After winning a record seven gold medals at the 1972 Munich Olympics, the legendary swimmer Mark Spitz was asked by a Russian coach if his famous moustache had slowed him down.

Deciding to have a bit of fun Spitz said: "No. As a matter of fact it (the moustache) deflects water away from my mouth, allows my rear end to rise and makes me bullet shaped in the water. That's what had allowed me to swim so fast and that's what had allowed me to swim so well."

Perhaps that explained the outbreak of moustaches on Russian male swimmers the following year!



Seven time gold medallist Mark Spitz.



TYR Aqua Shift worn by Yana Klochkova, on her way to four Olympic swimming gold medals.

TYR Sport

Swimsuit technology made a splash in Athens

At this year's 28th Olympiad in Athens, another American swimmer was setting out to try and equal Spitz's record of seven gold medals. In addition to the exalted place in history books it would give him, Michael Phelps had the small matter of a $1 million bonus from his sponsor Speedo if he were to achieve this feat.

With this goal in mind it was clear that, just like all his modern day competitors and in complete contrast to the Spitz era, Phelps would not go anywhere near a competition without first… shaving and, more importantly, without the latest innovations in swimsuit technology.

'Technical equipment'

Officially regarded now by FINA (the international governing body for swimming) as a piece of 'technical equipment', no swimsuit of 'new design, construction or material' can be used in competition without prior approval by the body and which, they also insist, must be made available to all competitors (FINA's General Rule 6.4).

The last few years have seen the organisation busier than ever in monitoring and testing the new developments which are being proposed by all of the leading brands in the world of swimming. This is really the sport's attempt to ensure that there is natural progression in swimming without unfair advantage. After all, swimsuits are not the only thing that has changed at the pool. Lane lines, starting blocks and even the pool itself – all have undergone improvements and always with an eye toward faster times.

Beyond the bodysuit

The suits that looked so revolutionary in Sydney in 2000 – some covering the entire body – are now commonplace at the World and Olympic pools. Yet the quest to make swimmers go faster and achieve even greater levels of speed and performance has not diminished.

Every brand featured at this summer's Olympics had a dynamic name to promote its technology. The number one brand Speedo had its 'successor to the Fastskin worn by 80% of medal winners in Sydney', the FSII. Adidas had the 'Jetconcept bodysuit' and Nike had the 'Swift Swim' which were both first worn at the Barcelona World Championships in 2003 and featured in WSA November 2003. Even Arena had its 'Powerskin' and Tyr its 'Aqua Shift'.



US swimmer Michael Phelps made the most of Speedo FSII technology to win six golds and two bronze medals in Athens.

Speedo

✔ DB ✔ DD

All these technologies focus on the same fundamental problem in swimming: 'drag'. The manufacturers are striving to come up with new ways to make the water flow more smoothly around a swimmer's body, thereby reducing the resistance and making it easier to go faster. Some of them have spent millions in the last few years, in some cases working with the most unlikely partners in order to achieve this goal.

British Natural History Museum to Formula One (via Hollywood)

Having already launched its Fastskin suits in Sydney four years ago, Speedo started by analysing even more intensely the skin and the shape of the shark on which the original suits were based. Together with noted shark expert Oliver Crimmens of the Natural History Museum in London, it was discovered that its shape and texture actually varied across the body thus enabling the shark to move through the water using less energy and with minimum resistance.

