NEW TECHNOLOGY CAPABILITY
CORE RESEARCH PROGRAMME
COMPLETED PROJECTS 2017
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The first Core Research Programme (CRP) was launched in July 2012. The CRP cycle is completed twice a year; April and October.

**The key aims of the programme are to:**

- Encourage collaboration between members and research partners
- Enable the MTC and members to examine manufacturing solutions, responding to both current problems and exploring future, innovative solutions
- Uplift MTC members’ cash contribution into the CRP projects via Catapult match funding and member in-kind contributions.

All members who opt into the CRP have the opportunity to define potential projects that will lead to future cost savings and increased productivity and efficiency.

The value of the CRP extends beyond responding to industry’s challenges and the benefits have an impact beyond the life of any single project. Members taking part will:

- Gain exposure to new ideas, technologies and innovations
- Collaborate with other members, sectors and MTC’s academic partners
- Access a wide range of expertise across the supply chain and across a range of industry sectors
- Benefit from shared project costs, resources and risks
- Benefit from access to intellectual property
- Generate publicity through case studies.

This brochure gives an overview of the CRP projects that were completed in 2017.

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**The role of the Core Research Programme**

Every year, since the MTC began operations, we have run a core research programme (CRP).

The aim of this programme is to create know-how at MRL3-4 that has the potential to impact on the competitiveness of our members.

Often, the issues they face are common across the sectors and by working together at this level, a huge leverage can be achieved both in terms of project funding and also in terms of learning across sectors.

In order to gain maximum benefit from projects at the MTC, collaborations and tight partnerships are essential between end users and equipment/technology suppliers. It is the MTC’s role to facilitate the building of these consortia and to manage through the research programme, the tensions that inevitably come from this mode of working.

The CRP is our major mechanism for creating these consortia and MRL4 capabilities, which in time, may lead to higher MRL work and business benefit to all of our members.

*Ken Young, Technology Director*
Delivering the Fourth Industrial Revolution

There is a monumental shift to re-establish the UK as a manufacturing powerhouse. The rise of organisations such as the Midlands Engine and Northern Powerhouse plus the government’s Industrial Strategy signify this push.

The UK – at all levels - is waking up to the need to embrace the Fourth Industrial Revolution and to be at the fulcrum of a more connected, digitalised world.

This has been taking shape over the past decade, but now there is a real urgency for businesses in all sectors to adopt new technologies and for innovation in future technologies to move forward at pace.

Lina Huertas, head of technology strategy for digital manufacturing at the MTC, sees this rapid change as delivering ‘transformative tools’ that will redefine manufacturing. These will cover four areas.

- **Intelligent technologies:** To extract more data, more insight and to generate not just predictions but provide guidance
- **Connectivity:** This is the Internet of Things. Everything is connected and will provide the ability to connect machines not just inside a factory but also in a supply chain, extending potential
- **Autonomy:** This is really going to start changing people’s jobs. It will be about trusting systems to then delegate decisions
- **New business models:** Technology is now more accessible and so manufacturing can increase its offering through new business models

The right noises are also coming from government. In his 2017 Budget statement, the Chancellor Phillip Hammond said: “For the first time in decades Britain is genuinely at the forefront of this technological revolution.”

The Industrial Strategy, unveiled in November 2017, is setting the agenda and providing the necessary investment to pave the way for the UK to remain on the front foot.

This followed the publication of Professor Juergen Maier’s Made Smarter review, highlighting key areas where investment, innovation and adoption is needed for the UK to be at the heart of industrial digitalisation.

Many of the large multi-national companies embedded in manufacturing are leading the way for this revolution, collaborating on research with the MTC, one of seven High Value Manufacturing Catapult centres across the UK.

The Catapults are the bridge between academia and industry and are leading the way in research and development of cutting edge technology that will bring widespread significant commercial benefit.

British industry needs to be innovative if it is to increase productivity and be competitive in an ever-changing global market.

At the MTC’s Digitalising Manufacturing Conference in October 2017, the message was simple: It is now time for the SMEs and the supply chains to get on the Fourth Industrial journey.

