

Exploring the upper limits: meet the new textile innovation that changes how we create footwear

The inside story of STRUNG as told by the team behind it

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For the millions of us who live and breathe it, sport is the ultimate stage. But, if you excuse the pun, as a group of designers, engineers, developers, and sports scientists, we should absolutely accept that our role is to be the support act, not the headliner. Because the undisputed star of the show is the phenomenal yet often underappreciated biometric wonder we know as the foot.

The life of the athlete – at any level – is heavily reliant on this incredible piece of natural engineering. And it's the same for us in the adidas Future team – what can we do to maximise its potential? The simple answer is to understand it better. As a single entity and as a part of the human body.

The way we do this is through a better understanding of how the human body moves. The better we understand the athlete, the better we can build products that work with their movement, and as adidas' Future team it's our job to harness the power of technology to do just that.

Rapid advancements in sport science research and development mean we now know more about physiological and biological performance needs than ever before. We have the data. But the limitations of many current footwear creation methods mean we haven't been able to apply this data to products that answer those needs with precision. Until now.

A MATERIAL REVOLUTION

Meet STRUNG: an industry first textile and creation process that combines athlete data, additive manufacturing and robotics to create a lightweight upper where each thread is individually selected and data-mapped for a seamless, lightweight fit - all within one piece of material, free from inhibiting excess components.

As a business we are constantly striving for optimum footwear performance. To achieve this, we need to get the most out of our materials. We like to talk about our products "silently serving" the athlete – seamlessly improving performance and in this case getting more out of every thread so that they can focus on nothing but their sport.

Traditional processes like knitting and weaving can hold back an upper's maximum performance potential as threads can only be set horizontally or vertically, so the textiles need additional components or material to provide flex and support.

Creating a new textile required both an entirely new machine and software that could integrate athlete data and enable the team to design, simulate and test uppers. This was only possible with collaboration between different teams, including engineering, design, sports science, and I.T.

STRUNG allows us to input athlete data into the precision placement of each thread - in any direction we choose - using the unique software. We can evaluate and simulate on-screen, so we know which structure will be the lightest and strongest (without having to create an actual

prototype), before sending our chosen design to the STRUNG robot. The final textile has performance zones and properties which blend together in just one piece.

After several years of incubation, we were able to develop this brand-new additive creation process. We're looking at performance and biometric data (and always have), but with STRUNG, we're now matching that up our running app data: athlete training patterns, objectives, where they are, how they work out. A general view of the athlete, all in the name of designing an upper that performs better and allows them to focus on their game.

THE JOURNEY

As is the case with many innovation journeys, it started in a basement with a small but dedicated group of the adidas Future team. The original inspiration came from architecture and some interesting experiments where we saw robotics used in a creative way to build fibre structures. But it was clear from the start that there was no script. With other technologies, there are other people doing similar things, but not with this. The fact that there is no real precedent means the journey is both exciting and frustrating. We're writing the script as we go, so there's a lot of trial and error, although our vision is always clear.

We wanted to see how we as a team could interact with robotics and athlete data in a meaningful, creative way. The process of creating and refining new STRUNG software, hardware and prototypes led to increased buy-in and more and more people joining as development became more complex. The travel restrictions that came with the pandemic brought its own challenges, but we were able to navigate some of these and maximise our efficiency due to having connected STRUNG robots on three continents. This allowed upper designs to be sent on to each machine remotely, meaning refinement work was ongoing around the clock.

This job is all about exploring and pushing boundaries – yes, you make mistakes but it's all about learning and using them to progress. It's important to remember that the foot is this wildly complex asymmetrical form. We are learning with every stage of development that the foot moves differently with each intervention of footwear that is placed on it. It doesn't move and contract in uniform ways so it's a really challenging problem to solve... how do you build a tool for such a unique system?

Initially it was really about building things by hand, making prototypes and allowing the project to evolve naturally instead of trying to rush things early on. We started to think about how we could make a machine that would do this type of thread "winding" by hand, how to integrate athlete data, and how to build software to create, simulate, analyse and test STRUNG uppers. After two years of internal adidas development, we decided to accelerate this process by collaborating with long-term design partner, Kram/Weisshaar – a pioneering digital design studio.

Our material tech challenge was very clear - we wanted to make something where we could place the yarns in any direction, to go beyond what existing textile creation methods are capable of. Getting that base STRUNG textile to work and function as we want is and will continue be a challenge. STRUNG is not knitting and it's not weaving: it hasn't existed before.

