

“With climate change at the forefront of everyone’s minds, it is now more important than ever to introduce major positive disruptions to the industry in order to encourage substantial changes for the future.”

## Platinum Electrical Engineering and Northumbria University’s innovation builds homes quicker, cheaper and more sustainably.

An engineering firm and university has pioneered the UK’s first structural concrete 3D printer, unlocking the potential for a system capable of building homes significantly quicker, cheaper, and more sustainably.

Through the Knowledge Transfer Partnership (KTP) programme, Platinum Electrical Engineering, experts in industrial automation solutions, based in Gateshead, collaborated with Northumbria University and KTP Associate Laurence Foster on the two year Building Additive Manufacture (BAM) project aimed at tackling issues within the construction industry contributing to the UK’s chronic housing deficit.

John Clayton, Knowledge Transfer Adviser who supported the KTP, said: “This was an extremely challenging and complex project. The impressive results, demonstrated by its ‘outstanding’ grade by Innovate UK, were achieved through excellent collaboration among the company, university and KTP Associate.

“This collaboration is an excellent illustration of the sustainable innovation and multitude of positive economic, societal and environmental benefits that can be achieved through the KTP programme.”

### THE INSPIRATION

Having successfully developed a pioneering automated resurfacing system for the military’s aircraft carrier fleet, Platinum embarked upon a mission to apply similar technology to the construction industry.

Stephen Maltby, Managing Director of Platinum, said: “The UK construction industry is a significant part of the UK economy and employer, but it faces many challenges. It is slow to innovate,

suffers low productivity, building only half of the 340,000 new homes, including 140,000 social housing, needed each year, and it has an aging workforce and skills shortage. On top of this, is the increasing pressure to address the ever-increasing demand for CO2 reductions. If the construction industry were a country, it would be the third biggest contributor toward global warming.

“The government’s Modern Methods of Construction’ (MMC) framework has started to increase adoption to more sustainable forms of construction, however until there is a much stronger drive, as seen in other countries, UK construction companies remain slow to engage in BAM technologies.”

Platinum successfully applied for support from Innovate UK’s KTP programme to develop sustainable materials and the machinery to enable the on-site, in-situ additive manufacture of structural materials for the construction industry, initially intended for the social housing sector.

Stephen added: “Our aim was to create a system capable of the in-situ manufacture of two-storey structures and eventually a row of terraced houses. With labour at a premium in terms of both cost and availability, the construction industry is losing domain expertise at a rapid pace. The strength of automation to run 24/7 with little or no supervision using cutting edge technologies can truly change the way we think about housing construction.”

### THE INNOVATION

The key outcome of the project was a prototype 3D printer, capable of ‘printing’ structural elements of a building - such as internal and external load-bearing walls - by autonomously depositing concrete layer by layer from the ground upwards, without formwork.

The system uses CNC deposition of the materials to optimise quality and accuracy.

It is also capable of integrating with supply chain processes which could accurately predict and automate materials usage and delivery. And it has been designed with 4G/5G cellular connectivity to enable remote file transfer, operation and monitoring from anywhere in the world, via a secure Internet of Things gateway.

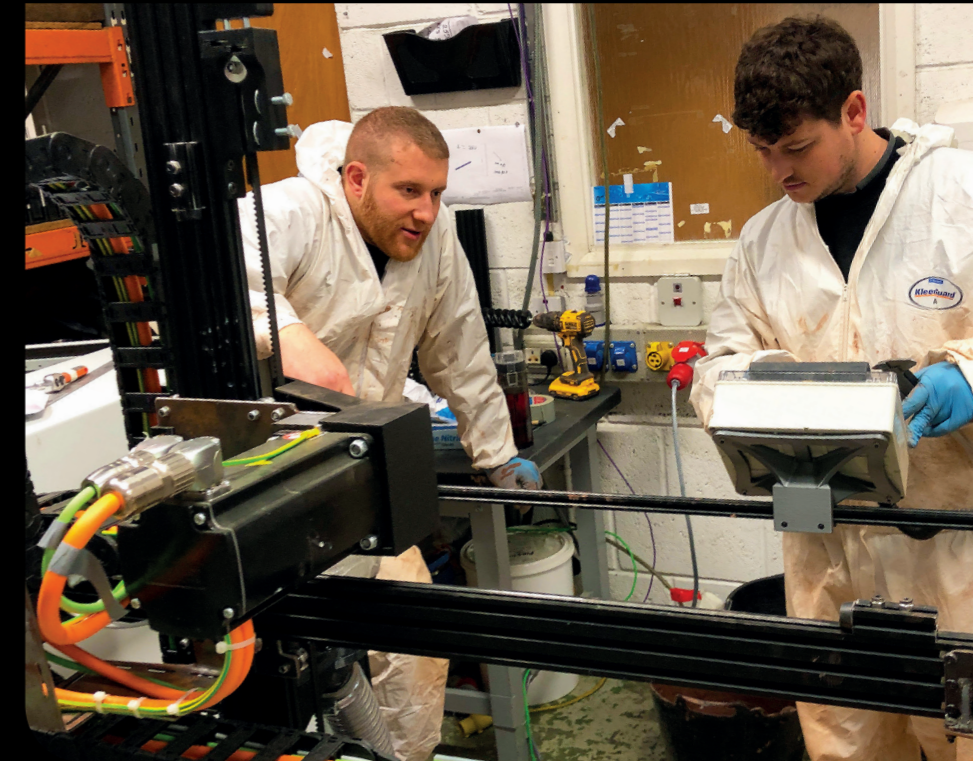
The other key area of innovation was that the project focused on alternative concrete mixtures as a means of reducing carbon content. These included using additive waste materials from steel and coal industries with concrete and using terracotta clay as an eco-friendly alternative.

### THE IMPACT

BAM has demonstrated the system’s capability to reduce build cost and time, as well as making a significant contribution to net-zero by streamlining the supply chain, reducing construction materials transportation and waste to near net-zero.

The platform is theoretically capable of reducing the 6-9 month completion time of a traditionally constructed 3-4 bed house by 90%.

The automation provides scope to reduce labour costs, which typically account for around 50% of a construction project, by 60%.



The precision and flexibility of 3D printing results in near-zero waste, while enabling a broader variety of geometries to be printed without affecting cost or complexity.

The refined concrete mixture design developed for BAM aims to reduce associated CO2 by over 30%.

Crucially, the partnership between Platinum and Northumbria University continues to develop. They are in talks with councils, housing providers, and architectural organisations to explore projects using the BAM technologies, while also developing a large-scale platform, the In-situ Building Advanced Construction (IBAC), to enable a 3-4 bed house to be printed within 24 hours.

Associate Professor Phil Hackney, from Northumbria University, an expert in Rapid Manufacturing, said: “This KTP Partnership has developed a new research branch and long-term partner for Northumbria University academics, enabling applied lab-based research to be industrialised in a commercial environment.”

Laurence Foster, who has now secured a job as Lead R&D Engineer at Platinum, said: “BAM has proved that through partnership we can develop new advanced automated manufacturing technologies to provide new and alternative ways for structures to be built with safer practices and significantly reduced costs, emissions, wastage and timescales compared to existing industry norms.

“Our innovation can combat so many of the construction industry’s problems, in terms of productivity and the skills shortage by reducing labour requirements and shifting skills toward digital model handling and conversion, as well as systems and process monitoring and management.

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