

MELBOURNE SCHOOL OF ENGINEERING

DP0988242 Dr TJ Baldwin; A/Prof S Bird

Approved Project Title **Online linguistic exploration: deeper, faster, broader language documentation**

2009 : \$ 57,000

2010 : \$ 59,000

2011 : \$ 60,000

Primary RFCD 3802 LINGUISTICS

Project Summary

This project will develop a new online mode for collaborative linguistic research. Linguists will be able to harness the power of natural language processing techniques for their study of the world's languages. A demonstration system will be developed, permitting linguists to locate examples of syntactic constructions in a large database of parsed text, and to explore similarities across different languages. The project will also encompass a selection of minority languages for which only a small amount of data is available.

DP0984915 Dr A Blencowe

Approved Project Title **The development of unique cyclic polymers**

2009 : \$ 100,000

2010 : \$ 90,000

2011 : \$ 80,000

Primary RFCD 2505 MACROMOLECULAR CHEMISTRY

APD Dr A Blencowe

Project Summary

The project will yield cyclic polymers with a large range of commercial and industrial applications (e.g. drug delivery, contamination clean-up, nano-wires, sensors) that will result in positive economic and social benefits for Australia. The research will lead to increased employment opportunities within the manufacturing industry and R&D, and also underpin and extend Australia's leading position in the development of innovative polymeric and advanced materials. The resulting materials will provide new and improved technological innovations for commercial products, delivering benefits direct to the public. Furthermore, there is potential development of spin-off companies - leading to further investment in Australian science and industry.

DP0986577 A/Prof MW Cantoni; Dr L Ntogramatzidis

Approved Project Title **Modelling and estimation methods for discrete multi-dimensional systems**

2009 : \$ 95,000

2010 : \$ 90,000

2011 : \$ 90,000

Primary RFCD 2802 ARTIFICIAL INTELLIGENCE AND SIGNAL AND IMAGE PROCESSING

APD Dr L Ntogramatzidis

Administering Organisation The University of Melbourne

Project Summary

Multi-dimensional signal processing plays a role in a variety of application areas, ranging from remote sensing for environmental monitoring and geological mapping, to medical imaging and the automatic control of industrial processes. The success of the project will provide mathematical tools for the advancement of the state-of-the-art in these broad areas.

Summary of Discovery Projects Proposals for Funding to Commence in 2009

DP0986384 Prof DY Chan; Dr RR Dagastine; Prof F Grieser; Prof GW Stevens; Dr S O'Shea; Prof Dr H Butt; Dr E Klaseboer

Approved Project Title **An integrated study of dynamic interactions in soft matter systems**

2009 : \$ 140,000

2010 : \$ 135,000

2011 : \$ 145,000

Primary RFCD 2918 INTERDISCIPLINARY ENGINEERING

Administering Organisation The University of Melbourne

Project Summary

Established Australian pharmaceutical, dairy and food processing industries and growing high-value biotechnology and nanotechnology rely on the processing and control of a generic class of materials called Soft Matter. Cost driven demands for high throughput and increasing water and energy conservation requirements will be met by advances in the underpinning engineering science pursued in this project. In addition to increasing the international competitiveness of Australian industries in high value products, the research outcomes also add to the knowledge capacity of the nation for future technological developments.

DP0985397 Prof S Dey; A/Prof GN Nair; Mr AS Leong

Approved Project Title **Resource-aware Signal Processing and Control Algorithms for Networked Sensor Systems**

2009 : \$ 130,000

2010 : \$ 95,000

2011 : \$ 105,000

Primary RFCD 2801 INFORMATION SYSTEMS

APD Mr AS Leong

Administering Organisation The University of Melbourne

Project Summary

Networked sensing and control is an important technology for Australia's future. Applications range from monitoring wildlife habitats to safety management of large civil structures. This project will lead to sustainable engineering solutions for these applications and provide key fundamental performance limits. Beyond the creation of new theory and algorithms, the national and community benefits will include: (i) enhancement of Australia's reputation for innovative Engineering research through quality publications and international collaborations; and (ii) improvement of the research and development capability in the ICT sector through rigorous training of postgraduate students and postdoctoral fellows.

