
Quality research
sustainability
industrial relevance
Socially, environmentally and financially sustainable solutions to UK manufacturing problems
making a difference
WARWICK
IMRC

Introduction

International

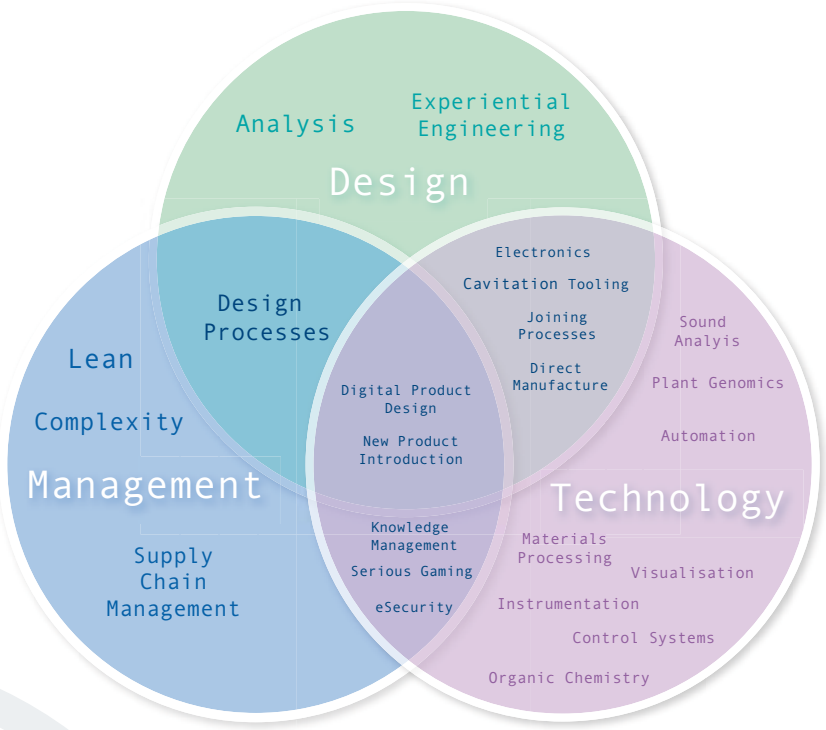
Manufacturing Centre,

University of Warwick.

Warwick Innovative Manufacturing Research Centre (WIMRC) was established at the University of Warwick in October 2001 to sponsor and manage challenging, adventurous, innovative, multi-disciplinary research, relevant to the future needs of organizations in the UK competing in the global marketplace. It is funded by the Engineering and Physical Sciences Research Council (EPSRC) with supplementary support from collaborating industrial partners. The research programmes are led by WIMRC's Director, Dr Ken Young, in conjunction with the Research Manager, Dr Nick Mallinson.

Based in the International Manufacturing Centre on the University of Warwick campus, WIMRC draws on research capabilities within Warwick Manufacturing Group (WMG), the wider School of Engineering, Warwick Business School (WBS) and, more recently, Warwick Medical School (WMS), Psychology, Chemistry, Warwick HRI and Microbology.

WIMRC has a number of key competencies in design, technology & management as depicted below:



Sustainable Manufacturing

Increasing prosperity in the UK has allowed many people to enjoy the benefits of goods and services that were once available to just a few. This is also true in many countries around the world. In the UK the environmental impacts from increased production and consumption are significant, and inefficient use of resources both compounds the damage to the environment and affects the competitiveness of UK businesses and the overall economy.

Sustainable Consumption and Production (SCP) is about achieving economic growth while respecting environmental limits, finding ways to minimise damage to the natural world and making use of the earth's resources in a sustainable way. Seeking step changes in industrial and commercial practices is central to the research challenges funded by WIMRC and it is our belief that innovative manufacturing goes hand in hand with sustainable development and a thriving UK economy.

Sustainable solutions seek to be environmentally friendly, economically viable & socially acceptable.

