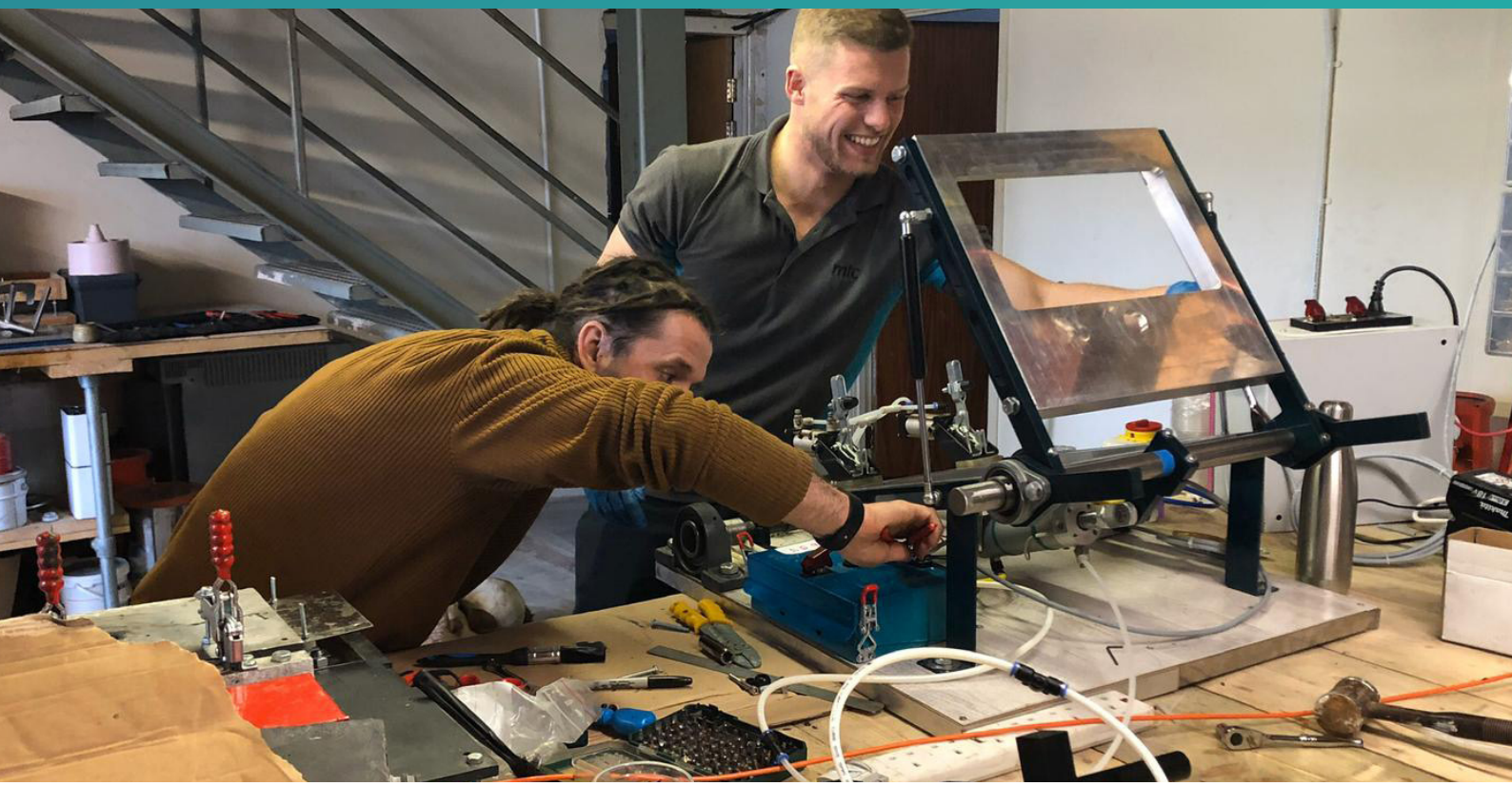
Market Sector:
CONSTRUCTION

Technology Theme:
PRODUCT MANUFACTURING INCUBATOR (PMI)

CARAPACE SLATE

Manufacturing process design to introduce automation to production of snap-fit roof tiles



THE CHALLENGE

Carapace Slate approached the MTC to support the development of a manufacturing process to produce snap-fit roof tiles. Having seen the MTC's Factory in a Box concept, the team at Carapace Slate wanted to explore viable automated solutions to improve productivity, speed of manufacture, and quality of output.

> Working with Carapace Slate to materialise their ideas has been an exciting journey to say the least. Helping SME's to develop and grow is at the heart of what we do in the MTC's Product Manufacturing Incubator, and this project has been testament to such a great collaboration.
>
> **Will Hankins**
> **Research Engineer – Design & Build Machines, the MTC**

Carapace Slate uses waste slate material to manufacture composite snap-fit roof tiles. Its unique system, where tiles self-align and interlock without nails or screws, has been designed to significantly improve speed of installation, subsequently reducing resource levels, as well as production and labour costs.

Initially each roof tile was being made by hand, so Carapace Slate wanted to introduce automation to the manufacturing process to significantly improve productivity and reduce the need for manual intervention, whilst still retaining the key components of the tile design.

MTC'S SOLUTION

At the start of the project, the PMI and Design and Build teams at the MTC, in partnership with Innovate UK, spent time onsite at Carapace Slate to understand the processes and potential challenges with implementing an automated manufacturing process.

