World leaders in 3D printing

26 Jul 2017

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Photography:
Video:

3D printing is set to spark a global revolution in manufacturing and Australian company Amaero Engineering is leading the way.

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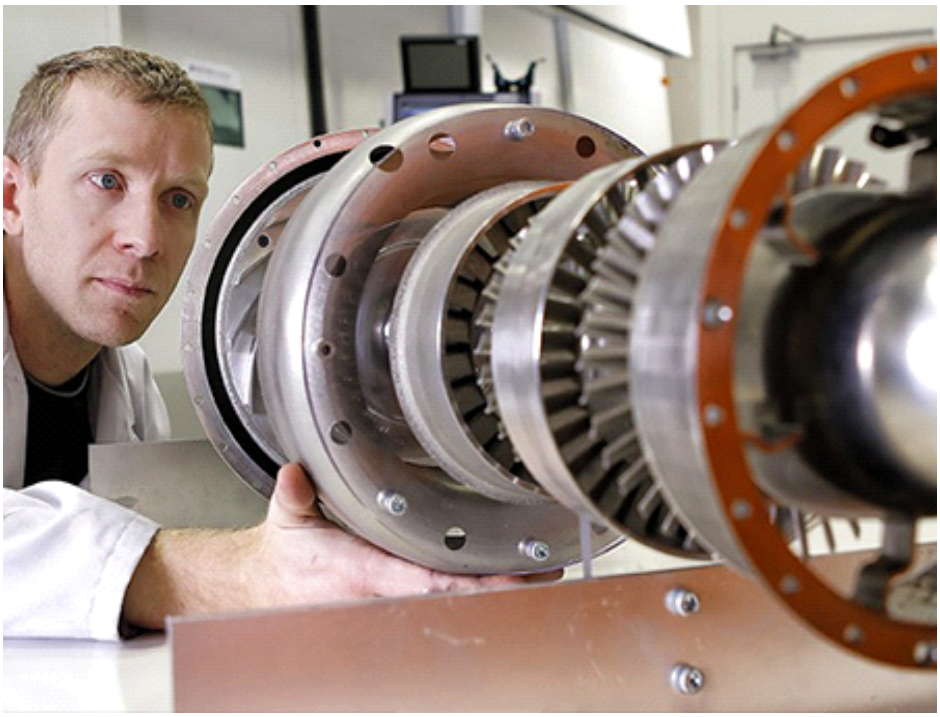
Technology



In 2015, Australian additive manufacturing company Amaero Engineering collaborated with Monash University Centre for Additive Manufacturing, and French aerospace manufacturer Safran Electrical & Power, to produce the world's first 3D-printed jet engine. The project, supported by the Science Industry Endowment Fund, caught the attention of major global aerospace players.

Amaero is a spin-off company of Monash University's Centre for Additive Manufacturing (MCAM), led by Professor Xinhua Wu, a world-leading scientist in aerospace materials. Amaero was set up in 2013 to commercialise the university's aerospace-material technology and was Australia's first company to use 3D printing to manufacture products (also known as additive manufacturing). With some private equity investment and support from the Australian Government Department of Industry, Innovation and Science Accelerating Commercialisation program, Amaero is addressing the challenge of meeting the expectations of the aerospace industry.

Amaero 3D prints components primarily for aerospace, defence and high-end automotive companies in Australia, Asia, Europe and North America.

“Through our partnership with MCAM, we’re right up there in terms of global technology leadership,” says Amaero’s Chief Executive Officer Barrie Finnin.

Why all the fuss about 3D?

Additive manufacturing, or 3D printing, is a revolutionary technique that Finnin says has the potential to bring some big changes to the manufacturing industry.

There are a number of benefits of 3D printing. Firstly, it’s a technique that can produce highly detailed and complex components.

“You can 3D print parts that you can’t make any other way,” says Finnin. “The advantages of those parts could be things like reduced mass or better heat exchange. For certain applications in the aerospace industry that’s very attractive. Those are the kind of performance benefits the industry is prepared to pay a premium for.”

Another benefit of 3D printing is speed.

