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Reinventing the wheel - part two

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As the city of Geelong builds a global reputation for carbon fibre technologies, Australian company Carbon Revolution is tackling the problem of how to turn a potentially disruptive technology into a commercial product. This year it began supplying the world's first mass-produced carbon fibre wheel to the Ford motor company.

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Geelong-based Carbon Revolution had its genesis in a competition Deakin University PhD students and academics entered to build a carbon fibre racecar. In 2007, with little more than a small amount of government funding to turn the lights on, the start-up managed to get an obscure American super car maker interested in the carbon fibre wheels it was experimenting with. Before the ink was dry on that first deal, the company's CEO, Jake Dingle, was knocking on the doors of big automakers throughout Europe and the US.

"Our aim with the business was to develop a technology that could, in the longer term, be disruptive," Dingle says.

"If it's successful as a disruptive technology, it will do to aluminium what aluminium did to steel in the 70s. So we weren't restricting ourselves to niche players or super car manufacturers that would make 10 or 15 cars a year. We were talking to the people who would make hundreds of thousands of cars a year but had an entry point for a high tech application that could then become mainstream."

The challenge for industry in working with a potentially disruptive technology goes beyond the science of carbon fibre. The benefits of the technology are obvious; applying it in a cost-effective way is another, Dingle says.

"The physics of massive weight savings in wheels are easy to calculate and demonstrate, however doing it safely and doing it so that it is fully integrated into a vehicle without changing the vehicle itself is the technical challenge. And then for us as a business, building it in a way that is economically viable has meant we have had to develop an efficient and scalable manufacturing process that enables us to price the product at a level that the customer was willing to pay. From the beginning, we knew that if we could make this work we would have a massive market to serve."

Eight years on, the company produces the CR9 aftermarket range of wheels for performance cars such as Audi, BMW, Porsche and McLaren. It's also supplying the world's first mass-produced carbon fibre wheel to Ford for its Shelby GT350R Mustang. At least a dozen other carmakers are now testing Carbon Revolution's products. The company plans to produce 250,000 wheels a year by the end of the decade at its Geelong production facility, and has plans for further expansion beyond that, which may involve operations outside Australia.

"Aerospace is also a very big opportunity for us", says Dingle. "We're on the cusp of signing up a major agreement with an offshore partner in that area. I'm very open-minded about where the manufacturing occurs for that industry. It's quite feasible that we can develop a global aerospace business from a manufacturing base that remains entirely in Australia, but time will tell in terms of how the strategic and economic factors ultimately stack up."

Carbon Revolution is located in the same technology precinct as Deakin University, carbon fibre research facility Carbon Nexus,

and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Geelong.

"Deakin University's Vice Chancellor, Jane den Hollander is extremely impressive and has a particular passion for ensuring the university and its respective institutes, including Carbon Nexus, are there to support industry and technology-based companies like us, with the sorts of outputs and services that we need to drive our businesses forward," Dingle says.

"It's not like a typical arms' length commercial relationship fortunately. We have very regular contact: people walk out one door and walk down the path and into the facility down the road and talk about specific problems to define what we need to do."

Both Carbon Nexus and CSIRO provide Carbon Revolution with technology partnerships and services.

"If you think about our two key raw materials, resin and carbon fibre, we are now creating a unique set of partnerships to drive forward aggressively with developments in these areas in a way that our future competitors will struggle to replicate. CSIRO have done a lot of work with us on resin chemistry over the last 12-18 months to accelerate our development of systems that perform better both in the product and through the factory. In parallel, Carbon Nexus are now beginning to look at particular forms of fibre and developing different and lower cost or differently performing forms of carbon fibre. It's early stages but we're optimistic that this will develop into something very powerful and unique to our circumstances here in Geelong."

In August 2015, the Australian Government announced that Geelong will be headquarters of its new A\$14 million Advanced Manufacturing Growth Centre. It will be part of a network of centres across the country and develop a sector competitiveness plan to link local businesses with global companies.

Meanwhile Carbon Nexus, in its first year of operation, produced 75 different batches of carbon fibre. It also tested 18 different precursor materials that can be used in the production of composite materials.

"There are so many exciting possibilities we continue to investigate", Carbon Nexus Research Director Professor Bronwyn Fox says. "For example, we're currently exploring, with our partners at the University of Queensland, the possibility of extracting the nanofibres found in the spinifex grass that grows in Australia's deserts and using it to make a Kevlar-like material."

Carbon Nexus is a world leader in carbon fibre R&D. Its research collaborators include the universities of Oxford, Sheffield, Kentucky, Southern Mississippi, Aachen and Stuttgart. It has agreements with 11 industry partners in the United States, South Korea, Russia, China, New Zealand, United Kingdom, Saudi Arabia, Turkey and Thailand.

Nonetheless, Fox still finds herself having to convince sceptics a regional university and a handful of businesses based in a regional city are capable of producing space-age materials that will be used to do everything from reinforcing crumbling bridges, to building cars that weigh as much as a bicycle, and to constructing giant wind turbine blades.

"It's not coincidental that this industry emerged in this region," Fox observes. "I'm constantly amazed at the number of my students who've grown up inventing things in their garage. Plus there's a workforce with experience making auto parts or operating an aluminium smelter. Those are skill sets that come in handy in the carbon fibre business."

Fox says: "An American engineer can spend their career focused on a car's right-side mirror. Because they are resource limited, Australian engineers are more likely to leave their comfort zone area of expertise and pitch in with colleagues to find solutions to problems.

"This is a place where people have had to show resilience and rebuild. It is a community full of people who like to create things."

Part 1 of Reinventing the wheel profiles Deakin University's Professor Bronwyn Fox's work developing carbon fibre.
[/Technology/reinventing-the-wheel-part-one]

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