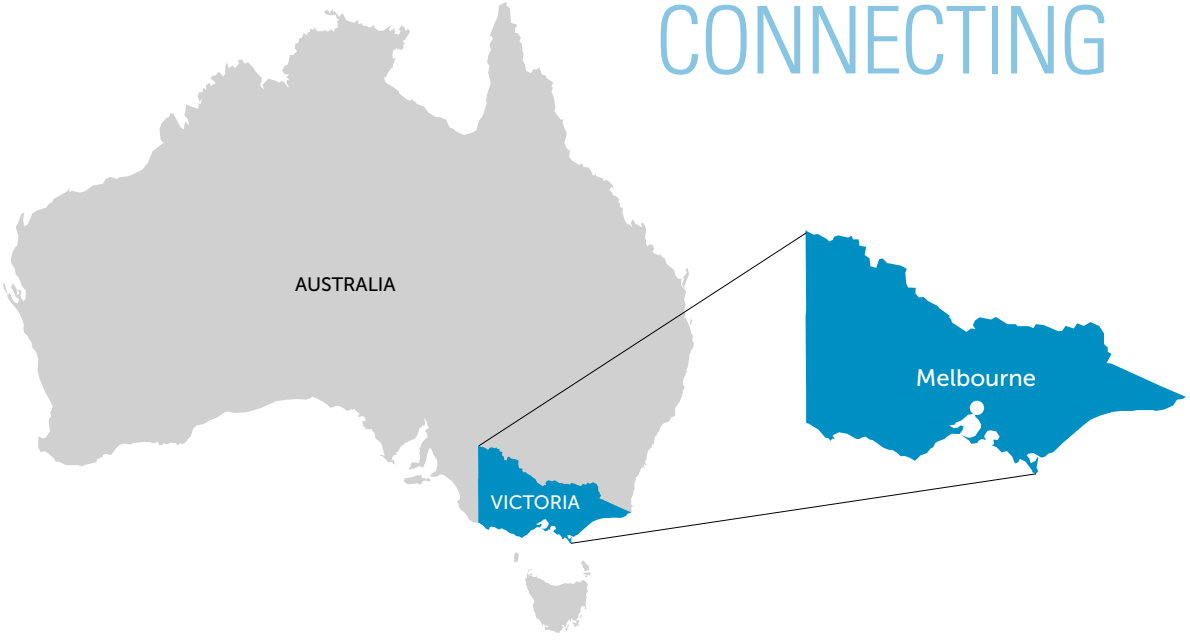
MELBOURNE
RESEARCH, EDUCATION AND TRAINING

ADVANCED MANUFACTURING

MELBOURNE
VICTORIA AUSTRALIA

MELBOURNE:
LEADING
INNOVATING
CONNECTING



Melbourne and regional Victoria are a perfect blend of economic strength and dynamism, with a lifestyle that is envied around the world. Talented people, a world-class education system, supportive government and superior infrastructure make the state of Victoria a global leader in research, education and vocational training.

Victoria's research centres, universities and vocational training providers partner with industry, governments, non-government organisations (NGOs) and other educational institutions around the world.

They offer extensive opportunities for partnerships and program collaborations, including joint research initiatives, research and development services, licensing of materials, tailored curriculum development, joint program delivery, staff/student exchange, consultancy services and customised employee development programs.

For more information about Victoria's research, higher education and vocational training capabilities, contact your region's Victorian Government Business Office at: **invest.vic.gov.au/offices**.

ADVANCED MANUFACTURING IN MELBOURNE

Melbourne is Australia's leader in advanced manufacturing and one of the few places in the world that covers the entire manufacturing spectrum, from research and engineering to design and production.

Melbourne's advanced manufacturing expertise spans design, composite materials, material handling, software development, additive processes, automated systems and advanced electronics and machinery.

Melbourne and regional Victoria are home to a network of specialised advanced manufacturing research precincts servicing a range of industries including: Automotive, Aerospace, Defence, Scientific Instruments, Medical Devices and Equipment, Chemicals and Plastics, Pharmaceuticals, Fabricated Metals, TCF (textiles, clothing and footwear) and Food Processing.

Victoria's advanced manufacturing capabilities are underpinned by the infrastructure and expertise of Australia's largest manufacturing sector, which provides 31 per cent of the country's manufacturing output and employs nearly 300,000 people.

FIELDS OF EXPERTISE

Melbourne and regional Victoria have three specialist areas of expertise in advanced manufacturing:

Composites and advanced materials

Victoria has been at the cutting edge of carbon fibre research and development (R&D) for over two decades. It is a global leader in carbon fibre research in areas including surface modification, recycling, energy conversion, property alteration, process manufacturing, nanofibre, autoclave processing and thermoset composite welding.

Victoria also has specialist facilities and research expertise in polymers, nanomaterial and advanced structure ceramics, grapheme-based optoelectronics, advanced biomaterials and state-altering materials.

Additive manufacturing and 3D printing

Leading specialist facilities in Melbourne provide additive and subtractive technologies in complex design fabrications and prototype testing and design. Selective laser melting, fused deposition modelling, U Print, object and 3D printing technologies are assisting companies in complex R&D projects.

Melbourne also offers expertise in material synthesis, industrial automation, advanced process design, future manufacturing and industrial optimisation.

Biotechnology

Melbourne is an internationally recognised leader in biotechnology. It has produced some truly remarkable achievements in the field including the world's first bionic ear and commercial 3D bioprinter.

