Future Athlete Project: How TCS powers performance through digital twins

Tata Consultancy Services

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Connecting technology, health, and sport through digital twins

Imagine holding a digital replica of a world-class athlete's heart and having the ability to observe how it performs under the stresses of marathon running. What if you could use this to optimize training, prevent injury, and enhance health outcomes for everyone?

Introducing the Future Athlete Project, a landmark initiative from Tata Consultancy Services (TCS), launched at the 2024 TCS New York City Marathon. The project is an innovation showcase, where we set out to create a digital experience that would demonstrate our cross-industry leadership in advanced technology, such as digital twins, especially as it applies to healthcare, life sciences, and sport.

But this was about more than just visibility. We wanted to create a new kind of touchpoint between brand, customer, and emerging technology – an emotionally resonant experience that could scale and flex beyond race day. It needed to inspire curiosity, fuel imagination, and show what technology can do when it's designed with care.

Over the three days of the launch at the TCS New York City marathon, we aimed to:

- Host 5 media partners and generate 150 media mentions.
- Accumulate 100,000 views of the digital twin sizzle reel created after the event.
- Drive traffic to the Future Athlete hub on tcs.com, with a goal of 10,000 views by the end of 2024.
- Use the event to host key clients and prospects and add $10 million to the new business pipeline.

Unlocking the power of digital twins for runners at every level

Through the Future Athlete Project, TCS helps a diverse group of runners by creating digital twins of their hearts, with the goal of helping them better understand how their bodies perform under various conditions, identify potential health risks, and tailor their training accordingly.

Using information gathered from 40 different readings, including MRI scans, ECG tests and wearables, TCS integrates the data with three-dimensional digital models to create digital twin hearts. By integrating AI, machine learning, and data analytics, the digital twin could predict recovery, optimize performance, and simulate countless variables, such as sleep, fitness demand, and environmental conditions – allowing the runners to tailor their training.

The project features both elite and recreational runners, providing a rich, varied look at how digital twin technology can benefit everyone – from the highest level of sport to everyday fitness. Des Linden and Reed Fischer, both professional marathoners, bring decades of experience at the top of their field. Alongside them are Ashleigh Lindow and Bill Quinn, two passionate recreational runners, representing the broader community of everyday athletes. Together, they show how digital twins can unlock insights for runners at every level.

The growing importance of digital twins

According to the TCS Digital Twindex (a technology index that explores the cross-industry impact of this technology) more than **52% of experts** believe digital twins will be widely adopted in Life Sciences and Healthcare within the next **3 years**.

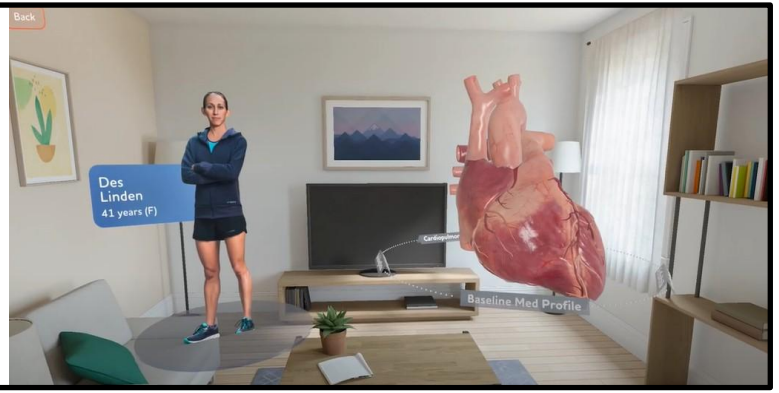
These digital twins replicate the unique physiological characteristics of each person's heart and can flag potential issues – such as irregular heart rhythms, early signs of fatigue, or other stressors – that might go unnoticed until it's too late. For professional athletes, this could mean the difference between finishing a marathon or sidelining a career due to preventable injuries or health risks. For everyday individuals, it promises a future where we can better monitor and manage our own health, leading to longer, healthier lives.

