

# IRANZ

## ANNUAL REVIEW

20

16



*creating a positive operating environment for Independent Research Organisations*



# Annual Review

*IRANZ: an association of independent research organisations*



20  
16

**“Science and everyday life cannot  
and should not be separated.”  
- Rosalind Franklin**

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# The year in review



## ROLE AND PURPOSE OF IRANZ

Independent Research Organisations (IROs) are a vital and unique part of the New Zealand Science ecosystem, they are all different and they are a great way of enabling New Zealand to increase high-impact research by business, economic sectors and the community. IROs consistently provide quality science outputs that provide high-impact results for their stakeholders and New Zealand. IRANZ represents the collective interests of members by undertaking activities to create a positive operating environment for Independent Research Organisations in New Zealand.

“IRANZ applauds Government’s ongoing commitment to increase, year-on-year, its research and development investment to drive growth in business investment in R&D and to create a thriving independent research sector. The funding increases announced in Budget 2016 will raise investment in science and innovation by 15% by 2019/20.”



## A WORD FROM THE CHAIR

**IROs (Independent Research Organisations) are a vital and unique part of New Zealand's science ecosystem**, they are all different and they are a great way of enabling New Zealand to increase high-impact research by business, economic sectors and the community. IROs consistently provide quality science outputs that provide high-impact results for their stakeholders and New Zealand.

IRANZ applauds Government's ongoing commitment to increase, year-on-year, its research and development investment to drive growth in business investment in R&D and to create a thriving independent research sector. The funding increases announced in Budget 2016 will raise investment in science and innovation by 15% by 2019/20.

We are very pleased to see new funding to grow the "Endeavour Fund" because of the increased opportunity it provides for independent research organisations to compete for funding to pursue new research ideas and collaborations. Without this investment the amount of competitive funding would have continued to trend downwards.

There is a very real risk that under current investment settings, high-impact strategic environmental research based on established scientific methods will not be funded from competitive funding pools. We hope that the Strategic Science Investment Fund (SSIF) announced in Budget 2016 will provide opportunity for Independent and Crown research organisations alike, to obtain funding for such research. IRANZ is committed to working with MBIE officials on the detailed design of the SSIF to help ensure that programmes funded by it are genuinely strategic and backed by a sound, strong business case.

It is good to see that the existing investment for Regional Research Institutes (RRIs) will be more than doubled. We would like to congratulate the New Zealand Research Institute of Viticulture and Oenology (NZRIVO) in Marlborough on their selection as the first new RRI. Two other RRI proposals have been shortlisted and a second RRI funding round is progressing. The Independent Research Organisation model has been adopted as a basis for the new institutes, which will

be a great way of engaging businesses and local communities in strategic research. IRANZ will welcome the new RRIs as members.

The Budget builds on the National Statement of Science Investment (NSSI) released last year. One of the NSSI elements was for the Government to support businesses in increasing their investment in R&D, with the aspirational goal of doubling business and enterprise research to well above one percent of GDP. IRANZ is keen to work with government and businesses to ensure a thriving independent research sector plays a key role in achieving this goal.

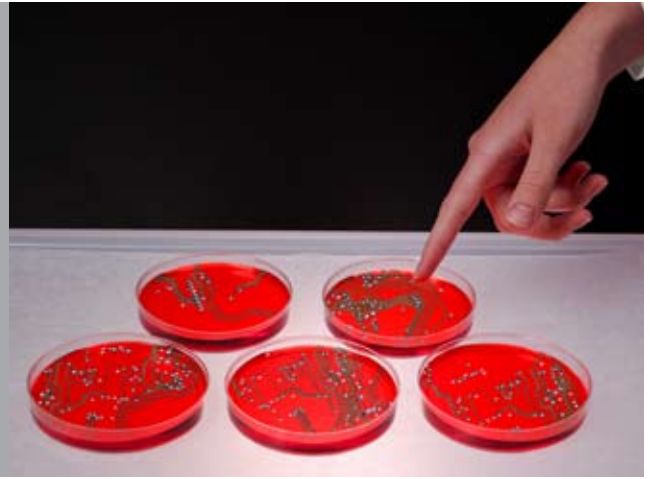


**Pesticide spray drift is an economic and environmental problem.**  
Photo: Lincoln Agritech.



Dr John Bright, IRANZ Chair.

**IRANZ members and our associates employ over 500 staff and have combined sales of \$80 million, including \$30 million of research investment from Government and \$30 million of stakeholder investment.**



## ABOUT IRANZ

**IRANZ is the peak body representing Independent Research Organisations.** Independent Research Organisations (IROs) are research organisations that have internal capability for carrying out research, science, technology, or related activities with ownership and governance independent of Government. IROs are not CRIs or universities, they have a variety of ownership structures including industry, private, public and community.