DP0985970 A/Prof GV Franks; Prof WA Ducker; Prof FF Lange

Approved Project Title **Controlling Anisotropic Growth of Metal Oxide Crystals in Aqueous Solution by Selective Adsorption of Small Molecules**

2009 : \$ 100,000

2010 : \$ 90,000

2011 : \$ 105,000

Primary RFCD 2914 MATERIALS ENGINEERING

Administering Organisation The University of Melbourne

Project Summary

The proposed research will enhance our ability to make both light emitting diodes (LEDs) and piezoelectric actuators from ZnO. LEDs are a high efficiency light source that save energy compared to conventional illumination sources and can be fabricated in thin films. The proposal is to also bring the technology for device fabrication to Australia where it can ultimately be used to broaden the economic base of the country. The knowledge of crystal growth rate and crystal morphology control can be applied to improvements in the efficiency of alumina production which is already an important contributor to Australian exports.

Summary of Discovery Projects Proposals for Funding to Commence in 2009

DP0984862 A/Prof SV Hanly; A/Prof JS Evans; Prof S Dey; Prof DN Tse

Approved Project Title **Closing the Gap: Fundamental Capacity Limits for Interfering Wireless Networks and Practical Methods to Get There**

2009 : \$ 205,000

2010 : \$ 140,000

2011 : \$ 140,000

2012 : \$ 130,000

Primary RFCD 2805 DATA FORMAT

Administering Organisation The University of Melbourne

Project Summary

Enhancing communication networks to achieve broadband data rates is now a national priority. Wireless communications is hugely important, with mobile phones, wireless computers, and wireless Internet access to homes, all rapidly growing areas. This project addresses the fundamental bottleneck of interference between links in wireless networks. Wireless unplugs the user and allows him/her to roam, and to set up ad-hoc networks with other users. This research will thus contribute to Australia's increased productivity. Just as importantly, this project addresses fundamental research; it will increase Australia's knowledge base and provide training for students and researchers in how to think about communications problems.

DP0987558 A/Prof M Kuijper

Approved Project Title **Smart coding for improved performance of complexity constrained devices**

2009 : \$ 85,000

2010 : \$ 80,000

2011 : \$ 80,000

Primary RFCD 2805 DATA FORMAT

Administering Organisation The University of Melbourne

Project Summary

The technical innovations of this project have the potential to have an immediate impact on compression technology. The overall expected outcome of the project consists of new compression algorithms for the Australian telecommunications industry. The novel outcomes of the project lead to better quality images in video mobile communications applications. As such, the project operates at the forefront of innovative next generation mobile video telephony.

DP0984577 Prof I Marusic; Dr C Manzie; Prof M Krstic

Approved Project Title **Practical wall-turbulence drag reduction through adaptive control**

2009 : \$ 220,000

2010 : \$ 150,000

2011 : \$ 170,000

Primary RFCD 2918 INTERDISCIPLINARY ENGINEERING

Administering Organisation The University of Melbourne

Project Summary

Long term increases in the price of aviation fuel disproportionately impacts on Australian carriers, given our geographic isolation and the resulting greater percentage of long-haul flights. The resulting higher fares will also have a direct impact on international tourism to Australia. One way to reduce the impact of rising fuel cost, and to reduce CO2 and other emissions at the same time, is to decrease drag on aircraft. This project will develop understanding in wall turbulence and adaptive control, and use this to experimentally demonstrate active reductions in skin friction drag. The results are equally applicable to a range of other applications including sea transport, pipe flows and combustor designs.

Summary of Discovery Projects Proposals for Funding to Commence in 2009

DP0988210 Prof W Moran; Dr SD Howard; Prof AR Calderbank

Approved Project Title **Mathematical Foundations of Distributed Radar**

2009 : \$ 135,000

2010 : \$ 130,000

2011 : \$ 125,000

Primary RFCD 2802 ARTIFICIAL INTELLIGENCE AND SIGNAL AND IMAGE PROCESSING

Administering Organisation The University of Melbourne

Project Summary

Conventional military threats to Australia are large or fast moving objects such as ships and aircraft and conventional radar systems are designed to handle such threats. Recent global political shifts have changed the threats to include objects that are small and slowly moving, such as people, small vehicles and boats. Advances in radar hardware make feasible small, low-powered, devices with inherently reduced performance in comparison to deployed systems. Methods for information integration over a dispersed system of such small devices, design of suitable waveform suites and clever local signal processing algorithms will be developed to achieve the performance improvements the hardware offers, to handle the new threats.

DP0985388 Prof D Nestic; Dr Y Tan; Dr C Manzie; Prof IM Mareels

Approved Project Title **Extremum seeking control: analysis, design and applications**

2009 : \$ 135,000

2010 : \$ 100,000

2011 : \$ 110,000

Primary RFCD 2301 MATHEMATICS

Administering Organisation The University of Melbourne

Project Summary

Optimal control is one of the central pillars in the field of automatic control, but is prevented from use in many engineering applications due to the computational complexity and system knowledge requirements typically associated with the technique. Extremum seeking promises the performance of an optimal approach, but with the benefit of real time implementation and very relaxed requirements on the system knowledge. Through improved understanding of extremum seeking algorithms, applications from vehicle dynamics to emissions reduction to manufacturing processes will benefit with greater levels of performance and robustness.

