

FOOTWEAR TECHNOLOGY: NIKE FLYKNIT

Nike's Flyknit running shoes shone at the Olympics, but this new method of manufacturing could end up changing more than just a few medal places. Footwear construction experts believe it could have the potential to revolutionise shoe construction the world over.

Purls of wisdom

It has been praised as one of the great marketing victories of the London 2012 Olympics: Nike's fluorescent running shoes designed in the colours scientifically proven to be the most noticeable. The neon yellow and green mix, which Nike calls volt, was unmissable on the track. It was almost as if the US sportswear giant had its own 'Team Nike', despite not being the official sportswear partner. And with 400 athletes wearing the Flyknit Volts, that team could have been a country in itself: it would have had more representatives than India, Turkey and South Africa combined.

But aside from the clever marketing and inspired colour choice, the technology that underpins some of the shoes in the range has the potential to make a lasting impression on the way we make footwear. Three years in the making, the Flyknit is made from a lightweight knitted upper, woven in one piece and engineered to create the feeling of a second skin. It is the brainchild of Nike CEO Mark Parker, Fragment Design founder Hiroshi Fujiwara and Nike vice-president of creative design Tinker Hatfield. They took an "organic approach" to their collaboration, according to Mr Fujiwara, with "no rules, no time limits and not too much thinking about a budget", until they perfected the technology and the product.

"The revolution is in the process of manufacturing, how we can engineer structure and support and breathability, and do it all in one layer," says Mr Parker. "The Flyknit has the potential to change everything."

Nike Volts modelled by a member of Team USA.



Bold words – but he might not be far wrong. Until now, shoe construction has always involved several parts, being glued, moulded or stitched together. If the technology is adapted to other types of non-leather shoes, it could mean a reduction in material, time and labour. On a global scale, this could result in entirely new manufacturing processes for athletic shoes, with an impact on materials, location, machinery and cost. Shoes that no longer need to be cut out no longer produce waste. If they are knitted in a single layer the need for multiple machine operators diminishes and the quality of work standardises. What would this mean in terms of location if labour costs were no longer a major consideration?

Shoe-making processes have evolved over the years, sometimes gradually through refinements of machinery and processes, other times at exponential rates, with the introduction of digital lasts, numerically controlled milling and CAD software. The flyknitting technology seems to be one such leap forward – if this is replicated and used for other shoe styles it will enable manufacturers to make millions of identical shoes, with no need to interrupt production flow and less ongoing investment. If location becomes less important, manufacturers might look to offset transportation costs by bringing the factories closer to home markets: we could see large-scale shoe production coming back to the West.

Of course, this process could only work for certain types of shoe – it would be no use for sandals, boots or high heels, for instance. But there are enough styles that could potentially be made in this way for industry observers to suggest we could be about to witness a sea-change.

Stay in the loop

As yarn generally has no structure and little durability, the three-year refinement process that Nike undertook involved building strength and flexibility and adding comfort. Each upper has many variations of polyester yarns, depending on the needs of a particular area. Although there is little information available on the software, it is thought to be both incredibly complex and expensive, with teams of programmers, engineers and designers working together to achieve the right mix of components.

With all the structure and support knitted in, the Flyknit Racer's upper and tongue weigh just 34g and the whole shoe weighs a mere 160g for a US size 9, which is 19% lighter than the Nike Zoom Streak 3, a shoe worn by first, second and third place athletes in the men's marathon at the 2011 World Championships. The Racer debuted on US athletes at the 2012 World Championships in January, with a second Flyknit shoe launched in April, this time aimed at the

mass market. At 220g, the company says the HTM Trainer+ will "bring the weight and fit benefits of Nike Flyknit to runners of all levels". Multiple yarns were combined to create a 'heather effect' with bold colour details, and the shoe went on sale in July in two versions: grey and volt, and black and white.

"The inspiration for Nike Flyknit was born from common runner feedback, craving a shoe with the qualities of a sock: a snug fit that goes virtually unnoticed to the wearer," the company states on its website.

Subsequent revisions have included a new Racer in orange and the Trainer+ offered in black, blue, volt, red and multi-coloured.

Track and field

Nike used the Olympic stage to introduce the concept to a wider audience, and the shoes were adapted for different sports. The Zoom Superfly R4 and the Zoom Victory Elite use a similar concept of woven threads, but are coated with a strengthening product. The company created a Flyknit distance spike worn by US 10,000 metre runner Dathan Ritzenheim. It features a narrower fit, with a Pebax plate and four removable pins to provide lightweight support and maximise speed. The sharkskin heel pad enhances grip and traction while helping to reduce the overall weight.

In the marketing material is the claim: "The result is precision engineering in its purest form, performance on display. Every element has a purpose, resulting in one of the lightest, best-fitting running shoes Nike has ever made."

Stitched up?

However, Nike is not the only company that has been looking at this technology. Not to be outdone, adidas launched its own knitted shoe – the day before the Olympic opening ceremony.

Adidas commented on its website: "Using the latest design tools with our new seamless engineering technology, adidas has created this first-of-its-kind [sic] running shoe, the adiZero Primeknit. While sport shoes

The revolutionary Flyknit is Nike's lightest, fastest shoe yet.



are usually made from lots of separate pieces, this breakthrough method digitally knits the entire upper in just one. Knitting fused yarn allows us to fine-tune the exact amount of flexibility and support needed in every part of the shoe. This means lightweight comfort that wraps seamlessly around your foot, whilst fewer materials produce less waste."

Sound familiar? While Nike has remained tight-lipped about the processes that go into making the shoe, adidas in August posted a video to its website, showing the machine it is manufactured on: a Stoll CMS 530 HP, Stoll's latest high-productivity computerised flat-knitting machine. The Primeknit's launch, however, has been to far less fanfare, quietly coming out of the factory in Germany – which also supports the theory that this type of shoe-making is not tied to any geography.

James Carnes, head of design for sport performance at adidas, said in a statement: "Three years in the making, the adiZero Primeknit harnesses groundbreaking technology we've perfected to introduce in London at the Olympic Games."

All of which suggests both companies began developing the technology at the same time, aiming for launch at London 2012.

Perhaps this is a case of life imitating art –



Gold-winning heptathlete Jessica Ennis with adidas' adiZero Primeknit.



that the competition is always hot on your heels. But it will be more than just rival sportswear companies that will be watching how this race unfolds: much of the shoe manufacturing industry will be keenly observing from the sidelines. 

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