



Additive
manufacturing

Sustainable
manufacturing

Advanced
polymer
products

Innovation

Nano
manufacturing

Collaboration

Industry
focus

Project Summary

June 2022

NW**CAM**

North West Centre for Advanced Manufacturing

Leckey



Company overview

Leckey, an SME based in Lisburn, specialises in the development of products that help children and adults with disabilities to participate in everyday activities. The company's teams of R&D specialists, designers, engineers and manufacturers create bespoke products that are sold internationally. Leckey's success has been achieved through relentless innovation; clinical focus; and working closely with parents, designers, therapists, experts and the broader clinical community to offer mobility solutions. In August 2020, Leckey was acquired by Sunrise Medical — a world leader in the development, design, manufacture and marketing of innovative, high-quality mobility products and services.

The project

- Development of a new additive manufacturing machine to enable use of engineering polymers and larger part build

Industry focus

Sitting concentrates approximately 50% of a person's body weight on to only 8% of their body's surface area¹. For a user of a seating system, this concentration of pressure increases the risk of developing pressure ulcers. Pressure-sensing mats are used to provide information regarding the user's levels of dis/comfort, and to establish the interactions between seating systems and their users.

Leckey identified a clinical need for the development of a more personalised, smart seating system for children which could be moulded to the shape of the individual using integrated embedded sensors. In order to provide vital dis/comfort information, the child's seating position, temperature, sweat and other measurements needed to be monitored. This required a smart seating

solution which could be integrated with a pressure-sensing mat. In order to facilitate timely intervention by a primary carer or clinical professional at the point of care, the solution needed to be able to issue notifications via a tablet or phone interface.

Research partnership

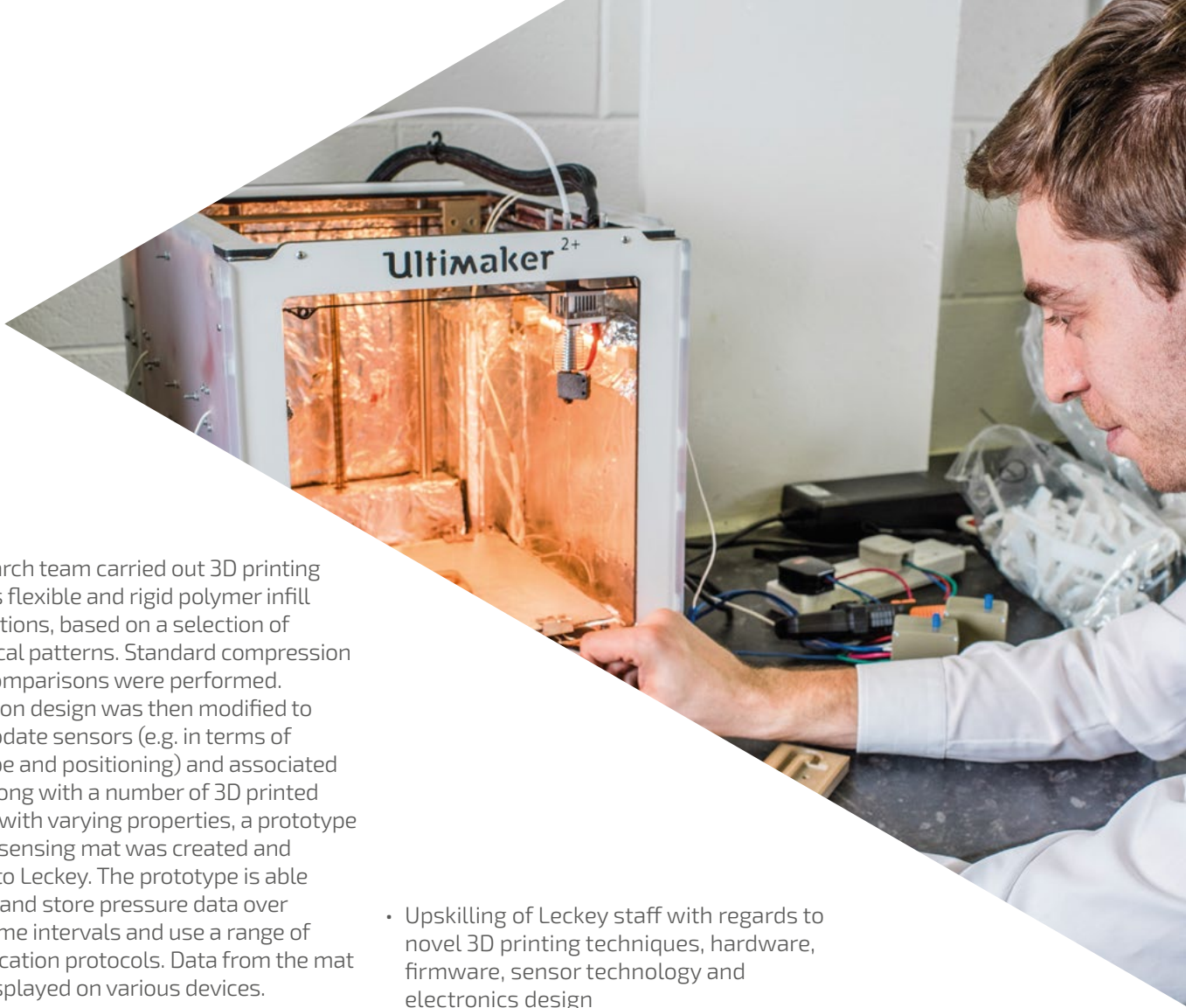
Leckey was partnered with Ulster University's Centre for Engineering and Renewable Energy (CERE) at Magee and Atlantic Technological University's (ATU) WiSAR Lab in the Faculty of Engineering and Technology at Letterkenny. The project research team included four co-investigators, one research assistant, and one PhD researcher.