DP0988427 Dr P Pivonka; Prof DW Smith

Approved Project Title **Multi-scale modeling of transport through deformable porous materials**

2009 : \$ 170,000

2010 : \$ 140,000

2011 : \$ 140,000

Primary RFCD 2908 CIVIL ENGINEERING

Administering Organisation The University of Melbourne

Project Summary

Understanding solute transport through porous materials is essential because it provides a technical basis for answering many important questions in society today-how can humans avoid 'brittle bones', how to design durable infrastructure, how to safely store wastes (e.g. hazardous and municipal). Solution of each of these problems requires innovation in model development, new method of analysis, and insightful interpretation of results. While theoretical developments of this project are general, in the sense that they are not restricted to particular engineering disciplines, the four chosen applications closely align with two major research priorities namely An Environmental Sustainable Australia and Promoting and Maintaining Good Health.

Summary of Discovery Projects Proposals for Funding to Commence in 2009

DP0986271 A/Prof GG Qiao

Approved Project Title **Building advanced polymeric nanotubes for targeted drug delivery**

2009 : \$ 60,000

2010 : \$ 50,000

2011 : \$ 50,000

Primary RFCD 2505 MACROMOLECULAR CHEMISTRY

Administering Organisation The University of Melbourne

Project Summary

Advanced drug delivery devices have major commercial applications in fighting diseases like cancer and infectious viruses. The success of this project will provide fundamental knowledge for the design of new drug delivery devices based on polymeric nanotubes. The project will also further advance Australia's nano- and bio-technological research and industries. This project will also provide additional benefit for developing controlled release systems in drug delivery and artificial vessels, and improve sensitivity in molecular sensors. The pioneering work proposed will ensure that Australia remains at the forefront of innovative scientific research within the rapidly advancing disciplines of nanotechnology and novel macromolecular design.

DP0988725 Dr W Shieh

Approved Project Title **Optical Multiple-Input Multiple-Output Communication Systems**

2009 : \$ 100,000

2010 : \$ 80,000

2011 : \$ 100,000

Primary RFCD 2917 COMMUNICATIONS TECHNOLOGIES

Administering Organisation The University of Melbourne

Project Summary

Optical multiple-input multiple-output (MIMO) systems exploit a simple yet powerful principle of diversity to improve the capacity and robustness of optical networks. This proposal focuses on making the most use of two polarisation modes intrinsic to the fiber by applying MIMO techniques to the optical communication systems. This project can potentially create many commercial opportunities in Australia in the area of integrated photonic circuits and high-speed digital signal processing. The funding support of these research activities will further enhance Australia's international ICT reputation in this emerging field.

DP0988001 Prof DW Smith; Dr BS Gardiner; Prof AJ Grodzinsky

Approved Project Title **Engineering cartilage homeostasis in health and disease**

2009 : \$ 80,000

2010 : \$ 75,000

2011 : \$ 75,000

Primary RFCD 2915 BIOMEDICAL ENGINEERING

Administering Organisation The University of Melbourne

Project Summary

Arthritis is a common, painful and often debilitating disease affecting 16% of the Australian population and costing this community \$11 billion every year. It is not well understood why cartilage degenerates into joint disease, nor how it may be reversed - partly due to the large number of mechanisms involved. This project aims to overcome this complexity by developing a computational model of cartilage that can integrate the various mechanisms of cartilage degradation. New experiments will be used to validate the model and test predictions. The model developed will provide fundamental insights into what is required for the maintenance of healthy cartilage, and what happens in injury-induced degradation of cartilage.

Summary of Discovery Projects Proposals for Funding to Commence in 2009

DP0986222 Dr GK Such

Approved Project Title **Synthesis and Functionalisation of Advanced Polymer Films and Particles.**

2009 : \$ 100,000

2010 : \$ 100,000

2011 : \$ 100,000

Primary RFCD 2505 MACROMOLECULAR CHEMISTRY

APD Dr GK Such

Administering Organisation The University of Melbourne

Project Summary

Scientific and technological advances at the frontiers of nano- and biotechnology are poised to revolutionise the scope of treatment and healthcare options. This project will involve the synthesis of engineered polymer building blocks with the capability for multifunctional and intelligent response. These smart polymers will then be assembled into responsive nanostructured materials for drug delivery and biosensing applications. These materials are expected to have health benefits for Australian citizens and will contribute to a world-leading nanobiotechnology industry. The project will also provide development opportunities for young scientists and will also foster multidisciplinary collaborations within both Australia and abroad.

