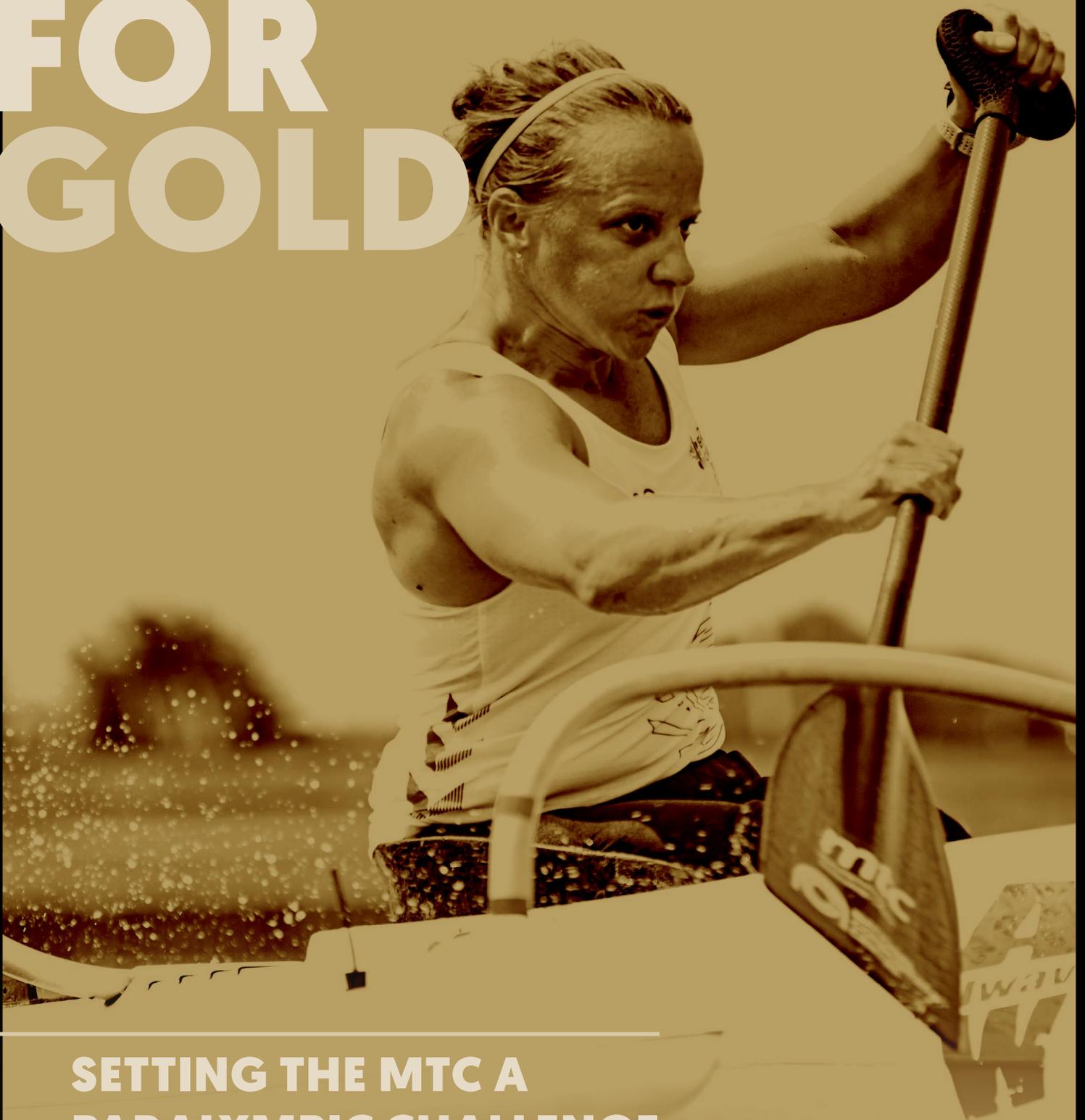


GOING FOR GOLD



SETTING THE MTC A PARALYMPIC CHALLENGE

AN MTC PROJECT DELIVERED IN COLLABORATION WITH OUR PARTNERS



THE PADDLE THAT PROPELLED A PARALYMPIC GREAT TO GOLD

Showcasing the power of collaboration and what can be achieved when world leading sporting and engineering talent combine to help bring home a gold medal for Paralympic Champion Emma Wiggs MBE.



PROJECT OVERVIEW

Sporting achievements at the highest level are increasingly determined by the smallest of margins. Even the very best need to constantly innovate to stay at the top of their game.

So when current Paracanoe, Paralympic Champion Emma Wiggs MBE came to the MTC to ask if we could help design and manufacture a stronger, lighter, personalised paddle ready for the Tokyo 2020 Paralympics we took up the challenge of supporting one of the UK's truly inspirational athletes on her quest for Paralympic glory.

“I knew that with a better paddle that was more personalised to my individual requirements that I could gain more power through my stroke and propel the canoe faster. What I didn't know was if it was even possible to make that happen. This is where the MTC came in and I can't thank them enough.”