Upon understanding the technical specifications, the MTC created concepts specifically addressing the key areas of development with regards to both the machinery and the process, including:

- Tile transportation and storage
- Mould tool actuation
- Process timings
- Size and weight constraints

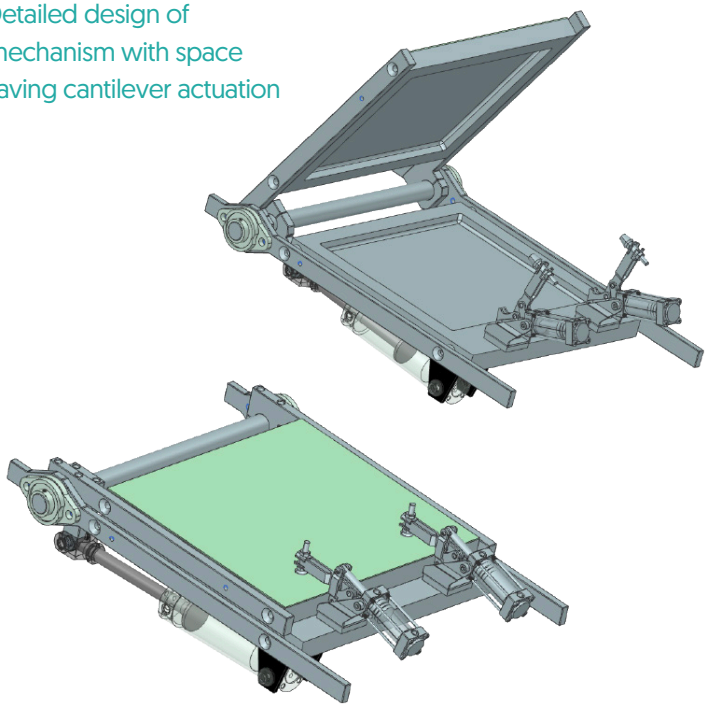
The first key milestone was the design of a mould tool module concept and production of a prototype.

The next phase of the project modelled the impact and feasibility of a different number of mould tool units and end effector variants to meet production targets, and potential solutions to automate the clip insertion process.

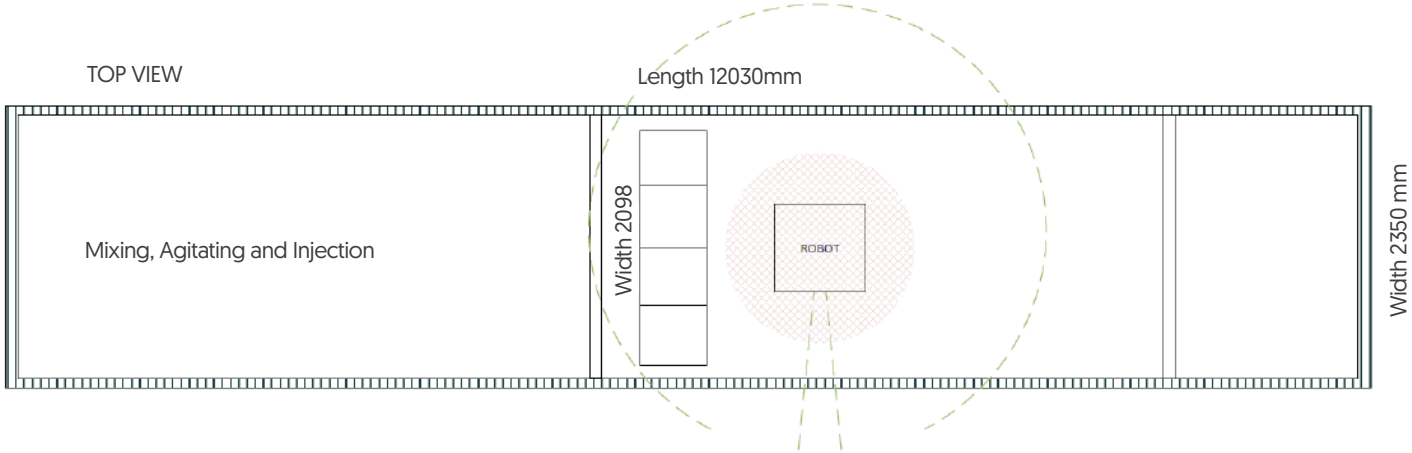
A CAD model animation was created to simulate robot movement and to help determine the position and height of the robot.

The tile design was reviewed throughout the project phases and the mould tool design updated accordingly. A controls system architecture was also scoped out.

Detailed design of mechanism with space saving cantilever actuation



Initial mould tool module concepts



Early stages investigating the positioning of the mould tool modules and robot

THE OUTCOME & BENEFITS TO THE CLIENT

One of the primary features of the final mould tool design is modularity - this was a requirement outlined early in the concept phase.

In delivering against this, the final design achieves the following benefits:

- Improved scalability and cost efficiency
- Easily interchangeable tooling (approx. 10 minutes), therefore reducing machinery downtime
- Simple hinge mechanism means limited requirement for moving parts and therefore cheaper to manufacture and maintain
- Lightweight and compact footprint

> We've loved every minute of working with the MTC. The unique dynamic of multi-skilled technical-led governance from the MTC alongside the commercially focused, agile approach of a start-up, resulted in a highly productive and enjoyable partnership. It's a fantastic example of how cross industry collaboration between an HVM catapult and micro-SME can achieve technological ambition and growth whilst remaining inherently commercially driven.
>
> **Amy Sheldrake**
> **Founder & Director, Carapace Slate**

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