The conference’s conclusions were also clear - it will require collaboration, skills and the people to adopt and drive change.

Huertas drew her own conclusions from the conference on how the world will move forward.
“Digitalising Manufacturing 2017 was all about the role of talent in this Fourth Industrial Revolution – the talent revolution.”

Lina Huertas, Head of Technology Strategy for Digital Manufacturing

- We need to influence the education system to breed talent that is relevant in the future
- However, developing the future workforce is not enough, upskilling the current workforce into more valuable jobs is essential
- The role of talent will continue to evolve rapidly and with it, the importance of continuous development of talent within businesses
- This will include development of their current workforce but also targeting new talent from new and varied sources, such as professions outside engineering
- From the workers’ perspective, this will require becoming proactive about managing their own careers. They will need to be supported and empowered in this journey
- Finally, collaboration will be another area where people will be key, taking and offering advice, sharing best practices and building synergistic networks and ecosystems for execution

At the MTC, that trio of collaboration, skills and people to deliver the technological revolution required for Industry 4.0 already exists. The MTC’s CRP is central to this and the projects that are selected are all about pushing boundaries, new theories and advancements that will make an impact in business and life. Additive manufacturing, robotics, virtual reality, data, enhanced validation all feature on the technological developments in collaboration with MTC members, as together we drive forward digital manufacturing.
COMPLETED PROJECTS
A review of the CRP projects concluded in 2017
Integrated Information for Improved Quality (IIIQ)

Using design, manufacture and measurement – three elements in quality control, this CRP project looked at bringing all three elements into a single framework to improve component quality.

To achieve this, engineers drew on rules and models that capture the behaviour of quality in a production system from an operational perspective, to predict performance in varying scenarios and provide design feedback.

Project aims:

- To integrate design, manufacturing and measurement data to improve quality control and component quality
- To standardise and automate measurement planning throughout the supply chain

Project objectives:

- To build on the automation of measurement planning and knowledge capture achievements of ‘PLM Integrated Measurement Planning’ phases 1, 2 & 3
- To extract meaning from knowledge gained from measurement and manufacturing process parameters, and show how it can be automatically used to improve quality
- To develop a framework for an automatic method of feeding back information to manufacturing organisations utilising a range of data standards
- To test the knowledge capture framework via a collaborative experiment

Project impact:

A framework has been presented which proposes data capture and integration from design, production and inspection processes in order to improve product quality and control.

A number of use cases have been proposed for applying this framework for particular end goals.

Test cases have highlighted capabilities and gaps within:
- Data capture and manipulation
- Measurement planning
- Key process variable analysis
- Root cause analysis

A tool has been developed to interrogate QIF (Quality Information Framework) data to produce a human readable measurement plan. With development through Digital Measurement Planning (04/17 – 04/18) project, this could become a tool for further capitalisation.

The work has developed the MTC’s capability in the area of data driven quality that directly feeds into the new ‘Intelligent Process Control’ roadmap.

Further opportunities within Computer Aided Inspection and Quality (CAIQ) are being investigated.

Total cost of research: £164,900
The MTC deployed a condition monitoring system within its workshop, based upon which a cost-benefit analysis was conducted to justify investment in condition monitoring systems.

**Project aims:**

- To identify the key stakeholders that can deliver solutions to overcome machine health challenges in industry
- To understand what are the use cases in manufacturing, associated with condition monitoring and health check of equipment
- To provide guidance on the latest techniques and technologies for maximising the availability of critical assets
- To increase the awareness and understanding of the current state of condition monitoring and health assessment tools

**Project objectives:**

- Perform background research on the requirements and challenges associated with condition monitoring and current industrial state
- Generate a reference guide on condition monitoring and health check solutions
- Benchmark condition monitoring and health assessment tools and showcase them in the MTC workshop, analyse the benefits and perform a ROI study

**Project impact:**

The MTC carried out a survey among a number of industrial companies to identify their current maintenance practices and infrastructure, their main requirements and perceived challenges associated with the adoption of condition monitoring systems.