Launch event features

Different technology features allowed visitors to fully immerse themselves in the world of digital twins, with demonstrations that allowed them to see digital twins of the athletes' hearts, the key insights gained from studying them, and information on how AI can be used to predict the future of each person's heart, based on marathon training data.

1. Cutting-edge Spatial Computing Demo

The premier attraction at the event was an immersive spatial computing experience powered by Apple Vision Pro headsets. Much more than standard augmented reality, it allowed users to explore a fully interactive walkthrough of the technology, featuring a 3D heart. Users could enlarge, shrink, or turn the heart with simple gestures – and they could even step inside it. The whole experience felt straight out of *Mission Impossible*, blending futuristic tech with hands-on exploration. See the demo here.



2. Interactive touch-screens

The team created a colorful, attractive bank of interactive screens, allowing visitors to explore digital twin hearts, understand how marathon training transforms the heart over time, and discover the key factors that differentiate amateur and professional runners.

3. Heart beats on show

Attendees experienced a live demonstration of their own heartbeats, captured in real time using an innovative integration of an Apple Watch. This allowed visitors to view a sample digital twin of their own heart, making the technology feel tangible, relatable, and within reach.

Innovation and creativity

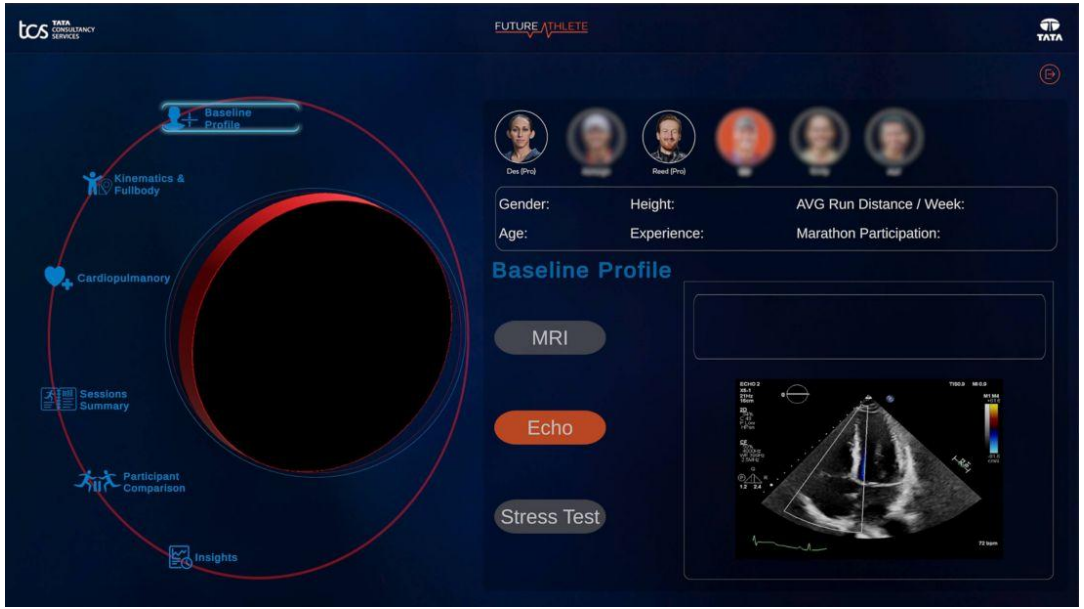
The Future Athlete Project experience is a striking synthesis of data visualization, storytelling, immersive technology, and physical design. While digital twins themselves are not new, the way we framed and presented them for this project was creatively distinct. It avoided traditional UI-heavy, metric-based interpretations and instead transformed medical and athletic data into a powerful sensory narrative. This required:

- Designing 3D digital twin hearts for athletes using real biometric and ECG data, tied directly to their training and performance journeys.
- Creating immersive experiences via Apple Vision Pro and a touchscreen, each offering a journey through an athlete's heart from rest to peak exertion.
- Pairing the immersive data experience with emotive video storytelling – introducing users to each athlete's background, motivations, and race goals.
- Using sound design, voice narration, and interactive touchpoints to guide users through the experience without overwhelming them.