Difference

Collaboration

A feature of many challenging problems is their multi-disciplinary nature which requires a mix of engineering, science and management research skills often drawn from several different University departments and external partner organisations. For this reason collaboration with industry and third party research centres is central to WIMRC achieving its objective of performing world class high-impact research. Collaboration can take several forms including:

- participation in workshops to assist in the formulation and review of research strategy
- funding projects via cash and/or in-kind contributions
- part or fulltime commitment of your personnel to project work
- participation in the dissemination of project outputs
- exploitation of the research outputs in the form of new product developments or changed working practices

If your organisation is committed to developing via the adoption of innovative manufacturing solutions and you are active in the intelligent and eco-friendly vehicle or next generation healthcare sectors, you may be a valuable potential partner for WIMRC.

Strategy

WIMRC is committed to carrying out high quality, high impact research that is relevant to UK manufacturing industry. As most problems in life are multi-disciplinary it makes sense to tackle research challenges in a multi-disciplinary way. In the past multi-disciplinary research proposals have often struggled to obtain funding from the traditional research councils: this is a situation where WIMRC believes it can make a difference by setting an example and encouraging others to follow.

In selecting projects for funding WIMRC seeks those that offer the potential to instigate fundamental change and improvement.

To achieve truly multi-disciplinary research WIMRC draws on competencies from across the University of Warwick. Our Principal Investigators and Researchers come from the following departments:

- Warwick Manufacturing Group
- Warwick Business School
- Warwick Medical School
- Civil & Mechanical Engineering
- Electrical & Electronic Engineering
- Horticultural Research International
- Psychology
- Microbiology
- Chemistry

quality research

& Focus

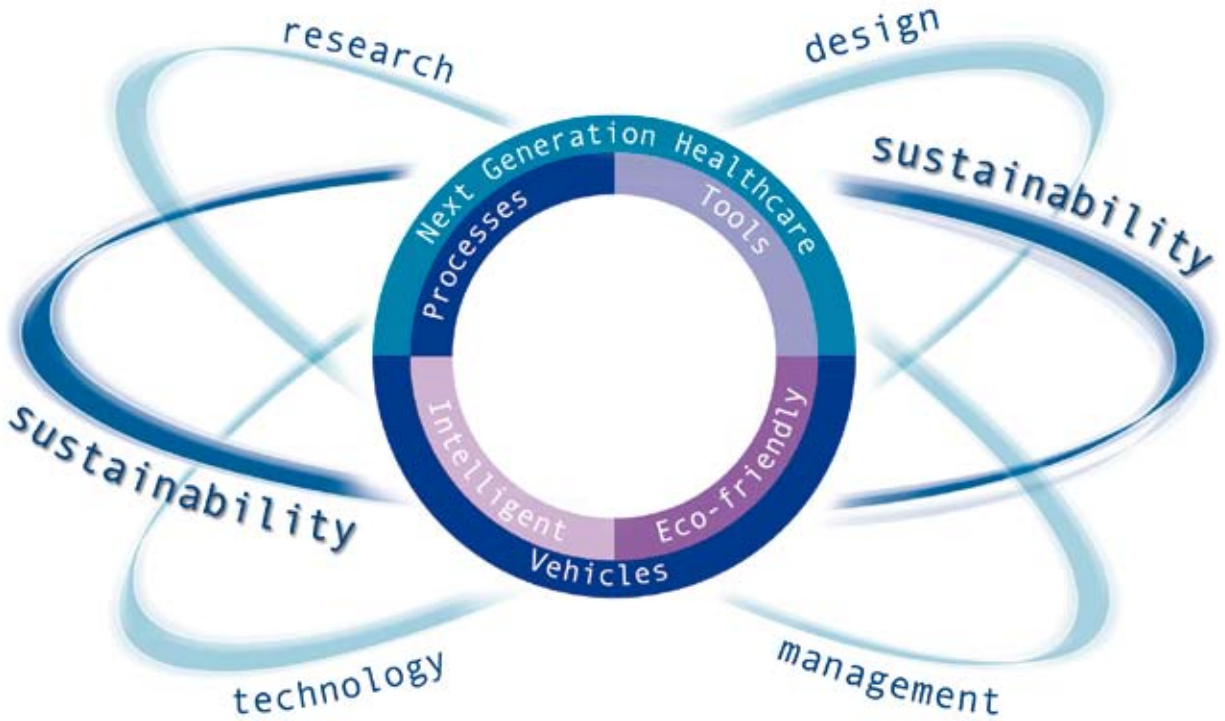
Focus Areas

In October 2006 WIMRC was awarded £9.9 million by EPSRC to continue its work under Phase 2 IMRC funding for a further 5 years until Sept 2011. During Phase 2 funding, WIMRC's focus areas are:

- Intelligent Vehicles
- Eco-Friendly Vehicles
- Next Generation Healthcare Tools
- Next Generation Healthcare Processes

We see these as key to future UK prosperity for a number of reasons;

- An aging population placing increasing demands on the healthcare system;
- A transport infrastructure running above planned capacity with no sign of demand falling or stabilising in the foreseeable future;
- Dwindling supplies of the world's natural resources forcing all consumers to use resources more efficiently and in a sustainable manner;
- Man made climate change requiring the identification of renewable energy and material sources and the reduction of non-recyclable wastes.



Intelligent Vehicles

All sections of UK society now recognise the need to reduce the effects of congestion, improve fuel efficiency and improve safety, in both road and rail vehicles. The incorporation of "intelligent systems" in the structure of vehicles to modify their operational behaviour, plus the use of intelligent systems during the design, manufacture and disposal of vehicles, is predicted to offer major opportunities for improved performance and reduced environmental impact. WIMRC is devoting significant resources to the identification and funding of suitable projects which will have a major impact in this area.

Aims

- To reduce traffic congestion and thereby contribute to a more efficient economy
- To improve road safety through the elimination of accidents
- To improve the reliability of vehicles
- To improve the experience of travelling
- To improve the efficiency of vehicles
- To reduce the pollution produced by vehicles (noise and chemical emissions)

impact

t Vehicles

Experiential Engineering

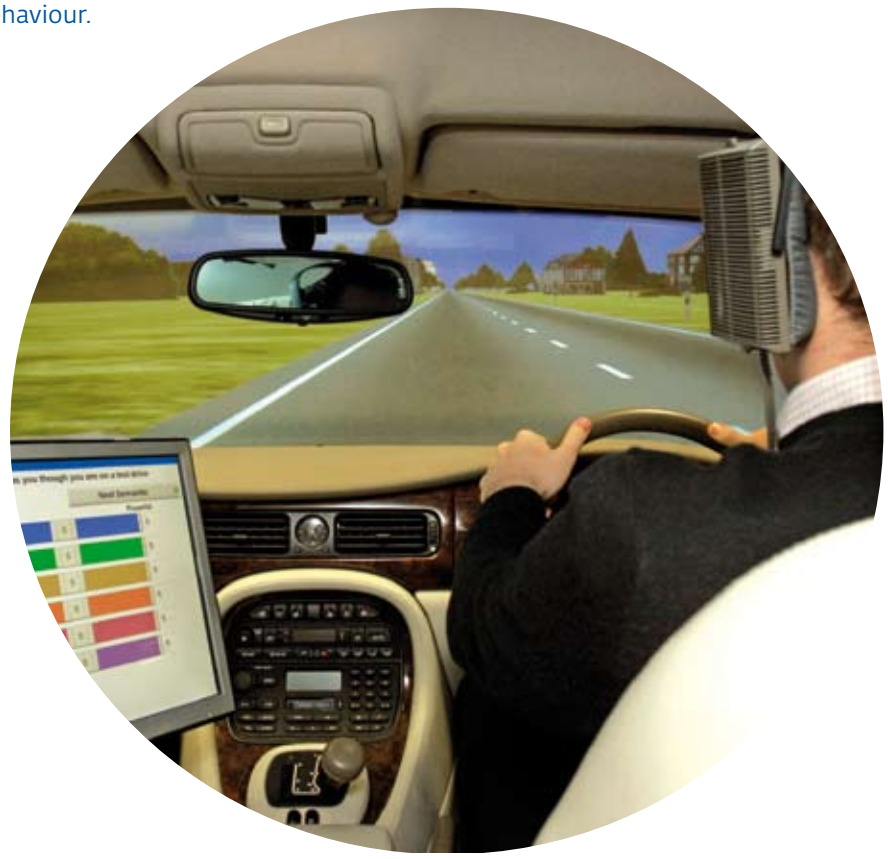
Key aspects of the research include :

- an approach involving expertise from Warwick Manufacturing Group, Electrical & Electronic Engineering, and Warwick's Department of Psychology
- development of Interactive NVH (Noise Vibration & Harshness) simulator methodologies
- novel predictive and analytical techniques for jury evaluations
- the capture, understanding and use of driver behaviour.

