skiing, mountaineering, sailing and so on). Nearly all outdoor clothing companies have a robust user testing programme, and are intimately linked with customer needs and satisfaction with their products. Waterproof breathable clothing is a fairly mature technology, and companies understand how the different membrane technologies available to them might be useful to a particular customer group.

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