The concept was born from multidisciplinary co-creation – bringing together clinicians, athletes, designers, engineers, and storytellers. The final product wasn't just about showing how a heart works, but making people feel what it means to push your body to its limit – and care for it.

Content quality

The project stands out for its high-quality content – meticulously researched, clinically reviewed, and carefully crafted for both scientific integrity and emotional resonance.



Data sources: ECG results, wearable health trackers, self-reported training inputs, and expert clinical analysis.

Digital Twin accuracy: Each 3D heart model reflected an individual athlete's heart profile, showcasing changes in size, rhythm, and capacity under stress.

Video and audio content: Custom-shot interviews captured each runner's voice – what drives them, their mindset, and how they approach health. These were integrated with motion graphics and captions to create a seamless audiovisual experience.

Narration and script: Carefully written to be clear without being simplistic – technical terms were explained using metaphors and plain language to ensure broad accessibility.

All content underwent rigorous quality control, with involvement from both health care experts and creative leads to ensure factual accuracy without losing narrative coherence. Nothing was generic – every word and asset was tailored.

Des Linden’s story

Desiree "Des" Linden is an American long-distance runner, two-time Olympian, and the 2018 Boston Marathon champion. Using TCS’s digital twin technology, Des was able to see for the first time the physiological impact of two decades of marathon training:

- Her heart chamber size has grown relative to her body surface area, with thicker walls and 40% greater blood-pumping capacity than average.
- 80% of the energy she generates moves blood through her body – compared to just 50% for most people.
- She achieves an optimal ventilation-perfusion ratio of 0.8, indicating highly efficient oxygen intake and delivery.
- Her heart shows 85% more elasticity than average, with no signs of age-related stiffening – even compared to much younger athletes.

These insights help Des train smarter – recovering on downhills, sustaining high performance longer, and breathing more efficiently. Her heart proves that with long-term base training, digital twins can unlock the science of peak performance for anyone.

See Des’ video: https://www.instagram.com/tcsnorthamerica/reel/DBzvcBDo5_X/

Visual design

Visually, the Future Athlete experience had to do something difficult: be both beautiful and accurate, emotionally rich but medically credible. This was achieved through:

High-fidelity heart modelling: Designed in collaboration with the TCS IoT and Design Engineering team, the TCS Research and Innovation team, and the TCS Health Care and Life Sciences Business Unit – and Unity developers to ensure anatomical precision and visual richness.

User interface: Minimal, intuitive overlays in Vision Pro and on the touchscreen to let the heart take center stage.

Typography: Sans-serif, large-type choices to aid readability on head-mounted displays.

Environmental design: The on-site booth featured screens and wraparound visuals, immersing users before they even entered the digital environment.

This harmony between technical and aesthetic considerations ensured a coherent experience – whether someone was seeing it on a screen, in a headset, or through social media clips.

Ashleigh Lindow and Bill Quinn's stories

Recreational marathoners Ashleigh and Bill prove that digital twin technology isn't just for the pros. Ashleigh, in her mid-20s, has completed multiple marathons representing Team TCS Teachers. Bill is a 55-year-old futurist from Colorado, who only started marathoning last year and has already completed three. Their digital twin hearts revealed insights to help them train smarter:

- Bill's high arterio-venous difference allowed him to avoid fatigue until mile 24 of the Chicago Marathon – when he "hit the wall." His left ventricle has low elasticity, due to age-related stiffening, so he now trains with longer recovery windows.
- Ashleigh's heart is strong, with larger-than-average ventricles, but a congenital condition means her VO2 max (volume of oxygen consumed) is low. Still, her data shows that marathoning strengthens her heart.