Relevant standards were reviewed in order to generate a reference framework to guide the planning, design, implementation and deployment of condition monitoring systems.

Working with ATS, a condition monitoring system was deployed at the MTC workshop using a modular, scalable approach, to demonstrate the integration of commercially available technologies in order to monitor the condition of pieces of equipment.

This produced monitoring data and a working timescale of when it would fail. The technology used enables the system to be fitted to a range of equipment across a workshop and to feedback to a central system, providing on-going analysis.

A cost-benefit analysis was also performed on the system, to provide a basis for industrial companies to determine if investment is plausible and if installation would provide return on investment.

Equipment Health Phase 2 to be scoped and proposed in 2019.

**Total cost of research:** £130,000
With the increasing prominence of additive manufacturing, this CRP project fused together three work packages with the outcome being greater control of the supply chain for end users and establishing a lower-cost entry point for adopters.

**Project aims:**

To assess the sensitivity of powder in additive manufacturing, through investigating the variability in powder characterisation sourced from different suppliers/manufacturing routes and the sensitivity in processing this powder for both electron beam melting (EBM) and selective laser melting (SLM).

**Project objectives:**

- Characterise the powders using varying sampling methods for selected batches and different test houses for these selected batches
- Manufacture a range of test geometry to assess sensitivity of the processes
- Assess equipment performance with each powder
- Identify powder screening methods to homogenise powder input
- Conclude feasibility of using alternative powder suppliers

**Project impact:**

Identification of ‘best methods’ for powder sampling and testing for metal powders for additive manufacturing, established via ‘round robin’ repeatable testing. This ensures consistency and confidence in the results. Tests were done for two types of powder. The findings also aid in the efforts for international standardisation of powder testing.

Research was also undertaken to assess the powder source and impact of powder from alternative supply chain sources for both the EBM and SLM processes of additive manufacturing powders. Through experimenting with combinations of the powders for EBM, a viable and cheaper alternative powder, delivering on density, metallurgy and mechanical properties was produced. For SLM, outcomes established that powder from alternative suppliers had no bearing on product quality.

These findings have increased robustness of the supply chain; highlighted key process variables (KPVs) for different powder production methods and characterisation of powder and has improved the business case for the adoption of additive manufacturing.

**Total cost of research:** £200,000
There is increasing interest in using X-ray CT as a tool in a production environment. CT is currently used as an ‘integrity’ assessment but there is interest in CT as a ‘dimensional’ measurement. This project examined the potential to conduct simultaneous tests as opposed to two individual measurements.

Project aims:
- To drive forward the search for a rate-scalable, affordable and appropriate inspection solution for net shape components
- To support the deployment in industry of advanced CT systems, building on recent technical advances and previous CRP projects

Project objectives:
- Assess approaches for making CT more rate-scalable and affordable
- Examine the scope for combined, simultaneous dimensional and integrity CT inspections
- Assess the value of system features and usage procedures designed for dimensional metrology using CT
- Examine the value of and hurdles to CT data retention and product lifecycle management (PLM) integration

Project impact:
This project has provided an interactive cost model to understanding the costs of inspection. This could have the potential to identify changes to reduce cost and cycle time.

An analysis of scope for elimination/reduction of a conventional dimensional metrology manufacturing step through a combined integrity and dimensional CT inspection. This is an indirect way of reducing costs and bottle neck issues of CT inspection.

An assessment of the scope for CT data to be compressed and integrated into product lifecycle management.

An experimental assessment of the capabilities of CT technology for dimensional measurement. This provides a starting point for deciding on suitability of CT as a measurement system for a given application.

Total cost of research: £90,000
Machine-to-Machine Interoperability

This was stage one of a CRP project to increase knowledge and understanding of ‘communication technologies’ between machines in real-time to enhance their future usability in manufacturing. The data from these sources would enable better and more efficient interoperability between robots and also robot-human interactions. This development is part of the widening ‘Internet of Things’ (IoT).