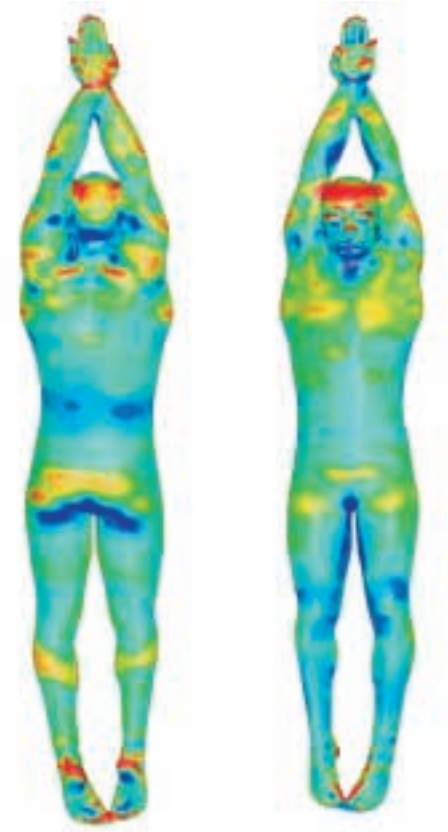
With this research Speedo then went to work in Hollywood with CyberFX, a leading body scanning/special effects company which had worked on movies such as Spiderman and The Matrix. They scanned 450 elite swimmers (including their own superstars) in order to create electronic blueprints for life-size, anatomically accurate mannequins to be used in further testing.

The brand then used a revolutionary technology known as Computational Fluid Dynamics (CFD). Already being used in Formula One motor racing, this technology enabled Speedo to create a computer-generated virtual swimmer which allowed it to monitor fluid flow over the body. As with the shark, it was discovered that water also moves at different rates across the human body. CFD also showed that friction and drag are higher over some parts of the body than others. As a result of this Speedo decided to create suits using different fabrics for different parts of the body and to create specifically engineered male and female suits.

Fastskin with its fin-like cuts helps to reduce drag at the chest and buttocks and saves energy by compressing the muscles and reducing oscillation. Flexskin, a much smoother fabric, offers greater flexibility whilst still reducing drag and is placed in areas where water flows much more slowly, such as the inner legs. In addition to these two fabrics, there are small applications of silicone on the chest and back, designed to improve the management of turbulence. Finally, Speedo created a 'Neutraliser' titanium scale which is placed on the inner forearm in order to improve the 'feel' of the water for the swimmer.

Otaga University, New Zealand

In addition to CFD testing on virtual models, trials were also carried out in the water flume at the Otago University in New Zealand. Over 1,000 flume runs were undertaken using the actual models of swimmers to test the resistance of a variety of suit designs that utilised the new findings.



An infrared photograph of a 'virtual' swimmer in Speedo's CFD programme.

Speedo

The outcome, Speedo claims, is a suit which reduces passive drag by 4% more than its closest competitor. It boldly claims that the FSII is now the fastest swimsuit in the world.

Michael Phelps certainly believes there is something to be said for all the investment. "To swim in the fastest suit in the world is an honour. It's definitely going to change the sport of swimming." Whilst not quite achieving Mark Spitz's record of seven gold medals, the FSII wearing phenomenon still performed outstandingly in Athens by winning eight medals (six golds and two bronze) and breaking a world record as well. In total, 22 gold medals were won wearing Speedo FSII suits and six world records were broken.

The Norse God of War

With Nike and adidas having already launched their new fast swimsuit technology in Barcelona, it was left to Tyr to challenge Speedo's claim to have the fastest swimsuit in the world at the 2004 Olympics.

Speedo celebrated its 75th birthday last year and Arena its 30th anniversary. Which makes Tyr (named after the mythical Norse God of War) very much the young upstart of the performance swimming brands.

Founded in 1985 by Steve Furniss (who actually won an Olympic swimming medal at the same Games that Spitz set his record), the brand has been growing rapidly. It has been the second largest manufacturer of competitive swimwear in the USA for some time now and is gradually increasing its exposure across the globe.

DT = DP + DW + DSF = catch me if you can

The task identified by Tyr was to conduct the most extensive tests yet on 'DT - Total Drag' where DT is the combination of the three main forms of resistance encountered in the pool:

1. The friction of the skin (DSF - Friction Drag)
2. The resistance of moving through the water (DP - Pressure Drag)
3. The impact created by the surrounding turbulence (DW - Wave Drag)

To this end Tyr has worked closely over the last four years with researchers at the University of Buffalo's CRESE (Centre for Research and Education in Special Environments). Normally called upon by organisations such as NASA and the US Navy SEALS, the institute is highly regarded for its work in theorising the limits of human performance by creating extreme controlled environments as an investigative tool.

