

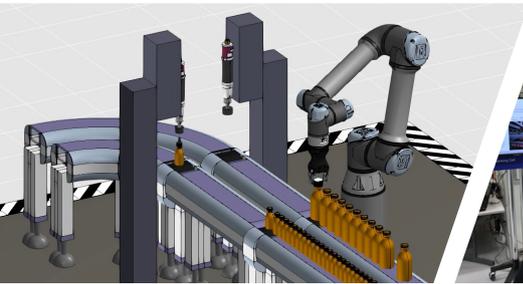


The  
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**AMRC**  
Advanced Manufacturing  
Research Centre

# Small firms, big ambitions

SME case studies



[amrc.co.uk](http://amrc.co.uk)





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**The University of Sheffield Advanced Manufacturing Research Centre (AMRC) is a network of world-leading research and innovations centres, based at the Advanced Manufacturing Park in South Yorkshire.**

We transform industrial and economic performance by making step changes in productivity, increasing competitiveness, developing new products and processes, and training new talent and skills. Our 125-plus industrial members range from global giants like Boeing, Rolls-Royce, BAE Systems and Airbus to smaller companies and specialist suppliers.



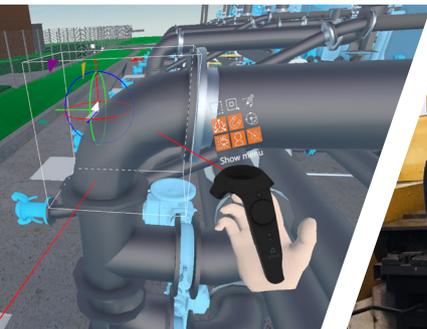
# Helping SMEs innovate and grow

**Small and medium enterprises (SMEs) are the backbone of UK manufacturing and key to the success of the sector.**

The very first partner at the AMRC was a family-owned Sheffield business. That's why we're committed to working with smaller companies, giving them access to the full suite of advanced facilities, capabilities, experience and expertise the AMRC has to offer to stimulate innovation and growth and strengthen performance and productivity.

Our projects are custom-fit and specifically tailored to each SME; so whether it's reducing the risk of adopting new technologies, prototyping and testing, or improving design and manufacturing processes to take new products to market – we can help.

These are some of the small firms we have worked with to achieve their big ambitions.



## Company:

## Stuart Mitchell Knives

**Sector:** Artisan knife maker

**Employees:** One

## What we did:

- Used Additive Manufacturing to explore new business models and opportunities



## About the project:

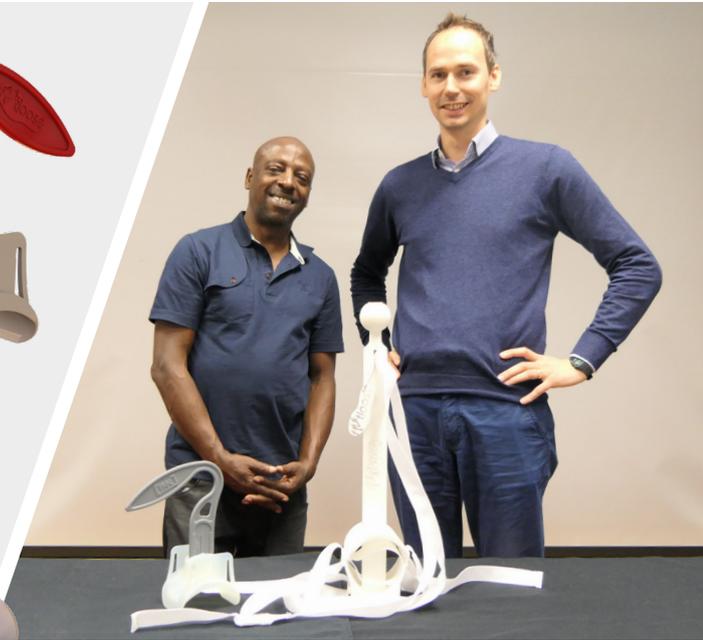
Stuart Mitchell has been making knives for more than three decades, cutting his teeth in the trade as a ten-year-old at his father's knee. His bespoke blades are made using many of the same tools his dad used before him in the same red-brick workshop his family took on in 1980. Despite his feet being firmly rooted in tradition as a craft maker, Stuart's curiosity about additive manufacturing made him want to find out whether the advanced 3D printing technology could be combined with his top quality knife making skills to create something truly beautiful and unique. The project to create an additively manufactured titanium chef's knife allowed Stuart to compare and contrast the end product with his own handcrafted knives to understand the potential of AM for his business.