Project aims:
To optimise real-time production process efficiency by enabling symbiotic relations between machines through machine-to-machine (M2M) communication.

Project objectives:
- Identify requirements, technologies, standards and challenges for M2M communications (i.e. real-time requirements, legacy equipment, available technology, compatibility, security)
- Identify areas of interest to develop a template use case for M2M communications

Project impact:
Working with technology providers, an initial investigation to establish current M2M technologies and standards was conducted, along with a stakeholder survey on requirements for new M2M interoperability technologies.
Concept development of potential applications of M2M for flexible manufacturing was also undertaken.
During the course of the five-month project, a template was established and a use case developed ahead of stage two of the programme.
Initial research of this capability has been used in a test environment with the small component assembly cell. The test involved an inspection station and manual work station for the remanufacturing of tools.
Via the test case, the inspection can assess the tools and, via M2M connectivity, provide information about its status and what, if any, action needs to be taken.
This project has resulted in an increased knowledge on emerging M2M technologies amongst the stakeholders. The concept has been defined. Development of a wider implementation in a second phase of this project is planned.

Total cost of research: £56,450
Electronics Assembly Process Stress Reduction (EAPSR)

This CRP project was the first stage of a programme investigating failure mode effect analysis (FMEA) on printed circuit boards. This initial stage was a research and test case, with a view to further development and more practical capabilities in phase two.

Project aims:
- To undertake electronics manufacturing process analysis for effects on printed circuit board assembly reliability
- To investigate the origins of stresses and potential manufacturing defects on parts resulting from stresses occurring during the electronics assembly processes
- The project focus was on the interactions between the process areas, discrete steps, components and materials in order to predict how products could fail and the severity of the failure in relation to the stresses

Project objectives:
- Detailed cause and effect analysis of process steps and stresses
- Research and propose alternative concepts, practices and processes for mitigation of stresses
- Process trials to improve reliability
- Point the way to defect free/low stress electronics manufacturing processes for high reliability

Project impact:
A significant amount of time was spent working with MTC stakeholders, exploiting the knowledge base and, via investigation, prioritising areas of concern and quantifying via trials. Baseline measurements were established on strain measurements prior to screen printing trials to prove the concept of measuring stress during the assembly processes. A series of trials, with varying weight loads and pin supports, revealed strain can be recorded with high accuracy – the average strain varied by less than one per cent. Phase two will progress the work and explore de-risking production level technology and deployment of new process technologies.

Total cost of research: £82,875
The LASAM project delivered three location awareness demonstrators utilising radio frequency identification (RFID), ultra wideband frequency (UWB) and augmented reality (AR) technology solutions.

Project aims:
- To expand on the technical capability readiness levels for the location awareness demonstrators implemented as part of LASAM Phase 1
- Incorporate new concepts, proposals and future roadmap definitions to improve the technology readiness level from phase 1, taking into consideration lessons learned and inputs from members solution matrix

Project objectives:
- Integrating additional capability to concept solutions from phase 1 into the following three projects:
  - Manufacturing Operations Management for Electronics
  - Location Services for Smart Tools and Assets Tracking
  - Augmented Reality Assembly Environment
- Develop location awareness concept systems utilising RFID, UWB and AR technologies
- Undertake development of interfaces/protocols to enable systems integration
- Defining and proving capability for specific manufacturing problems
- Leveraging from supply chain capabilities for demonstration in a production representative environment against industry KPI
- Read across into other sectors and applications

Project impact:
- Manufacturing Operations Management for Electronics
  - Automated materials control
  - Real-time location visualisation of printed circuit board (PCB) and materials on the factory floor
  - Machine tool usage tracking
  - Process flow authoring and automated work order execution through MES and production equipment integration
  - Real-time equipment capability and data analysis
  - Universal service bus for MES, SCADA, track and trace system and surface mount technology (SMT) machine integration

- Location Services for Tools and Assets Tracking
  - Real time tool or asset location tracking and data
  - Automated changeover for tool programs based on location data
  - Virtual operator guidance for tightening operations
  - Poka-Yoke for human operated SMART tools and collection of location and operational data from products and tools for real-time feedback analysis
  - RFID portals for tools and assets tracking

