TWI Innovation Centres: Project Showcase

TWI-university partnerships for collaborative research and development

TWI currently runs ten Innovation Centres for its university partners, each of which focuses on a particularly technology area, field of engineering and/or sector. TWI Innovation Centres undertake collaborative research and development (R&D) projects that are funded through successful proposals to EU programmes, such as Horizon Europe (HE) and its predecessor Horizon 2020 (H2020), and UK bodies, most notably Innovate UK (IUK).

The first TWI Innovation Centre was established in 2009 and the most recent one in 2023. Together, they deliver significant technological, industrial, societal, environmental and economic impact through their R&D and wider partnership initiatives. Below we look at a selection of our Innovation Centres through a range of their project examples.

Joining 4.0 Innovation Centre (J4IC)

- Partner: Lancaster University

METAMET: Digital framework for the design and additive manufacture of lattice metamaterial structures (IUK)

METAMET will identify a comprehensive, traceable way of optimising 3D printed parts using lattices; namely intricate, repeated patterns that can give additional material properties, such as directional cooling, reduced vibration and enhanced crack resistance, to parts. This could offer substantial benefits to industry in the manufacture of lightweight parts and structures. It also supports the wider environmental goals of reduced materials consumption and carbon emissions by enabling the production of lightweight parts using less energy.

TWI Innovation Network Subscriber company Holdson Limited is a project partner.

DIGIPIPEWELD: Digital platform for defect-free plastic pipes welding (IUK)

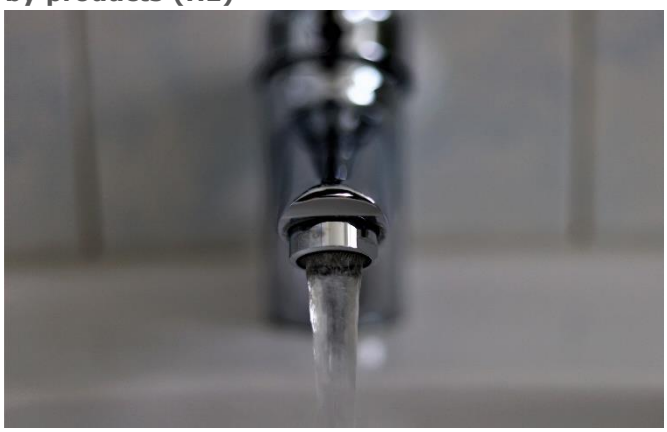
This project addresses the issue of premature failure in plastic pipelines during installation and/or in service. The autonomous DIGIPIPEWELD system will enable a joint to be welded while simultaneously testing the results against known parameters and avoiding possible failures, offering manufacture and self-test of pipe welds in a right-first-time package. It will use a controlled, digitally intelligent, Pinweld plastic pipe welding system, and incorporate machine-learning algorithms, advanced sensing and data processing.

TWI Innovation Network Subscriber company PinWeld Ltd is a project partner.

Materials Innovation Centre (MatIC)

- Partner: University of Leicester

H2OforAll: Innovative tools and technologies to protect and treat drinking water from disinfection by products (HE)



Water purification and disinfection are crucial in providing safe water to citizens, but when disinfectants interact with natural organic materials in water, this results in disinfection by-products (DBPs) which, if consumed, can have serious effects on the liver and

nervous system, and cause environmental damage. H2OforAll is addressing this by developing DBP sensor monitoring devices, modelling the spread and fate of these contaminants through drinking water systems, establishing innovative water treatment methods to remove DBPs or prevent their formation during water disinfection and more.

Sol-Rec2: Innovative strategies for multi-layer materials recycling (H2020)

Sol-Rec2 seeks to reduce pharmaceutical packaging waste, which is a significant source of pollution, by developing and implementing innovative strategies to improve the sorting, separation, and recycling of pharma blister packs and laminated consumer packaging waste. The project is also developing pioneering digital watermark technologies, fast and effective sorting of multi-layer packaging, and a toolbox of advanced green solvent systems to delaminate multi-layer packaging material and selectively dissolve targeted polymers. Subsequently, the recycling process established within Sol-Rec2 will be scaled up for pilot stage.

Brunel Composites Centre (BCC)

- Partner: Brunel University London

EMPHASIZING: Enhancing material properties of recycled glass fibres through sizing (IUK)

This project targets the wind energy-to-automotive sectors to address the challenge of recycling composite structures currently consigned to landfill or incineration. The methodology behind EMPHASIZING introduces 'pressolysis', a novel recovery method and technical step change from state-of-the-art processes such as pyrolysis and solvolysis, to enable commercial innovation through high-yield reclamation of top-quality, clean, free from residue, reusable fibres, with retained length and properties almost akin to virgin materials.

TWI Industrial Member company Gestamp, in the UK, is a project partner.

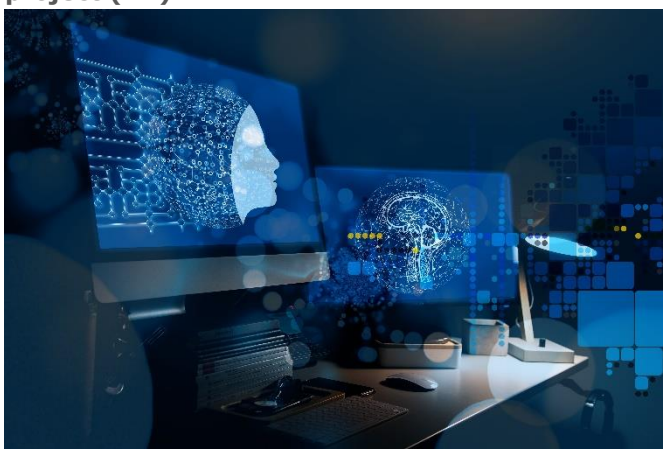
CoPropel: Next-generation marine vessel propellers

CoPropel puts forward a holistic approach for the shipping industry by introducing a composite marine propeller that offers corrosion resistance, light weight tailoring of material properties, low electric signature and acoustic properties. The project consortium seeks to contribute to the optimisation of propulsion systems by developing, and maturing, technologies for the realisation of marine propellers made of advanced composite materials. Compared to current counterparts, the new propeller will also be quieter, stronger and more reliable, and have flexible deformation capability and lower energy consumption.