Melbourne has world-recognised capabilities in biomaterial development and applications and nanotechnology health applications. Its research precincts offer state-of-the-art advanced technology facilities in bioinformatics, genomics, metabolomics and industrial process advancement, computation and ICT life sciences modelling and biomedical imaging.

Home to more than 150 biotechnology companies, Melbourne's life sciences industry generates annual sales of approximately A$7.6 billion with expenditure on research exceeding A$600 million.

VICTORIA'S ADVANCED MANUFACTURING RESEARCH PRECINCTS

Advanced Manufacturing Precinct

Melbourne's Central Business District is home to an advanced manufacturing precinct, incorporating the University of Melbourne and RMIT University, that offers state-of-the-art facilities including 3D printing and reverse engineering.

Parkville Health Sciences Precinct

Melbourne's Parkville Precinct is a globally recognised hub of excellence in healthcare, research and education. A cluster of diverse research and health sciences institutes in the Parkville Health Sciences Precinct specialise in smart and advanced materials applications, instrument development, advanced ICT applications and nanotechnology. The precinct includes the new A$1 billion Victorian Comprehensive Cancer Centre, currently under construction and due for completion in 2015.

Monash CSIRO Scientific Precinct

Home to Monash University, the Australian Synchrotron, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Monash Health (the largest public healthcare provider in Victoria), the Monash Health Translation Precinct, and Melbourne's key pharmaceutical and biotechnology industries, including Servier, GlaxoSmithKline and Bristol-Myers Squibb, this precinct is the locus of numerous advanced manufacturing research projects and collaborations.

Geelong Technology Precinct

Located in Victoria's largest regional centre, an hour's drive from Melbourne, the Geelong Technology Precinct has strengths in health and industrial biotechnology, carbon composites, nanotechnology, biomaterials and functional foods. Key facilities include the A$100 million Australian Future Fibres Research and Innovation Centre (AFFRIC), newly opened in 2013, and the soon-to-open Carbon Nexus, an industrial-scale A$34 million plant that will have the capacity for large-scale R&D manufacturing research.

Scoresby Small Technologies Cluster

The Scoresby Small Technologies Cluster is an entrepreneurial collection of facilities and businesses involved in the uptake of small-scale advanced technologies, with a specific focus on instrument design and fabrication. This cluster assists in research, product realisation and process design. It provides the infrastructure to accelerate commercialisation, and links with key stakeholders across industry, government and academia, to nurture cross-fertilisation of innovation.

Werribee Agriculture and Food Technology Precinct

The Werribee Technology Precinct is principally focused on animal and food research. It incorporates mixed research and industry hubs of excellence in biotechnology, including veterinary applications, agribusiness and environmental sustainability.

Bundoora Plant Science Precinct

The Bundoora Plant Bioscience Precinct hosts La Trobe University, La Trobe Research and Development Park and RMIT University's Bundoora campus. It includes a range of organisations spanning industry sectors, including Rio Tinto's Research and Technology Centre, the Plant Biotechnology Centre and the Walter and Eliza Hall Institute.

COMMERCIALISATION

Many global companies have manufacturing operations in Victoria and have chosen to establish their R&D and design facilities here, including:

- BAE Systems (UK)
- Siemens (Germany)
- IBM (USA)
- Microsoft (USA)
- Thales Group (France).

Victoria offers a diverse and highly skilled workforce and its advanced manufacturing sector has a strong culture of collaboration between the state's academic, research, corporate and industry sectors. Victoria's manufacturing sector provides the commercial experience and knowledge to take R&D breakthroughs to design and production – such as the Cochlear bionic ear implant and the Black Box flight recorder.

The State and Federal governments are both highly supportive of advanced manufacturing, providing grants and assistance programs for commercialisation, product application and design, profitability testing, market positioning and capital raising.

VICTORIA'S MANUFACTURING SECTOR PROVIDES THE COMMERCIAL **EXPERIENCE AND KNOWLEDGE** TO TAKE R&D BREAKTHROUGHS TO DESIGN AND PRODUCTION.

MELBOURNE'S ADVANCED MANUFACTURING RESEARCH CENTRES

- Advanced Centre for Automotive Research and Testing
- Australian Future Fibres Research and Innovation Centre
- Bio21 Institute
- Carbon Nexus
- Centre for Technology Infusion
- Commonwealth Scientific and Industrial Research Organisation (Clayton laboratories)
- Cooperative Research Centre for Advanced Automotive Technology
- Cooperative Research Centre for Advanced Composite Structures
- Defence Materials Technology Centre
- Defence Science Institute
- Defence Science Technology Organisation
- Green Chemical Futures
- Melbourne Centre for Nanofabrication
- Microsoft Research Centre for Social Natural User Interfaces
- Monash Centre for Additive Manufacturing
- Monash Centre for Electron Microscopy
- RMIT Design Hub
- RMIT Green Engines Research Facility
- Sir Lawrence Wackett Aerospace Centre
- Swinburne Advanced Manufacturing and Design Centre
- The Australian Synchrotron
- Victorian Centre for Advanced Materials Manufacturing

CASE STUDY

ADVANCING AEROSPACE

The Monash Centre for Additive Manufacturing (MCAM) is leading the next generation in aerospace manufacturing.