- Augmented Reality for Assembly Environment
  - Basic augmented reality system concept to assist operators with PCB rework and manual assembly operations

Business Impact
- Unique test and demonstration environment
- Co-ordinated roadmap for practical implementation amongst the stakeholders
- Concept demonstration around system integration
- International networking raising awareness
- Visibility of members/partners capabilities

Total cost of research: £180,500
Voids in solder joints are one of the main problems for power packages. This project explored different techniques to identify key factors in the causation of voids and improve future performance.

**Project aims:**
- To investigate repeatable void free in-line soldering for thermal performance and reliability of problematic surface mount parts (e.g. power components, array packages and bottom terminated components)
- To compare new vacuum-assisted convection reflow processes with incumbent convection and vapour phase soldering

**Project objectives:**
- Comparison of reflow techniques such as:
  - Vapour phase reflow
  - Vacuum-assisted convection reflow
- Conduct trials with suppliers for practical capability assessment
- Identify current MCRL to support implementation planning for members/stakeholders towards defect free assembly

**Project impact:**
De-risking potential production level technology, Deployment of new surface mount technology reflow process which may enable:
- Improved yield without compromising throughput
- Reduced rework
- Reduced set-up times
- Reduced risk of thermal/reliability failures
- Increased product life
- Increased market/market share for new equipment vendors

**Total cost of research: £48,880**
This project explored the use of advanced visualisation devices (AdVs) as digital tools to deliver virtual and augmented reality instructions to enhance operator performance and reduce assembly times. Digitally assistive technology can enhance operator performance through visual aids and access to the required information as and when required by the operator.

Project aims:

- Introduce augmented and/or virtual reality for industrial applications
- Analyse, develop and de-risk AR/VR technology so that it is not seen as a disruptive technology
- Develop a working prototype with general end use cases

Project objectives:

- Literature review of current best practices and review of regulation/standards
- Identify and analyse the potential benefits and weaknesses of this technology
- Identify and establish a proof of market
- Identify and develop a technical specification (customer requirement and member capability) and implementation plan
- Benchmark current and emerging technologies for specific industrial applications
- Develop a proof of concept through to a working prototype

Project impact:

The MTC engaged with a range of members and other organisations to create an augmented reality solution to increase efficiency in assembly operations. This project delivered a demonstrator showcasing the industrial use of head-mounted advanced visualisation devices in manufacturing assembly and training. The following key concepts were demonstrated in the AdV system developed:

- System Architecture – The VIVAR system demonstrates two-way communication between an industrial MES and a HoloLens using a universal service bus adapter. This allows the user to view work instructions and confirm a task is completed from the HoloLens back to the MES
- Augmented Reality – Design and development of an augmented reality app in collaboration with Theorem, illustrating step-by-step assembly instructions along with CAD overlay onto parts and directional animations

A working prototype was achieved and demonstrated:

- A reduction in time for assembly tasks potentially by 30% based on average assembly times taken from industry members within the consortium
- Quick upskilling/transfer of skills without the need of in-person time

The MTC has also gained new capability within the AdV technology sector including applied knowledge of hardware/software available on the market. Additionally, the MTC has gained an understanding of the technology trend and key stakeholders, and have used this to create a road map focused on AdVs. There is a follow-on CRP project, VIVAR Phase 2, plus an internal major project on the potential implementation of a similar system for the construction and infrastructure sector.

Total cost of research: £209,000
The digital twin is a central digital manufacturing tool for the digitisation of physical assets and processes. It can be defined as the combination of data and intelligence that represent physical systems and processes.

Project aims:
To understand how the digital twin concept can be used to improve the manufacturing process and product quality. The digital twin has the potential to improve quality, product performance and achieve process efficiencies.