“ This is design led disruption in the truest sense of the word; a craft maker applying advanced manufacturing technologies and exploring how this could change their business model now and in the future. ”

Dr Andy Bell,  
AMRC Design and  
Prototyping Group.

**Company:****Infinite Kreationz Ltd****Sector:** Graphic Design**Employees:** One**What we did:**

- Proof of concept model for injection moulded luxury sports shoe carrier
- Initial design review
- Reduced componentry
- Manufacture ready design
- Simplified geometry

**About the project:**

We worked with Infinite Kreationz to develop a proof-of-concept model for a luxury sports shoe carrier for injection moulding manufacture by identifying design changes to make it manufacture-ready. One of the main barriers for start-up companies launching a plastic moulding product is initial investment in tooling. We were able to review the initial design, reducing the number of components and simplifying their geometry without compromising the functionality of the product, creating a carrier made up of just three parts rather than the six in the proof-of-concept model. This meant just two injection mould tools would be needed for manufacture as two of the three parts shared the same geometry.

“ The advice provided during the one-to-one meetings was invaluable and the technical CAD services were of the highest quality and second-to-none in professionalism and expertise. I would highly recommend the AMRC to anyone requiring advanced manufacturing research of design services as they exceeded expectations and provided the high quality services needed to develop, produce, and market new products successfully. ”

Dee Warburton,  
Infinite Kreationz Ltd.

## Company:

## Trilogi Fashion Ltd

**Sector:** Fashion/retail

**Employees:** One

## What we did:

- Provided CAD modelling and manufacture ready design
- Created 3D printed semi-prototypes



Image: Rotherham Advertiser

## About the project:

Founder Sarah Chappell came to the AMRC armed with an idea and a sketch for a new type of clutch bag featuring customisable covers that can be changed to match an outfit. For Sarah, the biggest barrier was her lack of knowledge of CAD and metal manufacturing processes to take her product to a manufacturer for feasibility completion. She wanted a way of making it relatively simply but also scalable for production so we worked with her to refine the bag's frame concept and came up with the best manufacturing processes to help turn her dream into a reality. We developed three concepts to semi-prototype stage and she was able to take these away with her and piece it together.

“ I can honestly say what I saw far exceeded my expectations. I expected to see a CAD model of what my bag would look like and some information on the type of manufacturing process I would need to source, but what I got was a selection of 3D-printed prototypes of my product to actually test, see and feel. This was my dream becoming a reality and a huge stride forward for my business. ”

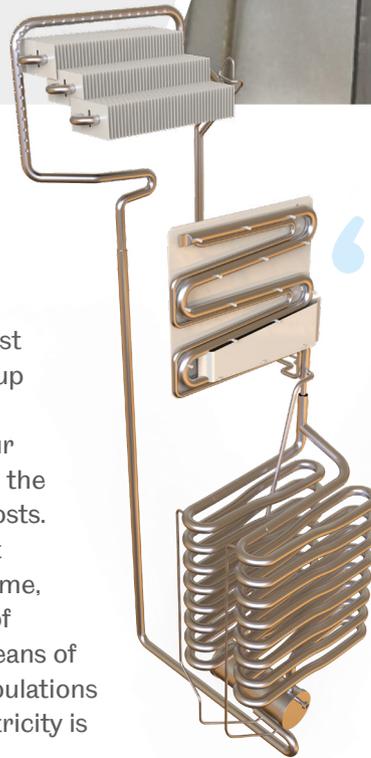
Sarah Chappell,  
Trilogi Fashion Ltd.

**Company:****Solar-Polar****Sector:** Renewable energy start-up**Employees:** Five**What we did:**

- Reviewed selected components
- Reduced component requirements to cut manufacturing costs
- Developed system for cost-effective manufacture at volume

**About the project:**

Solar-Polar has invented an electricity-free refrigeration technology that could be used to preserve life-saving vaccines and vital food in some of the hottest and most remote places on earth. But the small start-up company needed help to simplify its design to make it cheaper to mass manufacture. Our engineers reviewed selected components in the cooler assembly to reduce manufacturing costs. By developing the system to a stage where it can be cost-effectively manufactured in volume, its potential can be realised for the benefit of communities unable to access affordable means of cooling, particularly in the growing rural populations of sub-Saharan Africa, where access to electricity is only available to a small minority.