The aerospace industry is seeking new materials that are lighter yet stronger, cheaper to manufacture and that will help to halve the aviation industry's overall carbon emissions by 2050.

Monash's Professor Xinhua Wu, who is internationally respected in the field of advanced manufacturing, and her team at MCAM have taken on this challenge.

One of Xinhua's new projects is a new aluminium alloy that will make aircraft 30 to 40 per cent lighter, twice as fuel efficient and still structurally sound.

So significant is this project that Microturbo, the European Space Agency and plane and train manufacturer Bombardier are working in close partnership with Xinhua and the MCAM team of researchers.

The world-class centre has attracted international aerospace heavyweights eager to see at first hand the world's best additive manufacturing equipment.

Additive manufacturing, including 3D printing, builds products directly from digital designs through a layering process. Traditional manufacturing methods result in wastage of up to 90 per cent. By building products from the ground up, additive manufacturing is virtually waste-free.

Xinhua's team has developed several new engine components that are undergoing early evaluation trials for one of the major European aerospace companies.

"MCAM is going to drive the development of a field that will have a myriad of economic and environmental benefits," she said.

Xinhua says the key factor with such industrial research is achieving this economically.

"The goal is to develop stronger, lighter, more durable and more stable metals. We have to create new materials that not only have the best performance but are also the cheapest."

platforms.monash.edu/mcam

MICROTURBO, THE EUROPEAN SPACE AGENCY AND PLANE AND TRAIN MANUFACTURER BOMBARDIER ARE **WORKING IN CLOSE PARTNERSHIP** WITH XINHUA AND THE MCAM TEAM OF RESEARCHERS.

CASE STUDY

BEATING THE HEAT

A partnership between RMIT University and Bruck Textiles is creating better protective clothing for Australian firefighters.

Australian firefighters face some of the most extreme and dangerous conditions imaginable when fighting the bushfires that plague the country's scorching summers.

In these conditions, heat exhaustion and dehydration not only reduce the performance of firefighters but, tragically, can also lead to fatalities.

In important work, Dr Rajiv Padhye and Dr Olga Troynikov of RMIT University are working with Australian textile manufacturer Bruck Textiles to develop protective textiles with enhanced protective and comfort properties for use in garments to better protect Australia's firefighters.

"If we can improve the protective performance and comfort of the materials used to manufacture firefighters' garments, they will be able to work for longer periods, minimise heat stress and have better concentration," Dr Padhye explains.

Over three years, Padhye and his team will look at how existing protective textiles and garments can be improved for Australian conditions. These new textiles will also have applications in military, mining, metal smelting and other industrial settings.

Keith Cowlishaw, Head of School in Fashion and Textiles at RMIT, says Bruck Textiles is uniquely positioned as the only Australian manufacturer of high quality, high performance, technical fabrics for the protective and safety markets.

"Bruck recognised they did not have sufficient in-house resources to make the necessary breakthroughs, especially in research, to enhance their current products.

"Consequently, Bruck initiated the establishment of the Australian Textile Technologies and Innovation Centre (ATTIC), in partnership with the Commonwealth Scientific and Industrial Research Organisation, RMIT and the Defence Materials Technology Centre in early 2010," Cowlishaw said.

As well as involving Bruck and all ATTIC members, an important component of the research was consultation with firefighters from the Country Fire Authority and the Melbourne Fire Brigade.

This research is an Australian Government-funded initiative under the Textile Clothing and Footwear Strategic Capability Program.

Bruck Textiles Chief Operating Officer, Sandip Ranjan, says the project will enable Bruck to develop and manufacture next-generation fabric constructions.

"We will be able to incorporate these into the latest garment designs by 2014, which will position Bruck at the forefront of this global industry."

THESE NEW TEXTILES WILL ALSO HAVE **APPLICATIONS IN MILITARY, MINING, METAL SMELTING** AND OTHER INDUSTRIAL SETTINGS.

PRINTABLE RFIDS

Monash University's chip-less radio-frequency identification (RFID) can monitor drug delivery to patients, track remote vehicles and prevent counterfeiting – and it is 1,000 per cent cheaper.

Associate Professor Nemai Karmakar and his team at Monash University have developed a technology that will revolutionise tagging systems. They have developed a series of chip-less RFID tags and readers that could replace printed barcodes and active chipped tags.

Associate Professor Karmakar said the use of chipped RFIDs is limited by their high cost.

"We have overcome this problem by removing the chip so that they are fully printable, like optical barcodes, onto plastic or paper. Chip-less RFIDs can be made for less than one cent, which is well below the one dollar it costs to make a chipped RFID," he said.

Chip-less RFIDs can store large amounts of data, are usable on metal products, are readable over greater distances and many tags can be read at the same time.

Karmakar is excited about the potential for this world-leading technology including commercial trials of polymer banknotes incorporating printed RFIDs.

Karmakar believes the incorporation of chip-less RFIDs into polymer banknotes will contribute significantly to reducing the global problem of counterfeiting.

Other projects, in partnership with FE Technologies, involve using printable RFIDs for improved control of books in libraries and printable RFIDs for remote tracking of vehicle movements in alpine regions.

RFID technology can also be used in conjunction with sensors for wireless monitoring.

The Monash team is currently exploring the use of sensors in conjunction with chip-less RFIDs to measure humidity and temperature, enabling the technology to be used in food packaging to monitor the condition of the contents.

Karmakar said this technology could also be used in medical devices and for monitoring drug delivery to patients.

