Completed fencing swords and prototype hilts

Olympic Precision

Iterative design contributes to success at the London games

One of Japan's top schools, the University of Tsukuba is renowned for its work in sports science and Olympic education, and for developing several of the country's best athletes. In 2011, the university began research and development projects as part of the Team Nippon Multi-Support Project, a program initiated by the Ministry of Education, Culture, Sports, Science and Technology to provide advanced support to Japanese Olympic athletes and teams.

The projects focus on developing sports equipment

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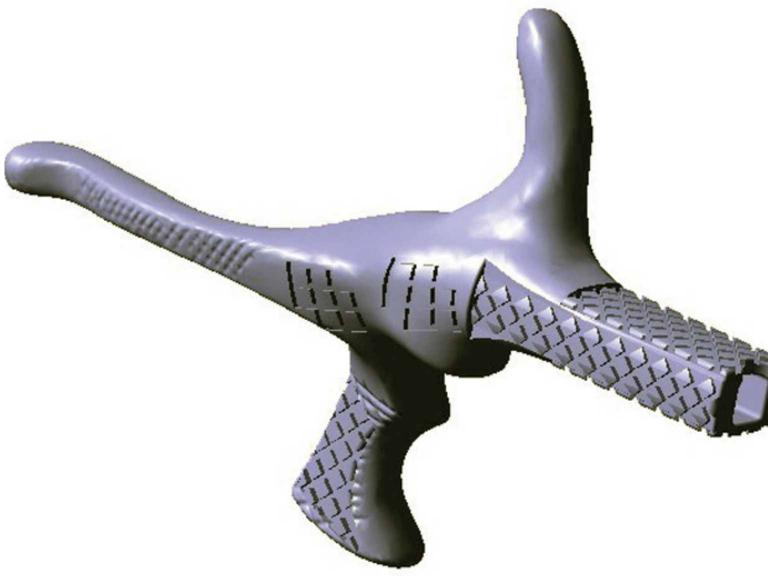
>
> Osamu Takeda
> **University of Tsukuba**



Case Study

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as well as training and conditioning methods. Already, results include gymnastic protective gear, shoes for javelin throwers, clothing for triathletes, masts for Olympic sailing yachts and a system to analyze badminton footwork. Most notably, the program developed the hilt, or handle, of the fencing foil for Japan's 2012 London Olympics team.

Refining the Athlete's Foil

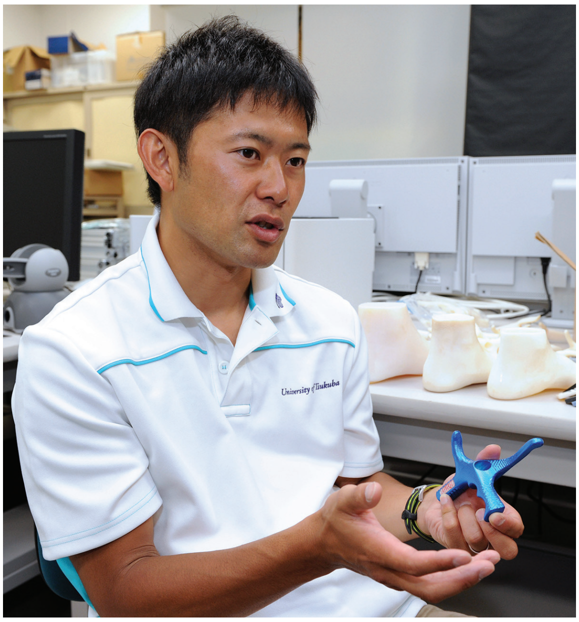
Every fencing foil is different, tailor-made to the athlete. Fencers traditionally hand-sand their hilts to adjust the fit and feel for optimal control. If a hilt breaks, it is irreplaceable.

When he was assigned to create new hilts for the Olympic team, Osamu Takeda, a researcher in sports biomechanics at the University of Tsukuba, was reluctant. He knew little about fencing and its rules, let alone the intricacies of how to grip the foil. With just months to complete production and deliver the final products in time for the London Olympics, time-intensive molded or machined prototypes were out of the question, says Takeda.

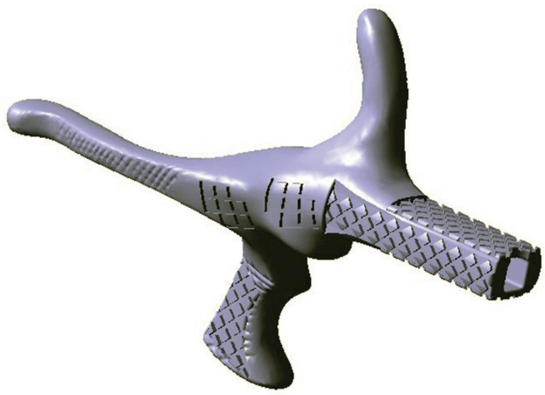
Thankfully, the university's Sport Performance and Clinic Laboratory had installed an Objet350 Connex™ 3D Printer for the multi-support project. Over six months, Takeda made nearly 70 prototypes. "It was only possible with this 3D printer," he says. Some prototypes were built in just hours, and the PolyJet™ technology-based system provided the impressively fine resolution needed for Olympic-quality product development. The 3D printer produces smooth prototypes with layers just 16 microns thick.

Skepticism Turns to Trust

Takeda's strategy was to use the team's existing hilts for the development base. He scanned the hilts, input the 3D polygon data into his 3D CAD system and fed the new data in STL format into the 3D printer's software to generate the first prototypes.



Osamu t worked directly with Olympic fencers to develop customized hilts for each athlete.



Athletes gave feedback on many iterations, resulting optimal control.

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Team members were skeptical of someone unfamiliar with their sport developing new hilts, but their doubts were skewered when they saw Takeda's first prototypes. "They were surprised by the prototypes' quality and started making customization requests," he says.

Having gained the team's trust, Takeda moved diligently forward on his mission, several iterations at a time. He often appeared with five to seven new prototypes within a day of fencers' requests. "Athletes are not engineers. So, I needed to translate their words into several prototypes as quickly as I could. Without 3D printing, it would not have been possible."

Peace of Mind

In April 2012, a few months before the London Olympics, final production was complete. Even the original hand-finished, non-slip pattern on the surface of each hilt was reproduced exactly. Takeda provided the team with a set of five new hilts for each member. "Now they have replacements, even if a hilt is broken. Probably, that is the biggest result of the project. Those replacements gave the athletes peace of mind during the competition." The team's silver medals are Takeda's proof. And Takeda predicts wider benefits: "No one can say that our efforts for top athletes won't result in better sports gear for the general public someday."

Objet350 Connex at the Sport Performance and Clinic Laboratory

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