“The AMRC is a breath of fresh air when it comes to assistance for small start-ups. The engineers we dealt with were extremely quick to understand what we needed and their work was world-class. As a start-up on our way to a high volume product we were keen to deal with an organisation who not only knew manufacturing intimately but were able to rapidly grasp what we needed and deliver answers quickly and effectively.”

Michael Reid,  
Solar-Polar.



## Company:

## New Motion Labs

**Sector:** Automotive, transportation

**Employees:** < 10

### What we did:

- CAD design to create laser cut prototypes
- Produced 100 parts from each link plate geometry
- Enabled company to show product to potential investors



### About the project:

The company is aiming to disrupt the mechanical power transmission market with its redesign of the roller chain – producing one that promises to be more durable, lightweight and low maintenance. The company wanted to put its design theory to the test but to do this would have meant having to pay for expensive tooling to create a physical prototype. AMRC engineers responded to the challenge, using our laser-cutting capabilities to manufacture two sizes of link plates using CAD designs provided by the company. We produced 100 parts from each link plate geometry, allowing New Motion Labs to assemble the link chain. This allowed them to show investors their technology and raise investment for more advanced prototyping and testing.

“ **This help enabled us to build a suitable prototype to test the technology, without which we wouldn't have been able to do, as we did not have the funding. It helped us move forwards really quickly. Other research centres don't have this kind of support for SMEs like the AMRC does. It allowed us to deliver our ambition.** ”

Marcel Fowler,  
New Motion Labs.

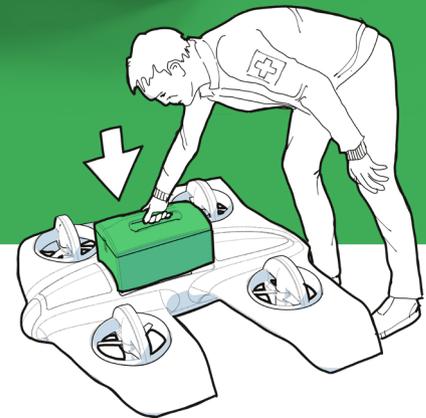
**Company:**  
**MEDeus**

**Sector:** Healthcare

**Employees:** Three

**What we did:**

- Provided CAD and early stage graphical design for drone
- Created storyboarding to enable company to pitch idea to potential investors
- Solved technical design issue to improve agility and flight efficiency of drone



**About the project:**

We created concept designs and storyboards for MEDeus, three medical students who won UK Space Agency funding to develop a drone and medical box system that delivers supplies to emergencies and remote areas. We provided CAD and early-stage graphical design assistance for the drone to produce a series of still images that could be collated in a 'storyboard' format to illustrate the drone's potential applications. We also solved a technical problem: they wanted a drone that can travel over long distances efficiently and economically and then be able to land easily in what could be close quarters with buildings or in difficult situations. To do this, our engineers came up with an innovative solution that incorporated the fans into the tandem wings.

**We approached the AMRC as it was evident they are the experts in design and prototyping. Having read about previous projects, we knew they had the capabilities we needed. Our experience of working with the team went far beyond our expectations, and everyone involved put in 110 per cent to help and guide us through the process.**

Thomas Franchi,  
MEDeus.

### Company:

## Anchor Magnets

**Sector:** Magnetic products manufacturer

**Employees:** < 60

### What we did:

- Built bespoke robotic arm demonstrator for process optimisation
- Carried out quick-fire validation testing of automation technologies
- Valuable insight into application of robotics



### About the project:

Anchor Magnets wanted to develop a process that allowed it to automate the pick and place process of C profile and other extrusions into the required packaging, which is done manually requiring an operator to perform the task. Anchor Magnets see significant benefit in automating the entire process to allow for magnet stacking during lights out, whilst reutilising the assigned operators to perform more dextrous/cognitive tasks. An entry level robot was used to help validate this process. A physical demonstrator was created at the AMRC's Factory 2050 to verify the robot and its capabilities for the specific stacking operation.