“We have a customer who makes injection moulding tooling and we made some inserts for them,” says Finnin. “From the time they placed the order and gave us the final CAD file until they received the first insert was only three days. In that time they hadn’t even received the raw material for the rest of the tool. So the time to market can be substantially improved by using 3D printing.”

Despite these major benefits and a lot of media hype, Finnin points out that while 3D printing will transform the way some things are manufactured, and has the potential to open up whole new markets, conventional manufacturing methods are still likely to dominate – at least for the foreseeable future.

“What it will change is the way we design things. We can now design things with complex internal structures that haven’t been possible to manufacture before,” says Finnin.

Examples include one-piece rocket motors – highly complex engines traditionally made up of many parts.

> “It’s really quite remarkable what can be achieved with additive manufacturing technology in terms of performance and new design,” he adds.

Printing technology for the future

The technology is still relatively new, and while there’s a growing number of businesses establishing themselves in additive manufacturing, many lack the knowledge required. Finnin says that even the companies that make the 3D printing machines aren’t experts on how to use them.

“We work with selective laser melting or powder-bed processes but also use direct laser deposition type processes as well,” says Finnin. “Those technologies are tricky. You can’t just buy a machine off the shelf, use the parameters that the machine supplier has given you and expect to go into production. It won’t work.”

Instead, the engineers and scientists at Amaero and MCAM apply their expertise to figuring out the most effective way to operate the machines, so they can 3D-print a range of often complex and intricate components.
When the Concept Laser XLine 1000 machine arrived at MCAM, the team had to work extensively just to get it up and running.

“[They] said the only thing that was working on the XLine 1000 when it arrived was the interior light,” says Finnin.

World’s largest metal melting machine

Amaero uses five different machines for 3D printing. When MCAM and Amaero acquired the XLine 2000R earlier this year – currently the world’s largest metal melting machine with a build volume of 800 x 400 x 500 mm and costing over $3 million, it was one of only five in the world. Another five have since been acquired by GE Additive.

“The machines are so complex, [GE Additive] has employed a team of 400 engineers to get them to work reliably,” says Finnin. “It is challenging.”

With only one other manufacturer using the technology in Australia, there aren’t many local experts.

“We’ve gone out to hire experienced additive manufacturing engineers: they don’t exist,” says Finnin. “They certainly don’t exist in Australia.”

So Amaero is fixing that too. The company offers paid internships, often taking on inexperienced engineers and training them to become world-leading experts.

Ground-breaking Australian innovation

3D printing has faced a number of concerns about the lack structural integrity in the production process, but in 2015 Amaero and MCAM proved this wrong. This was demonstrated when they produced the world’s first jet engine – a feat previously thought impossible.

The project was commissioned by Safran Power Units, part of the French multinational aircraft engineering company Safran Electrical & Power, as a result of its relationship with MCAM.

Working in collaboration, engineers from Amaero and MCAM were able to 3D print the entire engine except the shaft that runs down the middle. The components of the engine subsequently passed all the required tests.

> It was a breakthrough that is expected to lead to lighter, stronger, cheaper and more fuel-efficient jets. It has also led to a partnership between Amaero and Safran.

In 2016, Amaero established a satellite manufacturing facility at Safran's secure defence manufacturing site in Toulouse, France.

The stakes are high

Using two selective laser melting machines onsite at the Safran Power Units factory, a team of engineers from Amaero will work with Safran's design team to make components for auxiliary power units and turbojet engines for French Defence and Commercial Aerospace applications. The stakes are high: weight reduction, the shortening of long production cycles and design innovation.

The team back in Australia will also support the activities in Toulouse. And Amaero's global expansion won't stop in France.

"Our global business model is basically to continue to have our engineering development team and small manufacturing hub here in Melbourne, and we'll have satellite manufacturing facilities such as the one in Toulouse," says Finnin. "We expect by the end of 2018 to have one in North America and possibly China the year after that."

The world is only just starting to see the potential of 3D printing in manufacturing, and with big changes ahead, Australian innovator Amaero Engineering will be leading the way.