Anglia Ruskin Innovation Centre (ARIC)

- Partner: University of East Anglia

Up-Skill: Up-skilling for Industry 5.0 Roll-out project (HE)



Up-Skill will develop a better understanding of how businesses in industrial and manufacturing environments can leverage value from human-machine integration. Companies are already exploring the benefits of applying technologies like real time data processing, the Internet of Things, automation and artificial intelligence, and the next step is to integrate

these with human capabilities. Objectives of Up-Skill include identifying the skills that existing workers will need to survive in the emerging digitalised workspace, providing data for technological integration and decision making, and reducing costs in primary manufacturing. The Joining 4.0 Innovation Centre is also a partner in this project.

Brunel Innovation Centre (BIC)

- Partner: Brunel University London

SWAG: Soft, wearable, assistive garments for human empowerment (HE)

SWAG will create a smart, human-centric, lower-limb exosuit, designed to be worn by individuals who need occupational assistance or support with their daily activities and/or fitness. The technologies being developed for the SWAG solution address a number of limitations associated with current, wearable robotics. Soft design will be united with embedded sensing, distributed control, functional apparel, biomechanical modelling and materials science. Personalised, real-time motion assistance, and user-intent prediction algorithms based on data-driven models, will ensure accurate, adaptive support for a variety of movements.

Soni-Laser: Ultrasonic assisted laser welding for high volume assembly of automotive battery packs (IUK)

Soni-Laser introduces a power ultrasonic vibration treatment into the laser welding process for electric vehicle (EV) batteries, designed to improve the integrity and quality of welds, and accelerate the production process for EV battery packs. The result is non-invasive control and modification of the microstructure between battery joints during post-weld solidification, i.e., the transformation of the molten weld metal from liquid to solid state that occurs due to loss of heat from the weld pool.

TWI Industrial Member company Carrs Welding Technologies Limited is a project partner.

Healthcare Innovation Centre (HIC)

- Partner: Teesside University

SusFE: Innovative processes and methodologies for next generation, sustainable, flexible electronics (H2020)

SusFE will develop a new, roll-to-roll manufacturing platform for the production of next generation, wearable and diagnostic devices. The platform design incorporates a flexible, integrated circuit on polymer and textile substrates, ultra-low power, printed sensors/bio sensors, and wireless communication driven by an organic, recyclable, bio-enzymatic fuel cell. A number of case studies will be used to demonstrate the solution including a smart, wound monitoring patch, a paper hybrid blood-self sampling device, and a point-of-care diagnostics device for identifying biomarkers and monitoring cardio-metabolic rate.

HOLICARE: Trustworthy, equitable healthcare diagnostics and clinical support for respiratory tract infections (HE)

HOLICARE is tackling the challenge of diagnostics, treatment and prevention of respiratory tract infections (RTIs) in low and middle income countries (LMICs), based on a holistic approach to bringing innovative diagnostics solutions to the population, with the aim of bridging the gap between technological excellence, available infrastructure, capacity and local uptake of technologies. The project will include a healthcare pilot in Ethiopia, Uganda and Senegal. HOLICARE comprises four pillars: diagnostics co-designed with end users; resources and networks; technical training; and engagement and access.

Essex Innovation Centre (essex.ai)

- Partner: University of Essex

GRINNER: Improving waste management through an AI-powered detection system of batteries (HE) utilising data from x-ray detectors and pick-and-place robots

GRINNER's mission is to improve the management chain of Waste from Electrical and Electronic Equipment (WEEE). Batteries are the main focus of the project because discarding them, in recycling bins or rubbish bags, can lead to fire incidents when sorting equipment causes damage to them. GRINNER aspires to become the first autonomous, artificial intelligence (AI)-enabled robotic sorting system to offer a method for detecting and removing waste containing batteries from waste streams, and thus shield them from the machines that crush and consolidate waste.

QuiLT: Quantum element interposition by laser transfer (IUK)

The objective of QuILT is to replace the expensive quantum distributor (QD) growth process and associated, expensive site pre-patterning by realising the QD or quantum element placement. The project's solution will use laser-induced forward transfer of the selected semiconductor material, from a mechanically nano-positioned donor layer to the now simpler sites of a PIC or other photonic device, as it is being built on the silicon wafer substrate. The resulting technology will enable the customisation of a vast number of electro-photonic devices with added quantum emission capability.

Delivering impact

The technical expertise and knowledge of Innovation Centre personnel, in combination with their ability to generate novel concepts and turn them into collaborative proposals that are successful in securing grant funded, means that that they are able to deliver a rolling portfolio of R&D projects. These generate new systems, processes and products that help to address some of today's major challenges at the local, regional and global level including the drive for net zero, access to clean drinking water for all and the transition to smart manufacturing.

TWI Innovation Centre personnel are also highly active in disseminating the progress and outcomes of collaborative projects via the publication of technical papers, attendance at conferences and events to give talks, present posters and man exhibition stands, and running project workshops with their fellow consortium members. These activities allow TWI and its university partners to contribute to innovation in the wider engineering community.

Visit the TWI Innovation Network website to find out more about TWI Innovation Centres, their projects and publications.

To explore the potential for an Innovation Centre with TWI, please email to info@twi-innovation-network.com and we will reply to discuss.