Emma Wiggs MBE,
Double Paralympic Champion, 2016 and 2020



THE CHALLENGE

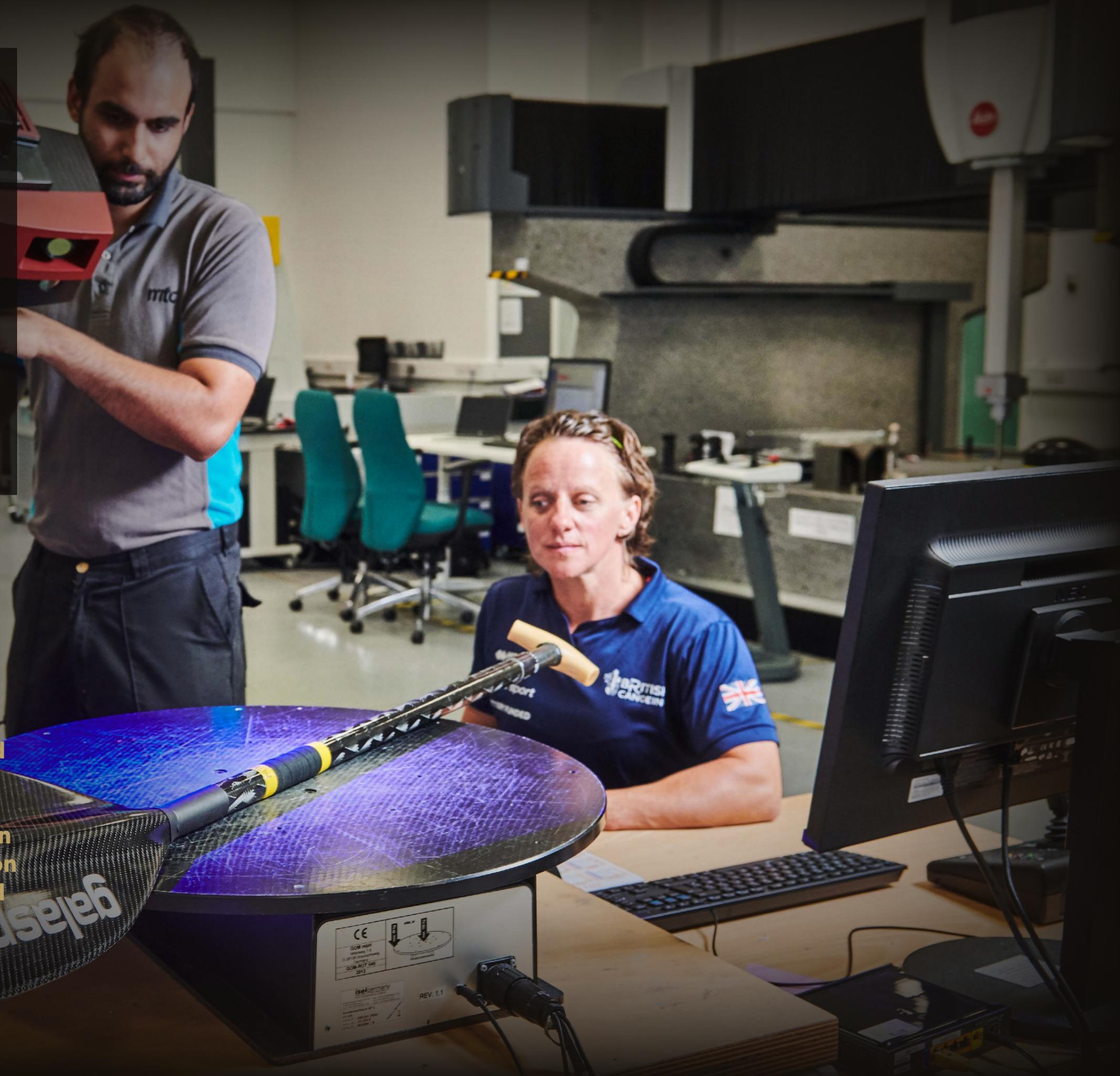
Some sports often lack the funding and the focus of major equipment manufacturers to innovate and produce new and better equipment for athletes at all levels.

Emma Wiggs MBE and the British Canoeing team identified the single blade paddle used in the VL classification of canoeing as an underperforming piece of equipment.

The basic design of the paddle had barely changed in years and wasn't adapted to the ergonomics of paracanoeists. It could only be altered by its length with the same basic design of the blade, shaft and handle for all athletes irrespective of their height, weight, hand size, grip preference or stroke style.

“Emma Wiggs is a truly inspirational individual and we are extremely proud of her success and our involvement in her journey to Paralympic gold in Tokyo. This project is a great example of what can be achieved when driven, expert, talented people from different sectors of society come together to work on a project with a real determination to make a positive difference and achieve great things.”