Project objectives:
- Define the digital twin concept
- Perform a state-of-the-art review of metrology, simulation and product/manufacturing software to include understanding the effect of uncertainty of the data and the processes
- Develop a framework with test cases for exploiting the digital twin
- Improve understanding of how the digital twin can be practically used, what the benefit is, and how a business case can be built to justify investment

Project impact:
The project helped the consortium understand what the digital twin is and how to exploit it in a number of industrial domains. The MTC collaborated across a number of its digital engineering themes [including metrology, design and simulation, controls and connectivity, and informatics] to deliver:
- An up-to-date definition for the digital twin based on thorough industrial literature review
- A comprehensive landscape of digital twin use cases, which were distilled down to 16 essential use cases and captured in a technical report
- A comprehensive review of the most relevant use cases to the consortium end users, which were expanded upon in a technical report. The latter included state-of-the-art applications and examples, benefits, enabling technologies, barriers to implementation, and gave MTC’s vision of future developments

In addition, the project also achieved:
- Providing a starting point for end users who want to start implementing digital twins within their organisation
- Bringing software vendors closer to end users and their requirements
- Detailed examples and ideas on how the digital twin can be used to improve the product quality and the manufacturing process
- Provision of thought leadership, identifying the benefits of the technology and highlighting the barriers to implementation

Following successful completion of the project, an industrial state-of-the-art report and white papers are in development to ensure wider impact and dissemination beyond the MTC consortium.

A large scale demonstrator is also in development to showcase interconnected and intelligent digital twins, showing members a path for maturing this technology and transferring lessons from the MTC.

Total cost of research: £56,450
This project built on phase 1, and its focus was on developing a multi-shot radiography analysis tool to address spatial challenges in complex geometries.

Project aims:
Optimise the data analysis of an image-based inspection modality, exemplified by radiography, to maximise the value extractable from the collected experimental data and so reduce the amount of inspection required.

Project objectives:
- Comparison of experimental and simulated data for reliable defect detection, even in the most complex sample geometries
- Partial 3D volume reconstruction for detailed defect localisation and sizing after detection
- Development of a multi-shot radiography analysis tool

Project impact:
The project has delivered two novel capabilities.
- An interactive software tool for exploring the spatial relationships between radiographs acquired from a complex-shape sample
- An algorithm for calibrating a radiographic simulation to one or more experimental radiographs, allowing a quantitative comparison of nominal and actual images, highlighting deviations, and hence providing an improved inspection capability

A follow on CRP project – Mapping Computed Tomography Performance was approved in October 2017.

Total cost of research: £56,000
Uneven, non-machined complex additive manufactured (AM) components are viewed as a barrier to adoption of the technology. The first stage of this project investigated options to identify and improve the process and finish of AM manufactured parts.

Project aims:
To use process control and optimisation of mass finishing processes to improve the surface finish of metal AM components and remove a barrier to industrial uptake.

Project objectives:
- Design, construct and validate a relevant software tool, based on process informatics, using a generic platform to aid the user to select optimal production parameters for the generation of parts with a specified output surface roughness.
- Quantitative understanding of the capability and efficacy of mass finishing processes in delivering target surface finish over a range of part input conditions. Specifically the study will focus on vibratory and drag as these provide strong variation in process energy efficiency and possess most promise and flexibility as the mass finishing solution.

Project impact:
The study delivered:
- New knowledge and capability in the area of High Energy Mass Finishing of AM parts.
- New understanding of the response of AM produced parts to surface refinement.
- Improved knowledge of the process limitations in achieving high precision outcomes for AM parts.
- This can be used by members to determine the pros and cons of mass finishing AM parts and the typical geometries that are challenging for the process.
- The results aid subsequent development of a system tool with a predictive performance to reduce process design time and costs.
- Members have access to a data set that can be used to achieve high quality repeatable mass finishing.
- The study has identified the need to further characterise selected high energy mass finishing processes for more realistic, and hence potentially more challenging, AM parts.
- The project has addressed only simple finishing of regular internal surfaces.
- The study has given important insight into media performance. This will aid future process optimisation and system design.
- The data generated will provide capability for process design and production planning included within the AM workflow.
- A follow-on phase 2 will continue to develop understanding of finishing systems.