Their digital twins didn't just show where they could improve – they gave both runners a deeper understanding of how their bodies work. Seeing how lifestyle choices impacted his data, Bill made lasting changes: "I cut alcohol out almost entirely because I saw what it did to my recovery," he says. "Whether you're training to win or just finish, everyone benefits."

Reed Fischer's story

Reed's digital twin heart reveals what makes him a top American marathoner – exceptional efficiency, powerful performance, and data-driven insight. Years of training at altitude have made his heart and lungs highly efficient at oxygen exchange. His blood carries 30–35 ml of oxygen per 100ml – 60% more than the average person – reducing fatigue and enhancing endurance, especially at sea level.

He requires less oxygen and blood flow to sustain his pace, giving him an edge in running economy. His heart can rapidly ramp from resting to peak performance:

- Blood oxygen content: 30–35 ml/100ml (60% higher than average)
- Peak contraction power: 4 m/sec
- Systolic pressure ratio: 2x average

Reed's altitude training has honed his cardiovascular system for high-intensity efforts and rapid recovery. He can maintain faster easy runs and deliver a powerful sprint finish.

"I'm always looking for that edge," Reed says. "Having this data gives me a whole new way to answer questions like, 'Where can I push harder, and where do I need to back off?' This technology allows me to make those decisions in a much more informed way."

User experience and accessibility

Every user experience element was designed to be welcoming, intuitive, and inclusive. Key UX and accessibility considerations included:

Apple Vision Pro interaction: Natural gestures like pinch and tap allowed users to rotate, enlarge, and explore the digital heart.

Touchscreen fallback: A computer-accessible version delivered a comparable experience for those without headsets.

Narrated guidance: A calming voiceover guided users through key functions and health insights, reducing cognitive load.

Contrast and legibility: All visuals were tested for visibility in low-light and high-glare conditions.

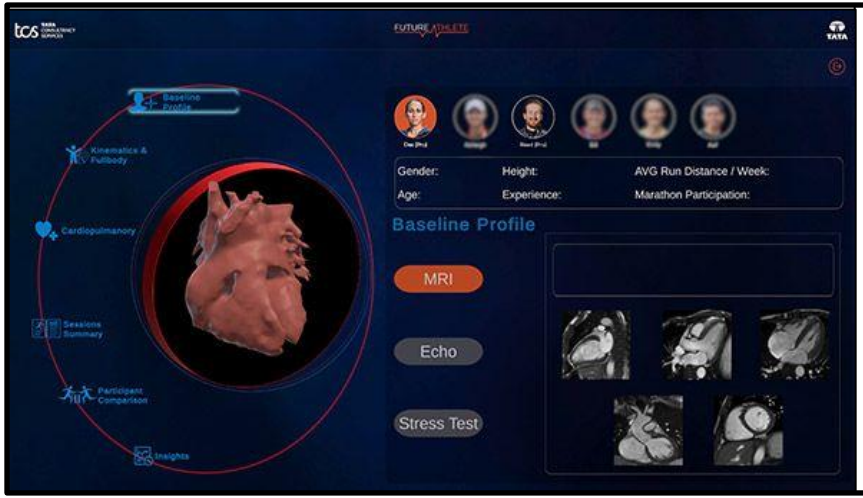
Accessibility: Subtitles for all voice content and alt text for images and graphs.

Inclusivity was central: whether you were an elite athlete, casual runner, or simply health-curious, the journey was clear, motivating, and respectful of diverse user needs.

Our star athletes see their hearts in action

Des Linden (left) Reed Fischer (top right) and stopped by to engage with the digital twins of their hearts and gain insights to be used in future training, while Peloton instructor Becs Gentry (bottom right) was wowed by experiencing the technology for the first time.