DP0987767 Prof RS Tucker; A/Prof C Lim; Dr G Shen; Dr AV Tran; Dr E Wong

Approved Project Title **Delivering Next-Generation Broadband Internet Access to Australia: Integration of Broadband Optical and Wireless Networks**

2009 : \$ 205,000

2010 : \$ 140,000

2011 : \$ 140,000

2012 : \$ 190,000

2013 : \$ 195,000

Primary RFCD 2917 COMMUNICATIONS TECHNOLOGIES

Administering Organisation The University of Melbourne

Project Summary

Provision of broadband services is a high priority for the Australian government as evidenced by a range of initiatives costing more than \$4 billion. Especially, the integration of optical and wireless broadband access will potentially provide inexpensive and efficient solutions to customers. Building on the strength of existing photonics and wireless industries in Australia, direct and indirect outcomes of this project can lead to new business opportunities and will further strengthen the growing local telecommunication industries. It is also anticipated that national and international collaboration will generate further research activities and significantly enhance the existing reputation of Australian research capabilities.

DP0985673 Dr DN Veitch; Prof FL Baccelli

Approved Project Title **Enabling Reliable, Efficient, and Secure Networks: Next Generation Measurement for the Internet**

2009 : \$ 150,000

2010 : \$ 80,000

2011 : \$ 95,000

Primary RFCD 2917 COMMUNICATIONS TECHNOLOGIES

Administering Organisation The University of Melbourne

Project Summary

Like the electricity network, the Internet is a core infrastructure connecting society, and so must be reliable, efficient, and secure. A gap in bandwidth supply is like a blackout in terms of lost business, productivity and essential data. Inefficiency increases costs as more equipment is needed for the same service, and poor security threatens both the economic and personal spheres, limiting freedom and adding cost. A raw material of network health and security is network measurements showing what is going on. However, current methods cannot cope with the size and speed of today's Internet. This project will provide the measurement breakthroughs necessary to ensure that networks are reliable, secure, and fairly priced.

Summary of Discovery Projects Proposals for Funding to Commence in 2009

DP0984586 A/Prof JP Walker; Mr R Panciera; Dr D Ryu; Prof DA Gray; Dr TJ Jackson

Approved Project Title **Active-passive microwave soil moisture remote sensing: Towards sustainable land and water management from space**

2009 : \$ 250,000

2010 : \$ 190,000

2011 : \$ 100,000

Primary RFCD 2605 HYDROLOGY

Administering Organisation The University of Melbourne

Project Summary

Soil moisture is a highly critical resource for the Australian agricultural economy which is stressed by climate change. Daily monitoring of paddock scale soil moisture from space represents a powerful tool to inform land management, allowing accurate crop yield and pasture growth predictions. At the continental scale, soil moisture information will result in better weather, climate and extreme flood prediction skill and the ability to assess the effects of future climate change on Australia. It is therefore imperative that active-passive soil moisture retrieval algorithms be developed specifically for the Australian environment in order to take full advantage of the SMAP remote sensing mission when it is launched in 2012.

DP0987738 A/Prof AW Western; Dr MR Grace; Prof JJ McDonnell; Prof RE White

Approved Project Title **An integrated investigation of nutrient generation and delivery processes and pathways from paddock to small catchment scales**

2009 : \$ 140,000

2010 : \$ 120,000

2011 : \$ 120,000

2012 : \$ 60,000

Primary RFCD 2605 HYDROLOGY

Administering Organisation The University of Melbourne

Project Summary

Improving water quality, primarily through reducing nutrient concentrations, remains a massive challenge for effective catchment management in Australia. Through a multidisciplinary approach including soil science, hydrology and aquatic chemistry, this project will develop an integrated catchment system understanding of water quality behaviour. This understanding will greatly improve the scientific underpinning of catchment water quality management and prediction, thus supporting improvements in the sustainability of Australia's water management. The work will focus on catchments with high intensity livestock grazing, which tend to be located in high rainfall areas near coasts where significant issues of water quality management exist.