Total cost of research: £54,000
With a growing demand for Additive Manufactured products, health and safety procedures are imperative for users to understand its impact. This project sought to further define the risks and how to limit and contain them when using metal powder.

Project aims:

Understand the risks associated with additive manufacture with respect to materials, ancillary equipment (sieves, extraction systems, etc.), post processing, handling and storage, personal exposure to hazards and environmental issues.

Project objectives:

- Understand potential issues around contamination of work clothing
- Understand whether health and safety controls currently applied to ancillary and post-processing equipment are adequate, and to reduce the dependence of staff on PPE/RPE
- Provide training material for employees working in the additive industry
- Gain an understanding of environmental issues relating to the manufacture and post-processing of additive manufactured parts, including rules and regulations for handling/storage, recycling, and minimising pollution from hazardous waste and emissions
- Provide an understanding of the implications of size, morphology and density of a dust on its dispersal and characteristics/propensity to migrate within a facility

Project impact:

- Provide confidence that the working environment is safe for employees and third parties, and that the right controls are employed to maintain safety when using both primary and ancillary additive equipment
- Extend members knowledge of powder handling systems
- Provide a training and reference resource (Sharpcloud)
- Improve member awareness of potential issues associated with metal powders
- Better understanding of health and safety implications around AM enabling safer adoption of the technology
- Further research is ongoing following engagement with HSE and will be continued as part of the DRAMA project

Total cost of research: £76,000
The demand for functional surfaces has increased significantly especially in industries such as aerospace, medical and manufacturing due to customer requirements for better and more efficient products. ENDURE explored how to meet the demand for more flexible, controlled and precise manufacturing technology to create these functional surfaces through engineering design.

**Project aims:**

Demonstrate applications of laser engineered functional surfaces through creating a laser surface engineering database.

**Project objectives:**

- Demonstrate applications of functional surface engineering through laser surface texturing
- Provide a more in-depth understanding and correlation of the effect of different laser parameters with different materials
- Create database for laser-material interaction parameters for common engineering materials

**Project impact:**

The MTC initially undertook a review of existing laser surface texturing and the type of applications surface engineering can be applied to.

A series of trials and experimental work was undertaken looking into the main key applications and the related surface functionality (hydrophobic, lubrication enhancement and adhesion).

The experimental work involved laser beam characterisation, laser process parameter optimisation, surface measurement and analysis, and functional testing design experiment and data analysis.

Consequently, the MTC has established surface engineering capability in terms of know-how, processing, metrology and functional testing in sector areas of its members such as food and drink and tooling industry.

It has generated IP knowledge of surface texture influence on specific functionality. In addition, the optimised laser parameter for surface texturing of specific material is also being generated. New testing method has also been identified and verified for functional surface testing.

The knowledge gained from this project is now being driven forward after the MTC secured European 2020 funding for the SHARK project, which will bring laser surface texturing technology for functional surfaces to the next level.

**Total cost of research: £169,150**
The MTC is an open access centre and we have a flexible approach to working with companies of all sizes – from SMEs to Tier 1s and large OEMs. We have a unique environment, as we bring together the country’s leading academics, engineers and industry professionals. This combination allows customers to develop new manufacturing processes in an industrial setting without the constraints of a commercial production environment.

Our services range from bespoke consultancy support on a single project to design and proof of complete production cells. We can even manage the factory implementation of the final solution and train the relevant engineers on site.

Our tailored service is designed to meet the needs of individual companies allowing us to offer the right solution for both members and non-members.

Tier 1 members

- AIRBUS
- Rolls-Royce
- DMG MORI
- HEXAGON
- SIEMENS
- SANDVIK
- GEN PLC
- GE
- BAE SYSTEMS
- amey
- AWE

Tier 2 members

- +GF+
- RENISHAW
- Nikon
- SPIRIT
- London Underground
- NATIONAL INSTRUMENTS
- GM
- KENNAMETAL
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If you have any questions we’d like to hear from you.

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