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In 2001, drawing on expertise gleaned from two decades in the professional yacht racing industry, Toby Whitfield and Jaime Marina founded the composites manufacturing company, mouldCAM.

“The engineering of a raceboat in the high-end marine game is second only to the aerospace industry in creating very strong and light structures,” says Whitfield. “So our maritime background gave us a solid grounding in advanced composites.”

In the early days, armed with four of the world’s largest CNC (computer numeric control) routers, mouldCAM worked with high-end boating industry clients to optimise their products. Its work in three-dimensional CAD (computer aided design) optimised lead times for luxury UK boat builder Fairline, while mouldCAM’s precision CNC tooling for Danish Yacht reduced the weight of the vessel, enabling it to reach its target speed.

mouldCAM became an important name in the maritime industry, while riding the wave of professionals in other fields seeking its specialised expertise. By fabricating materials applicable across an array of disciplines, mouldCAM has had the unique ability to work with and provide specific products for industries as diverse as architecture and animatronics. Its list of custom projects includes the construction of full-size aeroplanes used as props for film, the production of parts for V8 supercars, turbines for the renewable energy sector, simulators used by the military and civil aviation industries, as well as the development of architectural responses with the Royal Melbourne Institute of Technology (RMIT).

The business had been primarily engaged in a consultation and supply sense, crafting specialised products to order. However, when

the effects of the Global Financial Crisis hit Australian shores in the late noughties, the local boatbuilding industry folded.

“We had to begin creating our own market, so we started to develop the idea that was already seeded – to target architects and builders,” says Whitfield.

Having experimented with built projects previously, mouldCAM shifted its focus squarely towards the building and construction industry in 2009, with architects approaching the business seeking engineered material solutions to complex structural forms.

“People came to us out of a sense that they were inhibited in the materials and the technology available to them, so we started to apply our knowledge of advanced materials and three-dimensional design to inform our approach to these complicated shapes,” Whitfield says.

Casting its collaborative consultative efforts under the new name, ShapeShift Design Technologies, saw what had begun with mouldCAM as a fabrication and supply business evolve to become a leading force in the field of advanced composites, offering highly researched, tailored design and engineering solutions.

mouldCAM remains as the large-scale machinery and technology behind the operation, while another branch of the company, ShapeShell, represents the compartmentalisation of its detailed research and development into a more tangible end user offering, with a clearly defined catalogue of construction products for builders and specifiers.

The expansion of the company has led to the development of major manufacturing and engineering facilities in Australia and Asia, as well as the US, Europe and the UK.

Case Study – Swanston Square

The imaginative built works by architecture firm Ashton Raggatt McDougall (ARM) act almost as cultural totems on Melbourne’s main drag – the radical green brain over one corner of RMIT University embodying boundless studious energy, its powerfully executed redevelopment of the Shrine of Remembrance, richly layered in meaning and symbolism – all overseen by the lone figure of Wurundjeri-willam clan elder, William Barak at Swanston Square.

“With the portrait façade – people either love it or hate it, but it is a unique project, and it takes guts to put out that kind of work,” Whitfield says, commending ARM Architecture’s progressive attitude towards unconventional façades.

At Swanston Square, ShapeShift was able to showcase the best of building in composites. Monocoque panels form the strips cladding the building, specifically engineered for the project and subjected to rigorous testing. Putting the composite through its paces, ShapeShift took the product to a third party testing facility in Melbourne, with Probuild and the project’s consulting engineers in tow.

“The idea was to test it to destruction. What we didn’t anticipate was that the machine would give way before the material did – we had to stop the test!” says Whitfield.

The end result was an incredibly strong, lightweight product, able to accept a high level of complexity and customised form. Using mouldCAM’s large-format, three-dimensional CNC technology, ShapeShift was able to custom fabricate every panel to depict each contour of William Barak’s face – not one panel is duplicated over the building’s complex curve. Furthermore, it was delivered within budget.

“I’d like to think that there’s a mutually rewarding relationship there with ARM – they push the boundaries of design, and we try to run with them by providing the technology and development of materials to aid their momentum,” says Whitfield.

“Every time we’ve worked with them, they have been willing to embrace these technologies to create all sorts of shapes. Projects like that give others the confidence to design equally unique structures, and we have the technology and expertise to realise them.”



Interview with Toby Whitfield

How involved is ShapeShift with the architects you work with?

We work directly with architects and structural engineers to find out how we can continue to improve and develop materials. Fundamentally, it is a similar proposition to apply our knowledge of materials from the maritime world to the building and construction industry. But the exciting thing for us is that architects truly appreciate form – and they're attuned to the quality of materials.

In the architectural world, people are looking for a point of difference. Whether that's to do with the ability to realise complex designs, or achieve increased efficiency or sustainability.

We plug in with the architects fairly early on in the piece to come up with a strategy; they really embrace our knowledge for the technology and design. But it's always an evolving equation, because architects are always pushing the boundaries.

What are the benefits of pursuing a composite solution as compared to traditional building materials?