Manufacturers want to optimise their products for the needs, acceptance and satisfaction of their customers. To do this, they need to be able to quantify and predict perceptions of the product, for example, the subjective impressions of a car driver, and to incorporate this knowledge within product development decision-making processes.

Research at WIMRC has highlighted the importance of appropriate product representation, context and interactivity within structured jury evaluations. These representations may be anything from a sound recording to a showroom test vehicle. However, advances in digital representation are allowing the use of more sophisticated simulated environments.

Current research focuses on the relationship between real world assessment and structured evaluations in controlled environments. Its aim is to improve the effectiveness and efficiency of decision-making during product development based upon the results of subjective evaluation of product attributes.



Eco-Friend

Eco-Friendly Vehicles

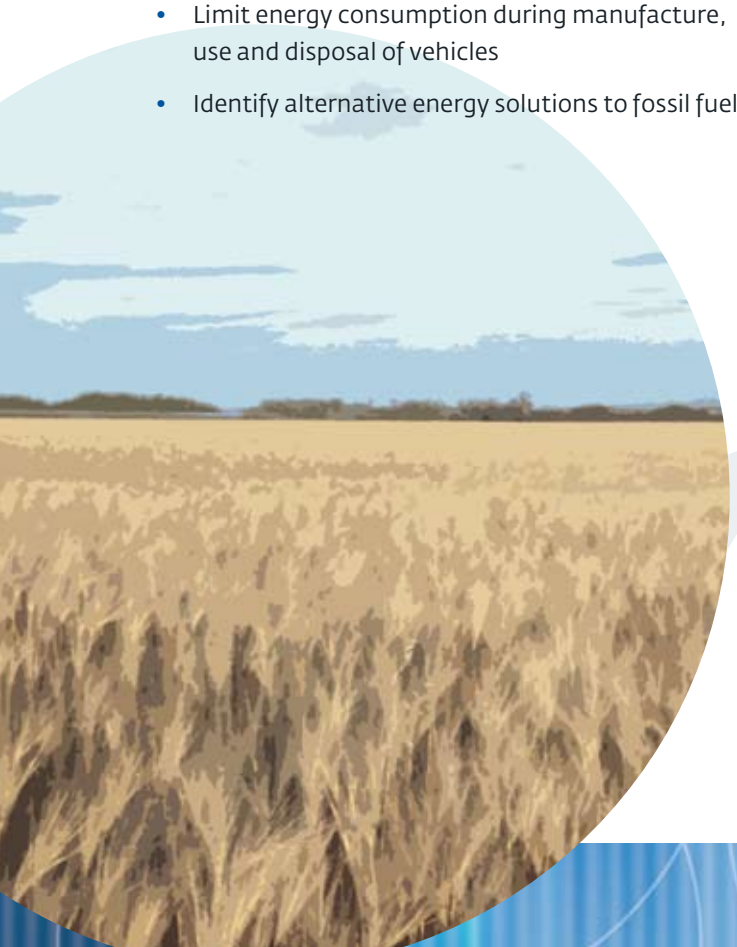
WIMRC is committed to build upon traditional vehicle manufacturing strengths at WMG. UK society is now seeking vehicles that are ecologically friendly whilst still offering the level of comfort, performance and quality that has become the established norm.

WIMRC is now funding multi-disciplinary projects, using the skills of researchers drawn form several departments, to identify innovative solutions in this area of vehicle technology.

sustain

Aims

- Support the design of vehicles which are ecologically friendly throughout their life cycle - from design, through manufacture, during service, and at disposal
- Seek to ensure that such vehicles are sustainable environmentally, economically and socially
- To identify manufacturing approaches that conserve traditional raw materials and identify suitable substitute materials
- Limit energy consumption during manufacture, use and disposal of vehicles
- Identify alternative energy solutions to fossil fuels



ly Vehicles

Eco One: A Truly Environmentally Friendly Racing Car

The concept for the Eco One project was simple: Create a high-performance racing car that has an environmental conscience. We researched the most technologically advanced sustainable materials available, and then used them wherever possible during construction.