We've come a long way from hand-winding and we're learning new things day by day as we explore the capabilities of this technology. With STRUNG, the end material is a composite so it's complex to try and figure out where you'll end up. It's actually changing the way we think of creating uppers. It's

not like an object or a specific material, it's more like a set of interrelated systems that work together to try and do something. We're building up a library of knowledge and it will get more interesting as we aggregate data of testing and from different athletes and sports. The more we understand about how data can become design code, the more we can take that and apply it to new STRUNG textiles. It's a continuous evolution.

PROOF OF CONCEPT

FUTURECRAFT.STRUNG is the first product created to illustrate STRUNG's capability in practice. It combines our latest and most powerful high-resolution creation technologies to produce the industry's first entirely data-driven footwear for a specific runner profile.

The first-of-its-kind concept shoe was created to provide a new experience of short-distance training runs at 5m/s or faster. Two adidas runners were identified as experts in this run and provided both motion capture and ongoing feedback to support development. The upper has a lightweight cocooned feel and fit, locking the heel to prevent slip, with stiffer and stronger red threads placed at the midfoot, toe-box, and heel (where the foot needs support), and suppler yellow threads in the forefoot for flexibility. These threads blend each of those features together within the material to provide precise fit and support through the gait cycle.

The midsole is our most radical ADIDAS 4D lattice design to date - featuring a new shape to cater for forefoot strikers. The heel has been minimized to remove weight and the rubber outsole is specifically engineered to provide traction just where needed, resulting in an extremely minimalist midsole.

Combining ADIDAS 4D and STRUNG is the first step in creating a new generation of what we're calling a "CODED" product; FUTURECRAFT.STRUNG is created specifically for the needs of the 5m/s or faster runner, with every millimetre of the shoe precisely tuned or "coded" to support movement and performance during these fast runs.

THE ROAD AHEAD

Probably the most exciting thing about STRUNG is that we're still in the early stages of developing it – the ongoing testing will be fundamental to what we do next, but more important than that is the trajectory of consumers and athletes – what do they want next and how are their needs changing?

STRUNG is a milestone that has the potential to transform the way athletes work with designers, engineers and sports scientists. The ultimate aim is for it to be a cross-category platform that serves multiple sports. We've started with running but that's just the beginning. We want this to be the most data-informed textile (based on foot anatomy and athlete movement), and we're planning to make the first shoe available late 2021/early 2022.

Technology can achieve wonderful things, but it can only achieve the right things if it's informed by human behaviour. It is this open approach that has guided us on the STRUNG journey so far, and it is this same approach that we believe will help us on the road ahead.

- ENDS -

NOTES TO EDITORS

- FUTURECRAFT is adidas' incubator for innovations and technologies designed to shape the future of sport. It's a platform for developing "what's next" and solving issues facing athletes, sports and the world at large.
- STRUNG is the first textile technology that transforms athlete data into dynamic performance material. Every thread in STRUNG is individually selected and data-mapped for a seamless, lightweight fit.
- "FUTURECRAFT.STRUNG" is the first concept designed to illustrate STRUNG's capability. It combines high-res creation technologies ADIDAS 4D and STRUNG, as the industry's first fully athlete data-coded running shoe.
- Whilst FUTURECRAFT.STRUNG will not be commercially available, the first STRUNG shoe is targeted for launch in late 2021/early 2022. Both final shoe and STRUNG technology will be developed in parallel over the coming seasons.
- adidas is striving to change the way designers, engineers, developers, I.T. and sports scientists work with athletes to transform how athletes feel, move and perform. Products created for natural movement with athlete data informing design: "Coded". Coded products will be data-mapped to do more with less - seamless, lightweight fits, with minimal material throughout. They will eventually be developed across the range of adidas sports.
- STRUNG is being developed by a cross-functional adidas team: Andrea Nieto, Fionn Corcoran-Tadd & Matteo Padovani (design), Benjamin Kleiman, Elise Hall & Thomas Feix (engineering), Clemens Dyckmans, James Tarrier, Nicholas Groeneweg (technology creation), Ian Hennebery, Fano Razafindrakoto, Reuben Bligh, Korbinian Berner (footwear development), Tom Elvidge (Sports Science), Grace Chang (materials), Steve Brimble (innovation management), Miriam Eirich (costing) & Christoph Walter (testing)