Radio-frequency identification (RFID) is the wireless non-contact use of radio-frequency electromagnetic fields to transfer data, to automatically identify and track tags attached to objects.

"KARMAKAR'S TEAM CURRENTLY HAS THREE COMMERCIALISATION PROJECTS FOR CHIP-LESS RFIDS IN PROGRESS, INCLUDING COMMERCIAL TRIALS OF POLYMER BANKNOTES INCORPORATING PRINTED RFIDS."

CASE STUDY

CASE STUDY

A NEW ERA OF NANOSCALE MAGNETIC IMAGING

HIS WORK IS "A QUANTUM LEAP IN THEORETICAL PHYSICS, THAT'S POISED TO MAKE A HUGE IMPACT IN CELL BIOLOGY."

Professor Lloyd Hollenberg and his team are on the brink of revolutionising sensing and imaging at the atomic and molecular level.

Imperfect diamonds could help answer fundamental questions in the life sciences, thanks to groundbreaking research by Victorian physicist, Professor Lloyd Hollenberg, winner of the 2013 Victoria Prize for Science and Innovation in the Physical Sciences.

In world-first experiments, Professor Hollenberg and his team demonstrated nanodiamond quantum sensing technology in a living cell with sensitivity and resolution a million times greater than any conventional Magnetic Resonance Imaging (MRI) system in the world.

The quantum sensor, a single atom defect in a diamond crystal called a nitrogen-vacancy centre, has the potential to revolutionise sensing and imaging at the atomic and molecular levels. The combination of the special properties of diamond and the quantum properties of the nitrogen-vacancy centre is one of nature's remarkable coincidences and allows the device to detect the very small magnetic fields arising from individual atoms and molecules.

With human life beginning and ending with atoms and molecules, a quantum sensor will provide views of life at this fundamental level in a way never before experienced.

Internationally, there is huge interest in the potential of quantum technologies. Working at the convergence of quantum mechanics and biology, Professor Hollenberg is sparking a new era of nanoscale magnetic imaging with research spanning quantum physics, chemistry, bioengineering, materials science and biology. As a result, he and his team have demonstrated that sensors based on the strange rules of quantum mechanics can offer new tools to address important problems in biology.

Professor Hollenberg received the 2012 Walter Boas Medal for pioneering work in quantum sensing and quantum computing. In 2013, he was awarded an Australian Research Council Australian Laureate Fellowship and was part of the team that received the 2013 Eureka Prize for Excellence in Interdisciplinary Scientific Research. According to ABC Television's Catalyst, his work is "a quantum leap in theoretical physics, that's poised to make a huge impact in cell biology."

Professor Hollenberg is Deputy Director of the Australian Research Council Centre of Excellence for Quantum Computation and Communication Technology within the Department of Physics at the University of Melbourne.

ENERGY EFFICIENT STEEL RECYCLING

Researchers and students from Swinburne University of Technology are reducing the energy and cost of recycling steel.

The OneSteel recycling plant is the biggest single consumer of electricity in Melbourne. The plant uses the electricity to maintain temperatures of around 1,600° Celsius to tap 83 tonnes of molten steel per hour from its furnace.

Swinburne researchers started working with OneSteel engineers five years ago to lower the energy requirements of the process. It has proved to be an extremely challenging task, involving complex mathematical descriptions and computer modelling of what goes on unseen inside the furnace, before working out how the process can be fine-tuned in practice.

THE MOST RECENT STUDENT WORK IS RESULTING IN **ENERGY SAVINGS** OF ABOUT 1.6 GIGAWATT HOURS A YEAR.

"But last year we had spectacular results," says Professor Geoffrey Brooks, who leads Swinburne's high temperature processing research and education. "OneSteel has cut its energy use by one to two per cent, and that's quite a lot because they were already running a reasonably efficient operation.

"It's good for the bottom line, but it's also good in terms of greenhouse gas emissions. And it's a really nice example of how our students work with industry to improve operations."

On completing a literature review of prior articles, papers and theoretical material, the students sat down with OneSteel engineers to discuss how their recommendations could be applied at their recycling plant. The students then analysed the results of their recommended processing changes.

OneSteel technical superintendent Andrea Fontana has high praise for the seven Swinburne students he has worked with. "This is very good research for young engineering students. They can contribute a lot with the new software tools they have at the university. We don't have them in-house, or the knowledge to use them, and because we are mostly focusing on day-to-day production, we don't have much time to spend on the theoretical side."

Fontana says the most recent student work is resulting in energy savings of about 1.6 gigawatt hours a year (equivalent to just over 3,000 60-watt lightbulbs burning for a year).

There have also been concrete results in terms of reducing cycle times. He is now looking at applying the advances at OneSteel's other recycling plants in Sydney and Newcastle.

The plants recycle scrap steel sourced mainly from demolished light industrial buildings, crushed car bundles, discarded whitegoods, and old rail tracks and wagons. The recycled steel is suitable for all steel products and uses about half the energy required to manufacture 'virgin' steel products, Professor Brooks says.

CASE STUDY

CAPABILITY STATEMENTS

BOX HILL INSTITUTE

Global Educators

Melbourne - Australia

Key areas of expertise

- Oil and gas extraction – on and offshore
- Process manufacturing of oil and gas derivatives, e.g. plastics
- Biotechnology industry, pharmaceutical and academic research

Research/program delivery capabilities

Box Hill Institute provides training in the process plant discipline of oil and gas and downstream derivatives and in laboratory technology for the research, pharmaceutical and biotechnology disciplines.

