

“  
The solution also offers customers more flexibility. If a customer wants to make 50,000 small components, we will give them a machine based on the size of their components”

### Raplas' 3D printing innovation enables sand casting industry to make components quicker, cheaper and more efficiently

A manufacturer of 3D printing technologies has produced a new automated solution to enable the sand casting industry to rapidly produce more complex components cheaper, quicker and more efficiently.

Raplas, headquartered in London with a manufacturing facility in South Wales, partnered with FMS, a foundry machinery expert based in Walsall, and Northumbria University, to develop a new solution for rapid sand casting production, funded by the Made Smarter Innovation programme.

Chris Needham, Innovation Lead, Made Smarter Innovation at Innovate UK, said: "Introducing new technologies to industry can be extremely challenging and cost and potential disruption to the production process can be prohibitive to adopt current technologies."

"The collaboration between Raplas, FMS and Northumbria University is a shining example of bringing together vision and expertise to create a solution which enables foundries of all sizes to competitively produce cast components."

Dr Megan Ronayne, Head of Industrial Technologies and Manufacturing at KTN, said: "Bringing communities together to drive positive change and transform UK manufacturing is exactly what we are looking to achieve with the Made Smarter Innovation programme."

"This project is a great example of digital manufacturing innovation activity taking place across the UK."

#### The Inspiration

Sand casting, an ancient metal casting process which uses sand as the mould material, has been used by the manufacturing industry, particularly automotive and aerospace sectors, to produce components for decades.

The traditional processes are inefficient, using a lot of energy and producing a lot of waste. Creating the tooling to produce the moulds is also time-consuming, and components still need considerable manual intervention and post-processing from CNC machines.

3D printing has emerged as a solution to improve the process, allowing more complex and higher quality components to be manufactured quicker.

However, the price and size of systems currently in the marketplace deter the majority of Europe's 4,500 foundries, which includes 700 in the UK, from adopting the technology.

Dr Richard Wooldridge CEO and Nigel Dowsett Special Projects Manager said: "Very few foundries across the UK and Europe are using additive manufacturing because current systems are large, expensive and are difficult to integrate into production lines. These systems also used expensive and unreliable printheads, which cause considerable downtime while they are replaced, and use

environmentally-harmful binders in the process.

"As experts in SLA machines we saw the opportunity to develop low-cost, automated, rapid manufacturing capability which speeds up cycle times, remains cost competitive for production volumes and enables the ability to tackle previously unachievable geometries.

"There is clearly a need for innovation in the casting industry to remain competitive and become more efficient and sustainable."

#### The Innovation

Raplas joined forces with Northumbria University, led by Associate Professor Dr Philip Hackney, an expert in additive manufacturing, and FMS, and the consortium explored a variety of system elements including printheads, print fireboards, software, the sand delivery system and post printing processes.

The university also researched binder ingredients, which ensured the sand granules adhered together while the mould is formed, and tested permeability and strength of the sand moulds to ensure they could withstand the 900 degree molten metal which is used to create the casting.

Meanwhile, FMS was able to share its detailed knowledge of existing foundry infrastructure to develop the solution so it could integrate easily and minimise the disruption to the current build chain.

The outcome was the creation of a smaller, modular 3D printing system which can be manufactured bespoke to customer requirements and easily



integrated into existing foundries.

The system can be fully automated or manually operated to suit all sizes of foundry.

It uses off-the-shelf printheads, which are cheaper and easier to replace, with currently a furane binder, with the aim to introduce a phenolic binder which is more environmentally friendly than what is currently used.

Meanwhile, the re-coater system, which deposits a fine layer of sand across the build platform before the printhead function, manipulated existing technology used to make agricultural seeds and powders.

It also uses an Integra operating system, a software used on Raplas's current resin SLA systems, to give high reliability and on-line maintenance access to reduce machine downtime.

#### The Impact

The result is a new, more affordable solution which can be made bespoke to a customer, with lower running costs because the machine

is smaller and uses less energy and uses cheaper print heads which are more available and easily replaced.

Nigel Dowsett said: "The additive manufacturing of sand moulding means you can move away from the restrictions that traditional processes give you.

"3D printing enables designers to make innovative, cost-saving designs with a free flowing geometry and no restrictions. This reduces material costs because you can make structures more efficiently and do away with that traditional tooling cost and all the heavy post-production machining.

"Our solution speeds up build by 50%, compared to traditional processes.

"The solution also offers customers more flexibility. If a customer wants to make 50,000 small components, we will give them a machine based on the size of their components."

"This project has provided a step change innovative solution to the foundry industry that will enable cost effective use of 3D sand printing."