“ It is fantastic that AMRC's Factory 2050 were able to fund and test this technology on our behalf, creating real-life scenarios using our materials. De-risking this part of the feasibility study and having access to specialist skills and resources is an enormous help to SMEs like Anchor Magnets. ”

Warren Turner,  
Anchor Magnets.

## Company:

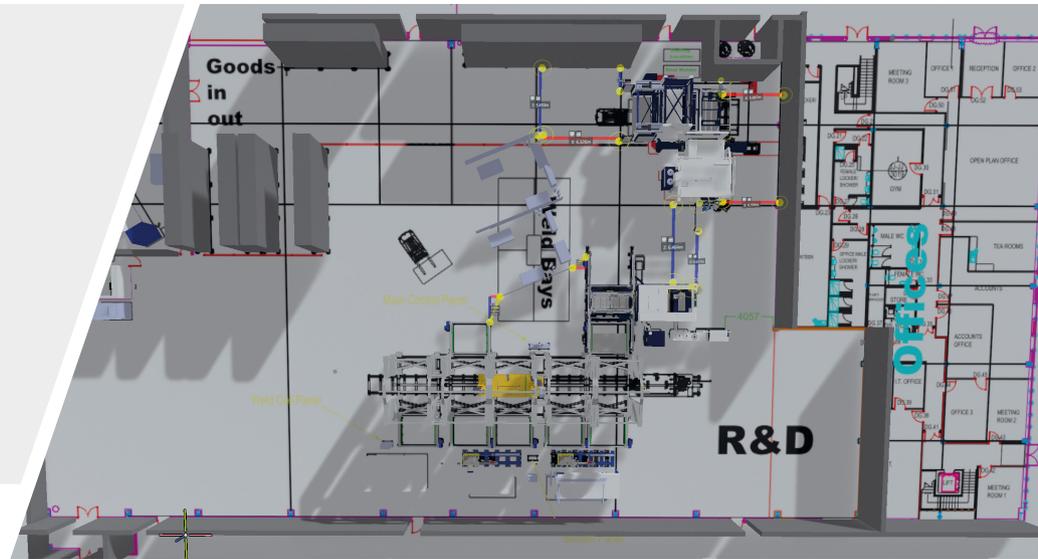
**ACS Stainless Steel**

**Sector:** Metal fabricator

**Employees:** < 100

## What we did:

- Used Virtual Reality to create carbon copy 3D model of new factory layout



## About the project:

With weeks to go before vital components were installed in their new factory building, ACS Stainless called on Virtual Reality (VR) research experts at the AMRC to build them a three-dimensional 'carbon copy' of the proposed layout for its staff to see what their new workplace would look like and provide feedback before installation. They wanted to be able to validate the layout of the equipment in a visual and contextual manner. As all of the items in the 3D layout were to scale, it meant staff could get a true feel for what the layout would look like and also meant they could make changes such as the position of equipment, avoiding having to do this post-installation which would have been costly. They were also able to include an important stairwell that hadn't originally been planned for and some alterations were able to be made to welding bays.

“ Working with the AMRC was very beneficial and gave me peace of mind as we had one opportunity to get things right. Due to the scale and complexity of some of the equipment, any requirement to reposition some of the machines would have resulted in significant delays to the project completion date, but also we would have incurred significant costs. ”

David Flannery,  
ACS Stainless Steel.

## ESTABLISHED BUSINESSES

### Company:

## Vitrition / Health Innovations

**Sector:** Pharmaceutical

**Employees:** < 30 / < 100

### What we did:

- Helped companies de-risk automation investment
- Improve efficiency of production facilities
- Created bespoke robotic demonstrator to test automation of bottle packing
- Developed process for automation of cap-screwing process



### About the project:

The two companies are part of Principle Healthcare Group, which manufactures and packages a range of nutritional supplements. Engineers visited both companies to determine how best to optimise their current manufacturing processes, which are heavily reliant on operators performing manual tasks. For Health Innovations, we developed and de-risked a process that automatically packages vitamin bottles into plastic trays. For Vitrition, we developed a process that allowed bottle caps to be automatically assembled on to liquid bottles. These processes were validated using a bespoke cell at the AMRC's Factory 2050 meaning Vitrition/Health Innovations did not spend money purchasing an incorrect piece of equipment.