The training team has a strong industry background with considerable experience in oil and gas extraction through to product manufacturing as well as pharmaceutical and biotechnology.

Box Hill Institute undertakes research in biotechnology in cooperation with industry partners. It has industry and organisational linkages with companies including Esso, Qenos, Alcoa, Shell, Caltex, Sypharma, GlaxoSmithKline and the Department of Environment and Primary Industries. The Institute provides the Diploma of Laboratory Technology in China and Sri Lanka through partial auspiced arrangements.

bhtafe.edu.au/courses/study-areas/Pages/science.aspx

bhtafe.edu.au/courses/study-areas/Pages/manufacturing.aspx

BOX HILL INSTITUTE

Box Hill Institute is a leading Victorian vocational and higher education provider known for its collaborative and creative approach to education in Australia and overseas. Box Hill Institute offers a wide variety of courses to local and international students and has been the recipient of many awards and achievements including the coveted Victorian Large Education Provider of the Year 2012, and the International Training Provider of the Year at the Australian Training Awards 2013.

Box Hill Institute offers Certificate II to Advanced Diploma in Process Plant Technology and Operations, Certificate IV in Laboratory Techniques, and a Diploma of Laboratory Technology.

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bhtafe.edu.au

Key areas of expertise

- Mechanical Engineering
- Mechatronics
- Electrical and Electronics
- Lean and Competitive Manufacturing
- CNC Machining
- Precision Robotics
- Vacuum Technology
- Clean Room Technology
- Optical Sensors and Vision System
- Fluid Power
- Industrial Control
- Electrotechnology
- Renewable Energy
- Fabrication and Welding
- Supply Chain Management
- Automotive
- Polymer
- Computer-aided Design (CAD)
- Transport and Logistics
- Electronics
- Management
- Business

Research/program delivery capabilities

Advanced Manufacturing is constantly transforming. That means there is an increasing need for higher technical skills, a broader range of skills and skills that are regularly updated.

With Advanced Manufacturing as a major specialisation, Chisholm conducts national and international research to ensure its centres of excellence meet current and future industry needs.

The Centre for Integrated Engineering and Science is a state-of-the-art training facility that includes a certified polymer testing centre. The new A$15 million Automotive and Logistics Centre offers training in a fully simulated work environment using the latest industry technologies.

Chisholm staff have extensive industry experience. Many also have experience in international business contexts that utilise their extensive technical and training capability. Chisholm works with a wide range of industry advisory groups to ensure training is consistently relevant to employers.

CHISHOLM INSTITUTE

Chisholm is a highly successful Registered Training Organisation that delivers government-funded, fee-for-service training and consultancy services to industry, business, government and community organisations across Australia and internationally.

Chisholm Institute offers quality industry-based research and training expertise, as well as specialised facilities, across a full range of advanced manufacturing areas.

Its state-of-the-art training facilities include a dedicated Centre for Integrated Engineering and Science and an Automotive and Logistics Centre, both with the latest cutting-edge industry technologies.

Skill development ranges from basic fabrication through to Advanced Diploma of Engineering and Bachelor of Technology in addition to specialised industry programs and skill sets.

Engineers Australia has accredited the Diploma and Advanced Diploma in Engineering Technology, and the Bachelor of Engineering Technology.

Examples of recent customised training include:

- a four-year contract with Qatar Petroleum to deliver accredited training programs, consultancy services and technical instructor training, both onshore and offshore
- delivery of the Diploma of Electrical Supply Industry Power Systems across 10 cities in China to 1,700 Chinese students (operating since 2005 and recently renewed); students receive dual qualifications (an Australian nationally accredited qualification and the equivalent Chinese qualification)
- full-time onsite delivery of customised mechatronics training at Toyota's manufacturing plant for five years
- conducting National Association of Testing Authorities (NATA) testing nationally and internationally.

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DEAKIN
UNIVERSITY AUSTRALIA

Key areas of expertise

- Electomaterials
- Metallurgy
- Carbon Fibre and Composites
- Fibres and Textiles
- Nanotechnology
- Engineering Design and Manufacturing

Research/program delivery capabilities

The Institute for Frontier Materials (IFM) at Deakin University works in collaboration with associated research centres and industry to develop new materials, material technologies and material processing techniques suitable for the textiles, metals, energy and automotive manufacturing industries.

deakin.edu.au/research/ifm/

The Australian Future Fibres Research and Innovation Centre (AFFRIC) is a collaborative relationship between Deakin and its partners. AFFRIC conducts research that focuses on all aspects of fibre manufacturing, with four key theme areas. The Carbon Nexus facilty will deliver the world's first, dedicated, pilot scale research plant capable of producing industrially relevant quantities of aerospace-quality carbon fibre as well as enabling research into the chemical, mechanical and nanoscale characteristics of the carbon fibre product.

deakin.edu.au/affric/about.php

DEAKIN UNIVERSITY

Deakin University is one of Australia's largest and fastest growing universities, providing learning, teaching and research opportunities across multiple campuses and innovative use of online technology through Cloud Deakin. World university rankings evidence Deakin's well established reputation for excellent teaching, innovative course delivery, high level student satisfaction and world-class research aligned to industry and community needs.