DP0986162 Dr E Weyer

Approved Project Title **Algorithms for change detection based on finite sample system identification theory**

2009 : \$ 140,000

2010 : \$ 90,000

2011 : \$ 90,000

Primary RFCD 2909 ELECTRICAL AND ELECTRONIC ENGINEERING

Administering Organisation The University of Melbourne

Project Summary

Detection of abrupt changes has many important applications. One particular application that will be investigated is leak detection in irrigation channels. As agriculture accounts for about 80% of Australia's water usage, the timely detection of leaks means that corrective actions can be taken early which will lead to large water savings and significant environmental benefits. The developed methods can be designed with any false alarm rate. This is important since frequent false alarms lead to wasted resources and operators will stop using the system. The technology once developed can be transferred to many other application areas such as urban water supplies, pipelines for oil and gas, and the process and manufacturing industries.

Summary of Discovery Projects Proposals for Funding to Commence in 2009

DP0985322 Prof M Zukerman; A/Prof M Palaniswami; Dr LL Andrew; Dr Z Rosberg; Prof G Chen

Approved Project Title **Efficient and Fair Traffic Control for a Multi-Service Internet**

2009 : \$ 195,000

2010 : \$ 130,000

2011 : \$ 130,000

2012 : \$ 180,000

Primary RFCD 2917 COMMUNICATIONS TECHNOLOGIES

Administering Organisation The University of Melbourne

Project Summary

Australia relies very heavily on its telecommunications infrastructure due to its geographic dispersion. For the same reason, it cannot afford to invest in inefficient infrastructure. Our novel and practical Internet congestion control scheme will overcome current weaknesses in the Internet, and will enable the Australian telecommunication service industry to provide a better quality of service to the customers (including Australian industries and rural communities) and at lower cost. This project will put Australia on the international stage as a leading contributor to Internet technology. We will provide training for PhD students and postdoctoral fellows in the important area of Internet traffic engineering and control.

MELBOURNE SCHOOL OF ENGINEERING UOM CROSS FACULTY PROPOSALS (WITH FOS AND MHDS)

DP0985143 A/Prof GF Egan; Dr LA Johnston; Dr M Gavrilescu; Mr EP Duff

Approved Project Title **Investigating evidence of control system dynamics in visuomotor skill acquisition using multimodal functional magnetic resonance imaging.**

2009 : \$ 85,000

2010 : \$ 85,000

2011 : \$ 85,000

Primary RFCD 3801 PSYCHOLOGY

Administering Organisation The University of Melbourne

Project Summary

This project brings together mathematical and engineering methods with cognitive neuroscience in a novel way to better understand the fundamental processes associated with brain imaging, and the acquisition of motor skills. An improved understanding of the function of regions within the motor network will have a direct benefit for the rehabilitation of patients suffering motor deficits from developmental causes, following traumatic brain injuries, and after stroke and other neurodegenerative diseases. The outcomes of the research will also contribute to our understanding of the complexity of brain networks involved in motor skill acquisition.

DP0987971 Prof WA Morrison; Dr AJ O'Connor; A/Prof EW Thompson

Approved Project Title **Tissue distraction: A novel approach to enhance tissue growth for soft tissue engineering purposes**

2009 : \$ 170,000

2010 : \$ 140,000

2011 : \$ 140,000

Primary RFCD 2915 BIOMEDICAL ENGINEERING

Administering Organisation The University of Melbourne

Project Summary

This project will provide new tissues for the expanding field of regenerative medicine to treat numerous tissue defects and

1. Benefit the health & economic well being of Australian society by rapidly supplying organs and tissues.
2. Benefit the academic community by a multidisciplinary approach, involving several academic Institutions in the fields of surgery, tissue engineering, physiology, morphology, polymer chemistry & biomolecular engineering that will produce basic scientific data with a practical application. Post-graduate students and staff will train & gain significant knowledge in this area.
3. Benefit industry through new product development and IP. This project advances a platform technology with multiple applications.

Summary of Discovery Projects Proposals for Funding to Commence in 2009

DP0986384 Prof DY Chan; Dr RR Dagastine; Prof F Grieser; Prof GW Stevens; Dr S O'Shea; Prof Dr H Butt;
Dr E Klaseboer

Approved Project Title **An integrated study of dynamic interactions in soft matter systems**

2009 : \$ 140,000

2010 : \$ 135,000

2011 : \$ 145,000

Primary RFCD 2918 INTERDISCIPLINARY ENGINEERING

Administering Organisation The University of Melbourne

Project Summary

Established Australian pharmaceutical, dairy and food processing industries and growing high-value biotechnology and nanotechnology rely on the processing and control of a generic class of materials called Soft Matter. Cost driven demands for high throughput and increasing water and energy conservation requirements will be met by advances in the underpinning engineering science pursued in this project. In addition to increasing the international competitiveness of Australian industries in high value products, the research outcomes also add to the knowledge capacity of the nation for future technological developments.