Ulster University provided vital expertise in the areas of additive manufacturing and polymers, in particular materials investigations of different types of polymers that could be considered for potential seating solutions. ATU supplied expertise in pressure sensing with textiles and edge-to-cloud technologies which the partnership could embrace to develop a prototype pressure sensing mat.

Project outputs

The project provided Leckey with the necessary knowledge and skills to upgrade its manufacturing system by incorporating new technologies such as 3D printing and sensor technology. These technologies enable more precision and streamlining in the manufacturing process, resulting in a more customised pressure-relief cushion to ensure personalised comfort for the user. Integrating sensors into these cushions offers the opportunity for continuous data feedback, and customised pressure sensing and monitoring.

¹ Carrigan, W., Nuthi, P., Pande, C., Wijesundara, M.B.J., Chung, C.S., Grindle, G.G., Brown, J.D., Gebrosky, B. and Cooper, R.A. (2019) 'Design and operation verification of an automated pressure mapping and modulating seat cushion for pressure ulcer prevention', *Medical Engineering & Physics*, 69(July), pp. 17-27.



The research team carried out 3D printing of various flexible and rigid polymer infill configurations, based on a selection of geometrical patterns. Standard compression testing comparisons were performed. The cushion design was then modified to accommodate sensors (e.g. in terms of size, shape and positioning) and associated wiring. Along with a number of 3D printed cushions with varying properties, a prototype pressure sensing mat was created and supplied to Leckey. The prototype is able to record and store pressure data over various time intervals and use a range of communication protocols. Data from the mat can be displayed on various devices.

Next steps include clinical trials to gain product validation, and evolving the innovations into Leckey's product offering of bespoke aids created to meet individual needs.

Project benefits

- Access to academic R&D expertise and equipment
- Cross-border collaboration between Ulster University, ATU and other NWCAM partners to deepen the understanding of sensor technology, 3D printing and polymer materials
- Establishment of academic additive manufacturing expertise in the north-west region of Northern Ireland
- Increased competitiveness of the life and health sciences sector through innovation
- Industry-related skills development of academic researchers
- Knowledge dissemination to the wider life and health sciences sector through academic publications and conference presentations
- Technology transfer between Ulster University, ATU and Leckey

- Upskilling of Leckey staff with regards to novel 3D printing techniques, hardware, firmware, sensor technology and electronics design

Project legacy

Reflecting on the project, Colm Dobbs (Design Manager at Leckey) commented: "The NWCAM project has been transformational for Leckey. The project has contributed to the development of our skills and knowledge within the area of 3D printing. It has allowed the Leckey business to use 3D printing to produce bespoke customised products that deliver to the complex needs of the user. Collaborating with Ulster University and ATU on this project has enhanced Leckey's new product development capabilities and supported us in continuing to strive for new commercial opportunities."

Dr Jim Morrison, ATU, commented that: "Participating in this industry-focused project has further developed ATU's capabilities in edge-to-cloud technologies. The project enabled development of relationships with a range of academic and industry partners, and facilitated cross-border research collaborations which we hope to build on in the future."