Deakin undertakes research in Advanced Manufacturing through its research centres, the Institute for Frontier Materials and the School of Engineering. It collaborates with a wide range of industry partners and government to develop next generation technology platforms and enhance innovation capabilities in the manufacturing sector in Australia and beyond.

Deakin University offers relevant study at undergraduate and postgraduate levels including PhDs.

The Centre for Intelligent Systems Research (CISR) works with major industry and government research partners to provide methodologies and tools to extend the capability of human decision makers and operators in the domains of infrastructure, health, security and defence, through increased autonomy of data collection, analysis and actuation.

deakin.edu.au/research/cisr/

The School of Engineering's key research pillar of Advanced Design includes specialist expertise in additive and subtractive manufacturing for future-focused and non-traditional engineering areas such as medical, sports and other highly customised areas. The state-of-the art Centre of Advanced Design and Engineering Training will house the latest virtual and physical prototyping equipment for advanced manufacturing and provide a level of expertise and capability previously unseen in such an environment.

deakin.edu.au/engineering/cadet

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LA TROBE UNIVERSITY • AUSTRALIA

Key areas of expertise

Department of Electronic Engineering

- Communications Systems
- Signal and Image Processing
- Radio Frequency Design, Radar, Remote Sensing Technologies, Sensor Networks
- Robotics, Automation and Mechatronics
- Automotive, Electric Vehicle Technologies and Motor Control

Department of Physics

- Nanotechnology and Condensed Matter Physics
- Advanced Surface Analysis and Surface Science
- Nanoscale Characterisation
- X-ray Tomography and Imaging
- Instrument Design and Fabrication

Centre for Technology Infusion

- Micro/nanotechnologies
- Wireless Systems and Sensors
- Embedded Systems
- System-on-a-chip

Research/program delivery capabilities

The Department of Electronic Engineering has strengths in the areas of Electronics Engineering, Communications Systems, Signal Processing, Mechatronics and Robotics and offers undergraduate and postgraduate degrees, fully accredited by Engineers Australia.

It collaborates with a range of research institutions and industries, both in Australia and internationally, and has partnerships with a wide range of industry sponsors who offer industry-based learning, cadetships, and work experience. The Department has state-of-the-art facilities for the design and implementation of industry-related projects in its courses.

latrobe.edu.au/ee

LA TROBE UNIVERSITY

La Trobe University is a multi-campus university that is ranked 11th in Australia and third in Victoria for research by Excellence in Research for Australia (ERA); the Times Higher Education Rankings also placed La Trobe 88th in the Top 100 Universities Under 50.

La Trobe offers cutting-edge research and education expertise in Advanced Manufacturing in the Departments of Electronic Engineering and Physics. Specialised facilities include robotics, automation and mechatronics laboratories, a specialised mechanical design workshop, a microelectronics fabrication and development laboratory, and 24-hour access to computer laboratories equipped with state-of-the-art industry-related technology and software.

La Trobe's Centre for Technology Infusion focuses on strategic and translational research and innovation, integrating complementary research expertise in micro/nanotechnologies and ICT.

The Department of Physics has R&D and consulting relationships with more than 40 Australian and international companies in the manufacturing, chemicals, pharmaceuticals and mining sectors.

Its highly ranked advanced functional materials and condensed matter physics research program is supported by world-class surface science resources, unique synchrotron instrumentation and an extensive, long-standing international synchrotron research program.

latrobe.edu.au/physics

The Centre for Materials and Surface Science, in collaboration with the Australian National Fabrication Facility and the Victorian Centre for Advanced Manufacturing, has flagship activities in the design and fabrication of complex instrumentation and offers a comprehensive surface analysis capability.

latrobe.edu.au/surface

The Centre for Technology Infusion (CTI) is a Research and Innovation Centre with strong capabilities in micro/nanotechnologies, wireless systems and sensors, embedded systems and system-on-a-chip. A strategic priority of the Centre is to further develop collaborative relationships nationally and internationally with partnership stakeholders including universities, research institutes, governments and industry.

latrobe.edu.au/technologyinfusion

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MONASH University

Key areas of expertise

- Additive Manufacturing
- Advanced Polymer Science and Engineering
- Advanced Light Alloys
- Adsorption Processes
- Biomaterials and Tissue Engineering
- Biochemical Engineering
- Chemical Reactor Engineering
- Coal Conversion Processes
- Corrosion
- Electronic and Magnetic Materials
- Engineering Alloys
- Materials Characterisation
- Medical Bionics
- Modelling and Simulation of Materials and Processes
- Nanostructured Materials and Membranes
- Particle Technology
- Rheology
- Structural and Functional Ceramics

Research/program delivery capabilities

Monash University has a long history of working with companies in a number of leading-edge areas through a range of funding mechanisms, including Linkage Project grants, cooperative research centres and via contract research.

This includes working with companies to make:

- lighter engines to reduce fuel consumption and noxious emissions
- bottles out of renewable plastics from plants, not petrochemicals
- cheap solar cells that can be printed like plastic money on polymer substrates
- large components for the aerospace industry
- improved magnets
- 'direct to brain' bionic eye to improve sight for people who are blind due to conditions such as glaucoma, macular degeneration and diabetic retinopathy.

MONASH UNIVERSITY

Monash University has become the largest university in Australia, renowned for outstanding teaching, transformative research, international reach and extensive alumni network. Monash is a global university possessing the ambition and ability to address momentous global challenges. Monash has campuses in Australia, Malaysia and South Africa and major partnerships with universities in China, India and the UK.