See their reactions: https://www.youtube.com/watch?v=m3r7ZbNXKfc



Functionality and performance

Performance metrics were closely tracked throughout the launch period and demonstrated that the project wasn't just high concept – it was high performance too:

- Load time: <2s average on touchscreen; <4s for headset streaming.
- Stability: Consistent 90Hz refresh rate in Apple Vision Pro under exhibition lighting.
- Cross-device functionality: Fully responsive on tablet, desktop, and headset.
- Technical issues: None reported by demo users; system telemetry showed >99.9% uptime.
- User satisfaction: Over 80% of visitors completed the full experience.

Technical execution

The backbone of Future Athlete was complex and robust, with the team executing a fully-engineered, scalable digital health demonstration with:

- **Data processing pipelines** to convert raw biometric inputs into visualised outputs using TCS-built advanced technology.
- **3D modelling** in Unity and optimisation for Apple Vision Pro, with support from Apple engineers.
- **Responsive front-end development** using frameworks compatible across devices.
- **Top-tier security** with adherence to best-in-class data protection standards and anonymization layers for personal health data.

Impact and effectiveness

We smashed all our objectives for the Future Athlete Project demonstrations at the TCS New York City Marathon, including:

- Hosting 10 media partners (vs five target), including the *Wall Street Journal*, FastCompany, CNET, and *The Atlantic*. Tech Reporter at the Wall Street Journal Isabelle Bousquette said: “I had no idea TCS does this… the demo was fascinating.”
- Featuring in 235 pieces of media coverage (vs target of 150), including major sports and tech outlets – with an approximate reach of 480million.
- Accumulating 136,000 views of the digital twin sizzle reel (vs 100,000 target) and generating 1,000 likes.
- Driving 13,971 viewers to the Future Athlete hub on the TCS website (vs target of 10,000) by the end of 2024. These were quality visits too, with the average visitor spending 3m30s on the page.
- Using the event to host 17 TCS key clients and 20 industry partners and adding $50million to the new business pipeline (vs $10million target).

An expanding project

Complementary Future Athlete Project demonstrations to spread the digital twin messaging took place at:

- TCS London Marathon
- TCS Mumbai Marathon
- Standard Chartered Singapore Marathon
- TCS Amsterdam Marathon
- TCS Lidingöloppet cross country race in Sweden
- País Digital Summit in Chile
- CIO Day event in the Netherlands

Overall experience

Over 3,000 people experienced the Future Athlete Project demos in-person during TCS New York Marathon week. By blending deep technology with storytelling, design, and empathy, TCS created an experience that didn't just inform – it connected and provided a memorable experience for visitors. User interviews revealed powerful moments of self-reflection and motivation, and some participating athletes asked for copies of their digital hearts.

"Everything I've seen to date [in augmented reality] is games – but now you're saying this is going to augment my life and have impact outside of gaming. It's for everyone!"

"I think what I saw was how quickly I can arrive at a conclusion! At an engineering and product level, it helps it make sense."

"Most of my ideas come while I'm running in the morning, so this is great for me to see how I can apply that and test it. Thank you so much!"

"I would pay for this experience /service on the spot!"

"I've never seen my heart like that before."

"My clients would love this!"

"That was very cool! I like visual of going into the heart."

"I work in eye care – we could we create a digital twin of a patient's eyes and be able to predict if they are prone to certain eye diseases."

Shaping the future of health and performance

Not only is TCS's digital twin technology transforming sports, but it also has the potential to revolutionize how we understand and care for the human body. By creating highly personalised digital twins, researchers and clinicians can safely test new treatments, study drug effectiveness, and even rehearse complex surgeries – without risking lives.

With the ability to track wellness from a young age and catch diseases like heart conditions or diabetes early, digital twins could usher in a new era of proactive, connected healthcare.

The Future Athlete Project provides a platform for future health, sport, and tech collaborations. It leaves visitors with a deeper understanding of their body, and a stronger connection to what TCS stands for: using technology to drive progress that's personal, powerful, and profound.