A doughnut-shaped aquatic research tank

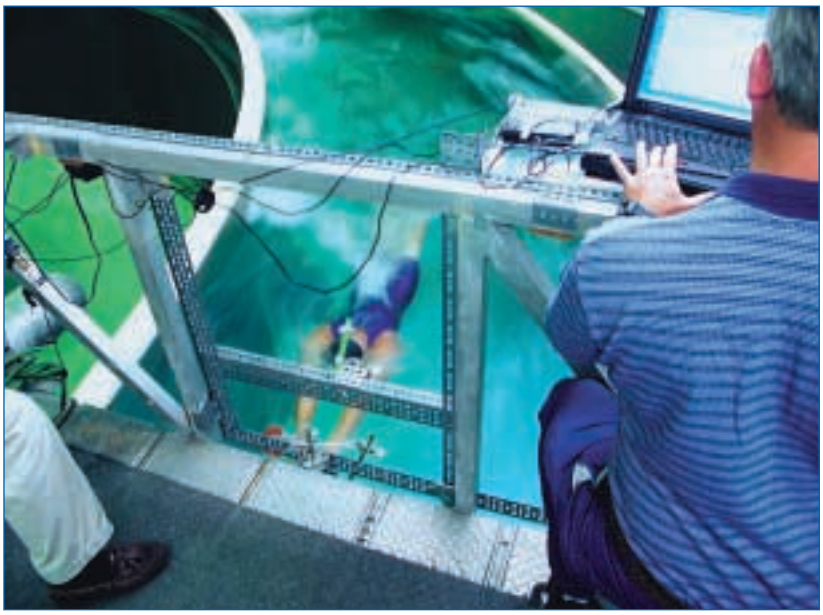
Testing was undertaken on Olympic athletes in the CRESE's Annular Pool, a doughnut-shaped aquatic research tank. Athletes were studied moving at a range of swim speeds using a performance bridge suspended over the pool centrifuge and driven by two 50hp turbine engines. Subjects were monitored with high speed digital film and computerised body torque analysis was used to collect and analyse data. Thousands of samples were taken from each subject at different velocities and it was discovered that the flow over the length of the swimmer's body was neither laminar nor turbulent but a noisy ambient flow.

The result of this work was to calculate where and when water clings to the body and to develop a formula to break down the different drag components. Tyr's solution to the drag problem was to develop a 'tripwire' technology. Basically, thin strips of bulging polyester and Lycra fabric (also known as 'Tribulators') are positioned on the chest, hips and buttocks of the suit in order to 'trip the water'. The water then re-attaches and flows smoothly along the body and the smooth swimsuit fabric used. And so the Aqua Shift suit was born.

By slightly increasing one component of drag, Tyr believed that the suit actually greatly reduces the other two components of drag. According to the University of Buffalo's David Prendergast: "What's unique (about the Aqua Shift suit) is that the way it works is revolutionary compared to other suits. Most suits concentrate on reducing friction but this suit actually increases friction to reduce pressure and wave drag."

As a result, Tyr claims that total drag (DT) is reduced by 10% to 15% in respect of any other suits made by itself or its competitors.

Whilst having a smaller stable of swimmers, three gold medals were won wearing the new Aqua Shift technology.



TYR Sport conducted intense research for its swimsuit technology, Aqua Shift, at the Center for Research and Education in Special Environments at the University of Buffalo.

TYR Sport

South African Heroes in Swimsuit Drama

One of the biggest upsets in the Athens Olympic swimming pool also provided Arena with unexpected gold. The four members of the South African 4 x100m Men's Relay team beat off some of the biggest names in swimming and took first place in a new world record time wearing Powerskin Extreme suits from Arena.

In simple terms, the Powerskin fabric is a stretch woven material with an exclusive polyamide coating. It is 30% lighter than a regular swimwear material and is claimed to absorb 15% less moisture. The Extreme suit launched at the Olympics also had 'Arena Riblet Technology' developed with the Polytechnic Engineering University of Milan. These riblets on the surface of the fabric are said to reduce vortices typically created on smooth bodies moving through water, thus improving glide. With minimum water absorption, this reduces excess water waste or ballast.