Eco One's chassis is made from steel and aluminium which can be recycled easily and efficiently. In addition, Eco One uses tyres, bodywork, brake pads, lubricants and fuel made from natural, renewable materials. However, just because the materials the car is made from are friendly to the environment, it doesn't mean we compromised on performance. Eco One has a power-to-weight ratio of 540bhp/tonne, can accelerate from 0 to 60 in under four seconds, and will go on to a top speed in excess of 140mph.

Motorsport is exciting, dynamic and fast, all of which are not currently associated with sustainable technologies. We are working hard to change public perceptions and bring renewable technology to the forefront of motorsport design.

The Eco One racing car has been shown at venues around the country including the Eden Project, the National Science Museum and the Royal Show. It has appeared on a number of news programmes, including Sky News and BBC News, and was featured on Channel 4's "Richard and Judy" show.

Next Generation He

Next Generation Healthcare Processes

Many prosperous well-developed countries are experiencing increasing pressures on their healthcare services due to a growing proportion of elderly citizens in their populations, coupled with increased demand across all ages as a consequence of new treatments for previously incurable ailments. To satisfy these demands with high quality treatments, provided in a timely, accessible manner and at a reasonable cost, requires that their health care systems operate as efficiently as possible. Experience within other industries such as automotive and aerospace that have had to survive global competition has shown that an organisational culture is required that is customer focused and accepts change as a natural, continual and beneficial process.

WIMRC is seeking to improve healthcare through research into:

- the application of lean principles to streamline health processes
- better knowledge management and dissemination to reduce adverse medical events and spread best practice
- accelerated approval and introduction of new products and procedures
- the creation of education tools for improved on-the job training and knowledge dissemination

relevance

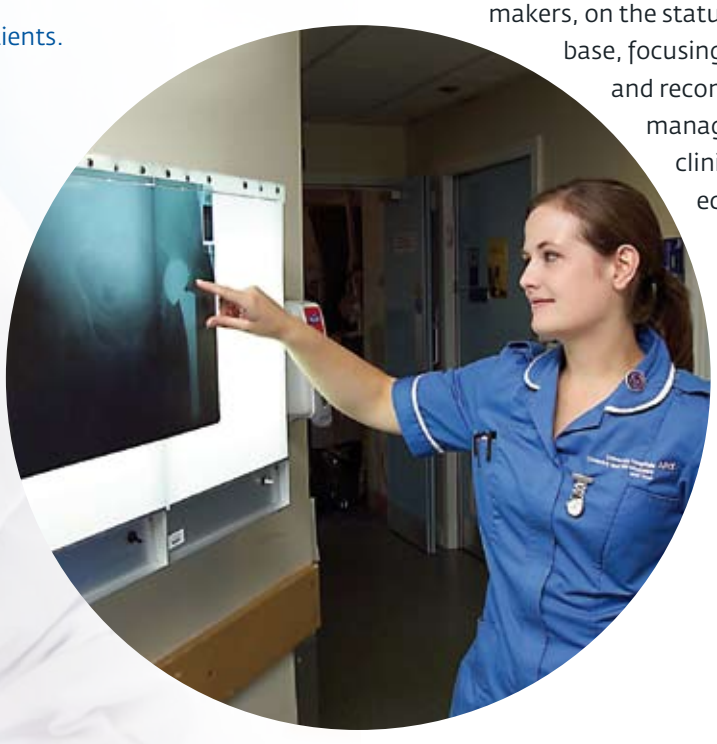
The Management and Organisation of Clinical Trials

A major challenge to innovation and improvement in healthcare is the increased time & costs associated with new product development and introduction (CenterWatch, 2006). Government, scientists and industrialists have all expressed concern about the decline of the UK's clinical research base and the gulf between basic research and innovations that will directly benefit patients.