Monash researchers make a unique contribution to the design of new products and making existing products work better by improving or altering the materials and technologies involved.

Whatever the application, the focus is on making "smart" technologies that are able to sense their environment – be it at the bottom of the ocean or inside the human body.

The tools used to take innovations from experimental processes through to application cover the range of modern engineering techniques, all the way from the atomic scale, through the nanoscale, to the industrial scale.

Monash researchers and industry partners have access to unique, large-scale facilities, including:

- Monash Centre for Additive Manufacturing
- Monash Centre for Electron Microscopy
- The Australian Synchrotron
- Melbourne Centre for Nanofabrication
- Green Chemical Futures.

In addition to expertise across the University, our New Horizons facility brings together Monash and Commonwealth Scientific Research and Industrial Research Organisation (CSIRO) researchers in a purpose-built facility designed for research on modelling and simulation, biological engineering, renewable energy and supported by the latest in virtual engagement and telepresence platforms.

Research interests include:

Modelling and Simulation: Multi-scale modelling with relevance to chemical, mechanical, and aerospace engineering.

Biological Engineering: including the manufacture of nanoparticles for drug delivery into cells.

Renewable Energy: producing the next generation of photovoltaic and solar hydrogen technologies.

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Key areas of expertise

- Engineering Technology
- Manufacturing Engineering
- Mechanical Engineering
- Metal Fabrication/Welding
- Security Technology/Locksmithing
- Jewellery Manufacturing

Research/program delivery capabilities

NMIT has over 100 years' experience as a leading trainer in manufacturing.

Its dedicated industry-experienced teachers use their wealth of experience, focusing on workmanship, instilling a sound work ethic and developing skills that are in demand in industry.

Classes are run at the Heidelberg and Fairfield campuses in industry-standard training facilities, including a robotics simulation laboratory, AutoCAD training centre, fully equipped industry-standard workshops and high-tech welding facilities.

NMIT is the major training institution for locksmithing and security technology in Australia and New Zealand.

NMIT

NMIT's Mechanical Manufacturing Department is located at its Heidelberg campus and has apprenticeship, certificate, diploma and advanced diploma courses covering Engineering Technology, Manufacturing Engineering, Mechanical Engineering, Metal Fabrication/Welding, Security Technology/Locksmithing and Jewellery Manufacturing.

A list of current programs is maintained at:
nmit.edu.au/departments/mechanical_manufacturing

NMIT also designs and conducts customised training to meet industry needs.

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nmit.edu.au

RMIT UNIVERSITY

Key areas of expertise

The School of Aerospace, Mechanical and Manufacturing Engineering

- Renewable energy park
- Industrial wind tunnel
- Fully operational aircraft
- Dynamics and control equipment
- Advanced manufacturing cells
- High-performance engine testing facilities

Laboratories for:

- Noise vibration
- Robotics and automation
- Composites
- Advanced materials testing
- Simulated aircraft maintenance
- Computers

Advanced Manufacturing Precinct

- Additive and subtractive process manufacturing in a range of materials
- High-speed multi-axis machining centres
- Reverse engineering
- 3D printing
- Industrial automation and robotic technology

RMIT Green Engines Research Facility

- Research into sustainable automotive technologies
- Investigations of combustion and fuel delivery systems for alternative fuels

Research/program delivery capabilities

The Advanced Manufacturing Precinct houses some of the most advanced additive manufacturing technology available. The Precinct assists in the training of the next generation of engineers, designers and technicians, in close partnership with industry in a collaborative "learning factory" environment. Industry practitioners work together with academic staff to scope and supervise projects. Experienced engineers support the training by making sure it is aligned to cutting-edge professional and industry needs.

RMIT UNIVERSITY

RMIT is a global university of technology and design with campuses in Australia and Vietnam, and international partners worldwide. RMIT is ranked 20th in the world among universities less than 50 years old.

RMIT's Advanced Manufacturing Precinct brings together expertise in innovative technology and design, including 3D printing and reverse engineering. RMIT Green Engines Research Facility enables research into sustainable automotive technologies.

RMIT's School of Aerospace, Mechanical and Manufacturing Engineering has achieved successes in advanced design and manufacturing in the renewable energy, aviation and automotive industry sectors.

By sponsoring projects, companies have access to the latest research and technology and obtain direct assistance on product design and manufacturing problems. Current links with industry enterprises include Rolls-Royce, Volkswagen, Siemens, Airbus and Bosch. We also deliver tailored training programs for organisations globally.

rmit.edu.au/advancedmanufacturing

The School of Aerospace, Mechanical and Manufacturing Engineering is recognised for its work-relevant education programs, cutting-edge research facilities, creative real-world project work and relationships with local and international industry leaders.

Capabilities include:

- design of high-performance racing cars, including solar, hydrogen, electric
- energy conservation and renewable energy technologies
- leading in virtual engineering technologies
- advancing the capabilities of a heavy-lift helicopter
- innovation in sports engineering resulting in cutting-edge sports technologies for able-bodied and disabled athletes.