Clive Hickman
MTC Chief Executive Officer





THE MTC'S SOLUTION

- Our project team included lead engineers from the MTC's High Value Design, Mechatronics, Metrology and Physics Modelling teams, as well as the National Centre for Additive Manufacturing (on-site at the MTC) and composite specialists at the National Composites Centre (NCC) based in Bristol
- The MTC worked with Emma and her coaches at British Canoeing to capture the current equipment dimensions and properties, as well as Emma's ergonomics and individual techniques to generate speed and power through the water
- A computer simulation model was developed using a digital twin of the old paddle to inform the new design of the carbon fibre paddle developed with the NCC
- As part of the testing programme a modular composite tooling was developed by the MTC and NCC to produce various design options, which were then manufactured by the NCC
- Various options of the paddle handle were designed, customised to Emma's hands, lightweighted and manufactured via high-performance polymer additive manufacturing, produced at the National Centre for Additive Manufacturing, on-site at the MTC
- The various paddle and handle options were then tested by Emma to identify the optimum configuration for her hand size and grip preference
- Measurement and analysis of Emma's stroke and how the blade entered the water also led to re-designing the angle of the blade and optimising the carbon fibre configuration to maximise the performance of the paddle.



“This has been a great demonstration of how, through technology and ingenuity, we can overcome any challenge. It’s been amazing to use our accumulated knowledge to help Emma achieve her objectives and win a Paralympic gold medal in Tokyo, thanks to great teamwork between her, the MTC and the NCC.”

**Miguel Fernandez-Vicente
MTC Senior Research Engineer**

THE ORIGINAL PADDLE VS. THE NEW DESIGNED PADDLE

50% lighter 3D printed, customised handle

7 handle prototypes produced using additive manufacture

254% stiffer high performance paddle shaft

143% stiffer blade

Optimised blade angle of -55% to gain more power on entering the water



THE OUTCOMES & BENEFITS TO EMMA WIGGS MBE

The production of a new, personalised, single blade paddle to meet the individual needs of world leading paracanoeist Emma Wiggs MBE.

A customised, additive manufactured 3D handle designed to fit her exact hand size and grip preference.

Produced using new composite materials by the NCC making the paddle lighter, stronger and stiffer and able to meet the rigors of an elite athlete's usage through the water.

Providing an essential piece of equipment to help win a second gold medal for inspirational MTC Ambassador, and now double Paralympic champion.

“I’m incredibly proud of working with the MTC and the NCC on this project. Races are won on small margins and this demonstrates that the right adaptations to our equipment can make all the difference on race day. I won my gold medal in a Paralympic best time under extreme pressure, but knowing I had the best possible paddle in my hands made a huge difference and massively contributed to me securing the gold medal.”

Emma Wiggs MBE



Image: CanoePhotography.com/Dezso Vekassy (ICF)

THE STORY BEHIND THE PROJECT

The MTC first started its relationship with Emma Wiggs MBE when they asked her to speak to the MTC's engineering apprentices. The speech was about how to overcome challenges and achieve your goals and maximise your potential.

She was the perfect speaker, and the apprentices were completely engaged. It was from that first visit to the MTC that conversations began to see if the MTC could use its expertise and world leading engineering facilities to help Emma design and produce a new and improved paddle in time for the Tokyo Paralympics.

With agreement gained from British Canoeing, the MTC kick started the project including gaining the support of the National Composites Centre (NCC) and National Centre for Additive Manufacturing (NCAM). The challenge then began - how to design and manufacture a new, bespoke paddle for Emma to enable her to generate more strength and power.

In what is a world first, a team of expert engineers from the MTC, NCC and NCAM alongside Emma and her coaches came together to create a project team whose purpose was to use the latest manufacturing technologies to design and produce the perfect, personalised paddle to help propel the eight-time world champion to victory in the paracanoe VL classification.

Emma Wiggs MBE, who lives in Derbyshire, went into the 2020 Paralympics as the current KL2 200m champion after victory in Rio 2016. But heading to Tokyo, she was fully focused to take on a new challenge with the introduction of the new VL2 canoe class which uses an Outrigger canoe with an ama that acts as a float support and uses a single blade paddle.

Despite her previous successes, Emma and British Canoeing identified the paddle as an underperforming element. The previous design was not adapted to the ergonomics of paracanoeists and could only be altered by its length with the same basic design of the blade, shaft and handle for all athletes irrespective of their size, weight or stroke style.

Determined to help Emma overcome a tough 18-months and once again sit on the top of the podium, engineers from the MTC measured her dynamics and her optimum requirements against a digital twin of the old paddle. From there a new, lighter paddle handle was designed and customised to fit Emma's hands and grip as she paddles through the water. This was manufactured using high-performance polymer 3D printing in the National Centre for Additive Manufacturing based at the MTC.

Modular composite tooling was developed to produce design options for the paddle, which was manufactured by the National Composites Centre. The final paddle had a bespoke handle that was 50% lighter, a shaft that was 254% stiffer and a re-designed blade that was 154% stiffer with an improved angle of -55% vs. the original to maximise Emma's power output on the blade's entry into the water.

So with the paddle fully tested and delivering impressive results in training it was all eyes on Emma to see if she could now deliver, under the biggest pressure of a Paralympics final.

The end result? Her second Paralympic gold medal, winning the VL2 200m final in a Paralympic best time of 57.028 and a lot of blurry eyed, very proud engineers who stayed up through the night to cheer her on!



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