The aim of this research project is to identify the social, organisational and managerial factors that influence clinical trials with a view to improving the clinical research process, thereby reducing the costs and risks of development and the time taken to introduce new procedures, devices and drugs.

The specific objectives are:

1. To map alternative models of clinical research and identify the key challenges they generate.
2. To identify the barriers and enablers to clinical trials management in the UK clinical research sector through in-depth interviews.
3. To identify the macro economic and policy drivers of the move toward outsourcing of clinical trials and consider the implications of this for clinical trials management at the micro level.
4. To develop new theory to deepen understanding of the processes involved in 'networked innovation', focusing on clinical research as an exemplar.
5. To produce a report for a target audience of UK policy makers, on the status of the UK clinical research base, focusing specifically on requirements and recommendations for the successful management and organization of clinical trials, in the face of current economic and policy constraints.



Next Generation

Next Generation Healthcare Tools

WIMRC is building upon its design and technology competencies to research new technologies which will reduce treatment costs and patient waiting times, at the same time speeding up treatment time while improving quality and safety.

Areas of research include:

- generation of lattice structures via spider based technologies
- optical detection of bone fractures
- digital opthalmoscopes

A number of key manufacturing competencies are available to WIMRC including:

- lasers for cutting & shaping
- ultrasonics
- optical detection
- thermal imaging
- rapid prototyping
- virtual reality

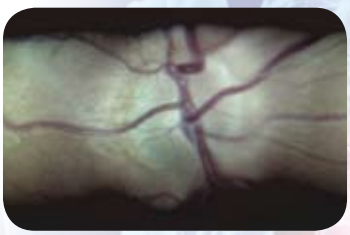


Image of a retina using the digital opthalmoscope.

improving

Healthcare Tools

This project aims to develop a novel technique to crush stones in the body using the enormous destructive power generated by focusing the collapse of a cavitation bubble cloud.

Current Project Example

Non Surgical Cavitation Destruction Treatments

Approximately 70% of stones are now treated with extracorporeal shockwave lithotripsy (ESWL). ESWL is non-surgical, minimising both discomfort to the patient and cost. However, damage to tissues surrounding the stone can occur due to the low accuracy of the shock waves caused by wave dispersion. Also, the stone fragments may be too large and too sharp to pass out of the body and surgical removal is often needed afterwards.

This project builds upon earlier work carried out by WIMRC, in collaboration with the Three Gorges project in China, into the cavitation destruction that causes erosion in hydro electric turbines. WIMRC researchers are building upon this expertise and, instead of looking at the harmful effects of the phenomenon, are exploring possible therapeutic uses.

The Teams

Management Committee

- Dr Ken Young (WMG)
- Dr Nick Mallinson (WMG)
- Dr Kerry Kirwan (WMG)
- Professor David Pink (HRI)
- Dr Peter Jones (EEE)
- Dr Paul Jennings (WMG)
- Dr Kevin Neailey (WMG)
- Professor Matthew Cooke (WMS)
- Professor Jacky Swan (WBS)
- Professor Vinesh Raja (WMG)
- Dr Jay Bal (WMG)
- Mr Mike James-Moore (WMG)
- Dr John Powell (WMS)

"Warwick IMRC is all about internationally leading, ground-breaking cross-disciplinary research with direct outreach to a wide range of applications.

As Chair of the Steering Group, I have been privileged to be part of WIMRC fulfilling this vision."

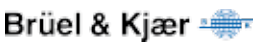
Dr Alistair Keddie (Chairman)

Steering Group

- Dr Alistair Keddie, Consultant (Chairman)
- Dr Louise Tillman, EPSRC
- Professor John Bessant, Imperial College London
- Dr Rolf Bernhardt, IPK Berlin
- Professor Yvonne Carter, Dean of Warwick Medical School
- Dr Robin Davies, Consultant
- Mark Goldman, CEO, Heartlands NHS Trust
- Professor Mike Hoare, UCL
- Dr Nick Mallinson (Secretary)
- Dr Allan Parker, The Performance Solution
- Phil Ruffles, Consultant
- Richard Scarre, IT Director, Aga Food Services Group
- Stephen Thornton, CEO, Health Foundation
- Dr Ken Young

Partners

A selection of some of our current partners:



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