The School is actively involved with:

- Sir Lawrence Wackett Aerospace Centre: rmit.edu.au/reseach/wackett
- Cooperative Research Centre for Advanced Automotive Technology
- Defence Materials Technology Centre
- Cooperative Research Centre for Advanced Composite Structures.

rmit.edu.au/aeromecheng

RMIT Green Engines Research Facility is:

- Supporting leading-edge experiments on alternative fuels for advanced and more efficient internal combustion engines
- Undertaking research into sustainable automotive technologies
- First of its kind in Asia-Pacific region

Key contacts

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SWINBURNE UNIVERSITY OF TECHNOLOGY

Key areas of expertise

- Advanced nano/biophotonics
- Advanced tooling for integrated composite structures
- Biointerface engineering
- Deposition technologies
- Electron microscopy and characterisation
- High-performance machining of titanium and aluminium alloys
- High-temperature processing
- Hybrid metal-composite components
- Rapid prototyping
- Robotics and non-contact inspection

Research/program delivery capabilities

Swinburne provides innovative manufacturing research and education to individuals, industry and government. It performs long and short-term research activities, including fundamental research and technique development and feasibility studies, and offers customised short-term training and degree courses. Swinburne's success is based on understanding customer requirements, appreciating worldwide market competition, a capacity to capture future technology trends and recognition of time-to-market constraints.

SWINBURNE UNIVERSITY OF TECHNOLOGY

Swinburne is an internationally recognised research-intensive university. Its emphasis is on high quality, engaged teaching and research in science, technology and innovation.

In 2014 the new A$100 million Advanced Manufacturing and Design Centre opens. The centre will provide a purpose-built teaching and learning environment for engineering, design, business and information technology students.

Swinburne's advanced manufacturing research focuses on innovations for a strong and sustainable manufacturing sector. Strengths include strategic design and the development and application of new and emerging technologies and materials. The core area of interest is surface science and interface engineering.

Swinburne offers master and graduate certificate-level courses in advanced manufacturing technology.

www.future.swinburne.edu.au/courses/study-themes/engineering

In the Australian Government's Excellence in Research for Australia 2012 report, Swinburne was awarded an ERA 4 (above world standard) rating for research in optical physics (the highest rated university in Victoria) and materials engineering.

Research areas

- Australian Advanced Manufacturing Research Centre **swinburne.edu.au/engineering/ausamrc**
- Centre for Micro-Phonotics **swinburne.edu.au/engineering/cmp**
- High Temperature Processing Research Group **swinburne.edu.au/engineering/cmp**
- Industrial Research Institute Swinburne **swinburne.edu.au/engineering/iris**

Industry and Organisational links

- Advanced Manufacturing Cooperative Research Centre
- ARC Centre of Excellence for Ultrahigh bandwidth Devices for Optical Systems
- Ausmelt
- Boeing
- Cooperative Research Centre for Polymers
- CSIRO
- Defence Materials Technology Centre
- Lovitt Technologies Australia
- Melbourne Centre for Nanofabrication
- OneSteel
- Sandvik Australia
- Victoria-Suntech Advanced Solar Facility

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THE UNIVERSITY OF MELBOURNE

Key areas of expertise

- Nanotechnology
- Chemical and Biomolecular Engineering
- Biomedical Engineering
- Automotive Engineering
- Robotics
- Wireless Sensor Network Technology
- Cloud and Grid Computing Technologies for business
- Sensor Networks for Smart Cities
- Sustainable Transport
- Advanced Optimisation Tools
- Advanced Smart Materials
- Materials Conservation
- Materials for Medicine
- Quantum and Nanophotonic Materials
- Materials for Energy
- Materials Processing

Research/program delivery capabilities

Key University of Melbourne initiatives in advanced manufacturing include:

Melbourne School of Engineering

Melbourne School of Engineering is an international leader in Engineering and IT research. It is home to large-scale research consortia such as Bionic Vision Australia. It has close, ongoing partnerships with IBM, Bell Labs/Alcatel Lucent and Ford and works at project level with many more private and public sector organisations in Australia and internationally.

eng.unimelb.edu.au/research

UNIVERSITY OF MELBOURNE

The University of Melbourne is a public-spirited institution that makes distinctive contributions to society in research, learning and engagement and is ranked number one in Australia and 34 in the world for the quality of its research.

The University's researchers are at the forefront of international scholarship in fields as diverse as nanotechnology, novel sensors and wireless sensor network technology, functional and smart materials, polymer science, drug design and delivery.

Students interested in advanced manufacturing careers may undertake relevant bachelor, master-level and research degrees across the sciences and engineering.

Bionic Vision Australia

Bionic Vision Australia (BVA) is a partnership of world-leading Australian research institutions collaborating to develop an advanced retinal prosthesis or bionic eye to restore the sense of vision to people with degenerative or inherited retinal disease. The partnership brings together world-leading experts in ophthalmology, bioengineering, material biocompatibility, vision science and wireless integrated circuit design.

bionicvision.org.au

Bio21 Institute

Bio21 Molecular Science and Biotechnology Institute (Bio21) is a multidisciplinary research centre, specialising in medical, agricultural and environmental biotechnology. Bio21 is focused on translating biological discoveries into biotech outcomes. It collaborates with a wide range of industry partners to deliver applied solutions.

The Bio21 Institute is one of the largest biotechnology research centres in Australia. The Institute is the flagship of the Bio21 Cluster project, which includes 21 member institutions recognised for research excellence and translational outcomes in medical and biomedical science and biotechnology.

bio21.unimelb.edu.au

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The Melbourne: Research, Education and Training series profiles the capabilities of Victorian education providers across 13 sectors:

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