What was a pleasant surprise for Arena about the South Africans' performance is that the athletes were actually meant to be wearing suits from a different brand – the one which had sponsored their national swimming federation. Apparently all four refused, saying that they thought the Arena swimsuit was faster than the one they had been told to wear. Talk of disciplinary action by the federation soon subsided. After all, they had just won South Africa's first gold medal for eight years and in a world record time.

Modesty preserved

Probably the strangest swimsuit development to be used at the Olympics this year was being worn by seven Japanese swimmers. The material dubbed 'Video Proof' has been developed and launched by Osaka (Kyodo) Descente Ltd, not so much with the thoughts of friction and drag in mind, but for female concerns with modesty.

The material used as a lining remains opaque by absorbing the infrared rays in wavelengths used by IR cameras currently on the market. The suits were intended to ease concerns by female swimmers over being photographed by cameras which can make regular swimwear appear transparent.

"Since there are some competitive swimmers who can't concentrate on swimming (due to this situation), with their results adversely affected in the competition, we hope to back them up as much as possible," a company official said.

Descente will use the material as a lining for commercial competition swimsuits which will be launched in December.

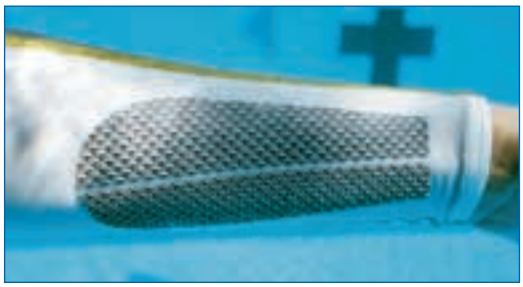
Tearing up the record book

As a precursor to the Sydney Games in 2000 the sport of swimming was propelled forward by the greatest technological advance in more than two decades – the bodysuit. The high tech attire provided less resistance than shaved skin and kept the body a little higher on the water. Most swimmers opted for a suit that at least covered the lower half of their body. The record book did not stand a chance. Fifteen world records were either tied or broken both in 2000 and since. With the use of various bodysuits they have continued to tumble.

At the 2004 Olympics gold medals were won by swimmers wearing suits from all of the major brands. In addition to Speedo, Tyr and Arena's successes, three individual gold medals were won by swimmers wearing the Nike Swift Swim suit and three individual gold medals were won by swimmers wearing the adidas Jetconcept bodysuit.

World records continue to be broken at an alarming pace by athletes wearing suits from each of the major swim brands:

- Michael Phelps (Speedo) at the tender age of 19 has held 19 world records.



Titanium scales patched onto the lower arm of Speedo's FSII bodysuit..

Speedo

- Ian Thorpe (adidas) at the advanced age of 21 has broken 22 world records.

Some scoff that too much emphasis is being placed on technology instead of the athlete. "They would have you believe that anyone who gets in these suits is going to swim as fast as Michael Phelps. That's simply not the case," said eight-times medallist Gary Hall. "This sport should be mano a mano – not my suit is better than your suit. If I had my way everyone would swim in the same nylon suit."

However Steve Furniss (co-founder of Tyr and ex-Olympian) believes the athlete's role is just as important as it ever was, even though the innovation has its place. "We can't take a swimmer who didn't train and make him do well. Training is paramount. But the suit can make a difference of a tenth of a second. In the Olympics that might be the difference between first and fourth."

What is actually happening is quite exciting for the sport. We are in a golden era of truly great swimmers like Thorpe, Phelps, Van den Hoogenband and Klochkova to name a few, at a time when the intensity of competition to develop the best technology is at its height.

In 1972, in the days of Mark Spitz's glory, the gruelling seven-days-a-week training schedules and athletes dedication were just the same – the technology was very different – it was all so easy just to throw away the razor blade and to grow a moustache.