“ Without the AMRC's work on this project we would have found it very difficult to test a theory and would have thus struggled to justify an investment into some process automation. ”

Jamie Shoosmith,  
Principle Healthcare Group.

**Company:****Clarks Vehicle Conversions****Sector:** Automotive**Employees:** < 200**What we did:**

- Optimised CAD models to improve process time and reduce complexity
- Transformed design stage using Virtual Reality to build virtual prototypes, slashing 'order to manufacture' time from six weeks to 30 minutes
- Developed digital process to convert curved surfaces into flat panels, replacing existing manual method using cardboard

**About the project:**

The family-run firm wanted to introduce Virtual Reality into the design process for converting vehicles, currently done by a skilled team building a physical prototype for the customer. We showed how VR technology can transform the design stage of a conversion by allowing the customer to wear a VR headset and 'build' a virtual prototype to their own specification, reducing turnaround time between an order placed and a vehicle leaving the shop floor. Existing CAD models were used to recreate an 'empty' van in the virtual world allowing the customer to pick items and place them in the van where they wanted them to go, creating a bill of materials in real time, and giving the customer full control over the design process which minimised the risk of changes being made down the line due to a wrong layout.

**CVC knew they wanted to utilise VR technology in regards to kitting out vans but didn't know how to go about it, what the technology is used for, what the benefits are or which is the best tech to use. We wanted to show them what we could do and what was achievable.**

Matt Bacon,  
AMRC SME project manager.

## Company:

## Tinsley Bridge

**Sector:** Automotive, Rail, Defence, Renewables and Recycling, Energy, Oil and Gas

**Employees:** < 230

## What we did:

- Retrofitted CNC machines with low-cost sensors to collect power consumption data
- Applied Artificial Intelligence and machine learning to the data and used AI algorithms to provide valuable manufacturing process insights



## About the project:

We worked with the company on an AI-led project to learn what machine use looks like on Tinsley Bridge's workshop floor. We retrofitted CNC machines with low-cost devices to collect power consumption data, and put this through an AI algorithm to provide new insights for the control and monitoring of manufacturing processes. The interrogation of machine utilisation rates gave the company better visibility of what was being manufactured and when, and the ability to assess if the business is scheduling effectively. The data allowed Tinsley Bridge to look at boosting productivity on the shop floor.

“ Rather than investing in significant cost and time for new digitally integrated smart machining centres, we were able to work with the AMRC to retrofit our existing capabilities to achieve the same results and enhance what data we were collecting by fitting a simple current clamp to our machines; an unobtrusive solution that caused no disruption or downtime. ”

Russell Crow,  
Tinsley Bridge.

**Company:****Footprint Tools****Sector:** Hand tool manufacturer**Employees:** Ten full-time equivalents**What we did:**

- Created virtual model of robotic manufacture of line pins
- Programmed a robot to carry out activity
- Designed and 3D print robot fixture to hold raw line pin
- Sourced capable second-hand robot

**About the project:**

Footprint Tools, a family business, is one of the most famous British brands for the manufacture of high quality hand tools. The line pin has been a staple of Footprint Tools for decades: a low value/high volume product that occupies two skilled operatives. But how to replace the subtle dexterity of hand movements performed by craftsmen? Using mathematical modelling, 3D printing and sophisticated programming, the AMRC was quickly able to prove a robot could match the quality and output of the skilled operative: 24 hours a day, seven days a week, if needed. This freed operatives to deal with backlogs elsewhere on the shop floor, while the robot picked up the raw pin, edged and polished it, before dropping it into the induction machine for hardening and quenching. With a limited budget for investment, the AMRC helped source a second-hand robot and identify a trusted integrator to establish the cell on the shop floor, supporting the integrator through any teething problems.

“ **The humble line pin is a complex thing to manufacture. To do it with a robot – well, we couldn’t have done it without the AMRC. Our aim was never to get rid of pairs of hands, quite the opposite, we need the workforce to perform higher value work and the robot has enabled us to do that. We wanted to improve the productivity of the company and we are already seeing these benefits. It has been a win-win all round.** ”

Christopher Jewitt,  
Footprint Tools.



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