The idea of composite materials essentially stems from processes you would use to build an old mud hut, in the sense that it's basically reeds being woven together into a shape to give strength, held together by mud. In a contemporary context, we use synthetic fibres like carbon or Kevlar, and it's held in place not by mud, but by resin systems.

One new ShapeShell precast we have been developing, called 'Light', is a structural substrate of woven reinforcement with an exterior of Australian Barossa quartz, granite, sand and cement. By introducing a ShapeShell binder, we were able to create a modern reincarnation of one of the world's most specified building materials, at only five percent of the weight.

Nowadays, it is inefficient – and I think irresponsible – to be hanging great lumps of concrete off the side of a building. Especially when, with our technology, you can still achieve that sense of concrete or cement, but innovate it to make a lightweight solution.

People in construction can't believe how few trucks it takes us to deliver this material to site. Simply because you can only load three traditional concrete precast panels on a truck at any one time – the weight limits the load. Whereas we've been able to put on 15 or 20! So you can approach the project in much a more environmentally sustainable manner, as the whole supply chain lightens.

Do you tend to find that people at construction level are wary of new products?

Yes, they are, and they have good reason to be. You can't always give way to the avant-garde if you're dealing with large apartment blocks that people are going to inhabit. A healthy level of scepticism is totally appropriate. I don't see it as a negative, it's just a challenge for us – we just have to test and do everything to 150 percent to win them over.

We might start with a progressive architect and work out a solution together, but when we approach the builder they are then tasked with a new way of doing things, which is perhaps not at the top of their agenda – they want to de-risk things. If they can have our product substituted out for concrete, or aluminium cladding, or something that they've used for the last 20 years, then that's going to be the lowest risk for them.

It's a process and I understand that the adaptation to new products is difficult – especially for smaller operators that can't afford to take the risk, or can't see a return on deviating from the norm. Our business is about proving that the application of our products is an improvement on past methods – that it's safer, that it's standardised and that people can have confidence in it.



What is ShapeShift working on currently that excites you?

Probably the thing that I'm most excited about is the delivery of the materiality of the 'Light' precast panel. The core guts of the product is Australian stone and sand, and all we've done is combine it in an optimised fashion, using new technology and the knowledge of materials that we have. We've delivered a smarter, engineered material, exactly what the architect wanted to see and feel, but were able to replace tonnes of the fillers you don't see with a very strong and much more sustainable solution.

I'm always most excited when we're able to achieve those kinds of results, to find the most appropriate design. I often look at older buildings, with huge panels of concrete hanging off them and think it's such a waste – as though construction hasn't moved forward in 50 years. There are so many smarter ways to build, and it just takes the leaders in the architectural space to recognise that this is the forward-thinking option. I think the product will find great favour, because I don't believe that anyone in construction enjoys lugging those huge old concrete panels around. It's dangerous and it's just not the best solution.

We've done funky shapes, and we can do that forever, but I think there are some real gains to be made in finding and developing the right materials for the job. Concrete has a place – no question – but it's in the foundations, in the core of the building. When people insist on using it for cladding, we're here to say confidently that there's a better solution, and we're constantly working with architects and engineers to refine it.

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Safety Testing and Manufacture

Each year, ShapeShift is committed to investing in research and development that not only improves the quality and application of its products, but also optimises efficiency and safety in building processes.

To maintain the sheen and integrity of surfaces post-build, the company is testing and resolving a finish that delivers gloss retention comparable to the 25 years of gloss retention in the baked-on technology currently available in the market. The value and ingenuity of ShapeShift’s system, however, is that it can be applied out of the factory, so that scratches can be patched up on-site, extending the life of the surface.

Not only are its external cladding products tested to weather the most extreme cyclonic conditions, but ShapeShift’s monocoque panels have been known to do damage to machines designed to test the breaking point of the material – a testament to its significant durability.

Besides testing for extreme weather and durability, fire safety is of concern particularly in Melbourne following the 2014 fire at a non-compliant Docklands apartment, and the findings of the subsequent audit of cladding on high-rise buildings by the Victorian Building Authority (VBA).

In December of 2015, with no facility large enough in Australia to do the full-scale test, ShapeShift went to the UK to complete fire safety testing on one of its products, which will soon set the new Australian standard for external façades.

“We want to make sure that when we discuss our product with fire safety consultants, structural engineers, architects and builders that we are confident, having tested beyond current criteria. We now have a product that meets the next generation of fire safety standards,” says Whitfield.

Safety was also front of mind for ShapeShift while working in conjunction with Cox Architects and builder AW Edwards on the Bradman and Noble Stand at the Sydney Cricket Ground (SCG).

By incorporating guttering and an underlying soffit into one design, assembled at ground level and raised in 12-metre sections, ShapeShift was able to minimise the workload and risk for builders operating at 20 metres above ground. For this ingenuity, the Master Builders Association awarded AW Edwards the MBA Excellence in Construction Award – Construction Innovation and Technique in 2014.