IRANZ members and our associates employ over 500 staff and have combined sales of \$80 million, including \$30 million of research investment from Government and \$30 million of stakeholder investment.

IRANZ members play an important role in collaborative research programmes with universities and CRIs, where we provide important industry and sector linkages to the programme. Some 25% of the research undertaken at IROs is as subcontracts to CRIs or university programmes, with around 10% of research led by IROs being contracted to other organisations.

IRANZ members are a key part of a thriving independent research sector that is a major pillar of the New Zealand science system, and a key to New Zealand achieving the goal of increasing business expenditure on research and development (BERD) to 1% of GDP by 2018.

IRANZ represents the collective interests of members by undertaking activities aimed at creating a positive operating environment for Independent Research Organisations in New Zealand. These activities include:

1. Providing a forum for IROs to discuss matters of common interest;
2. Raising the profile of IRANZ and its members with the Government (and their advisors) and the research community (partners);
3. Developing IRANZ policy positions on key issues, but only advocating to Government on issues that are important and where there is a clear collective requirement;
4. Sponsoring the Royal Society Speaker's Science Forum and other activities to promote science in the community; and
5. Disseminating news and success stories from IROs that demonstrate the wide impact of our members' work by means of our quarterly email newsletter *Connections* and our website.



Cawthron Institute freshwater scientist Dr John Hayes gets a closer look at a trout.  
Photo: Darryl Torckler.





Centre pivot spray irrigation at use on the farm. Photo: Aqualinc.

## STRATEGIC SCIENCE INVESTMENT FUND

CRI core funding, independent research organisation capability funding and MBIE research infrastructure investment will be combined into a single new Strategic Science Investment Fund (SSIF) worth nearly \$250 million per year. The SSIF will support underpinning research programmes and infrastructure of enduring importance to New Zealand, with funding allocated on merit for proposals that respond to the strategic scientific goals and priorities in the SSIF investment plan, rather than by organisation. All IRANZ members are keen to be part of contributing to a larger-scale research infrastructure that supports enduring priorities and a high-performing science system.

## ENDEAVOUR FUND

Contestable research is a fundamental part of the New Zealand research, science and technology environment, but over the years this investment has been eroded by new initiatives (e.g. Core Funding, Industry Capability Funding and National Science Challenges). The renaming to the Endeavour Fund, the focus on impact as well as research excellence, the broader strategic direction and the new investment signalled in the Budget are welcomed initiatives for contestable funding.

## NATIONAL SCIENCE CHALLENGES

The eleven National Science Challenges provide an opportunity to align and focus New Zealand's research on large and complex issues by drawing scientists together from different institutions and across disciplines to achieve a common goal through collaboration. The *Building Better Homes, Towns and Cities* Science Challenge is being led by an IRANZ member, BRANZ, while other IRANZ members are also involved in several other National Science Challenges, including the Cawthron Institute playing an active part in both *Sustainable Seas* and *High Value Nutrition* challenges.

## BUSINESS AND ENTERPRISE R&D

The Government's National Science Investment Strategy seeks to grow Business and Enterprise expenditure on R&D (BERD) to well above 1% of GDP by 2018. It sees this as driving a "thriving independent research sector that is a major pillar of the New Zealand science system". IRANZ members are excited to be part at this new growth area for New Zealand's research. A number of IROs are built around Industry Levies: collective investment by business and enterprise in R&D and other collaborative activities.

## CRL ENERGY LTD

**CRL Energy is an energy, minerals and environmental research and consulting company,**



offering specialist services that span the resource value chain. For the minerals sector, services include minerals-exploration programme management, geological mapping and 3D modelling, and resource evaluation and certification. Environmental services include hydrogeology, mine drainage treatment and site remediation, and workplace and domestic environmental testing. For the energy sector, CRL Energy offers coal-seam-gas content analysis, thermo-chemical conversion systems, pilot plant for combustion, carbonisation and gasification, and air emissions and stack testing.

### CRL Energy Ltd

CRL Energy's past and present Government-supported research programmes include environmental protocols for coal and mineral mining, coal gasification, clean energy production from coal and biomass, biorefining, and coal-based nanomaterials.

CRL Energy has a core staff of over 40 people, including on-call consultants, located in Lower Hutt, Christchurch, Hamilton and Greymouth. In 2013, the company was purchased by New Zealand Coal and Carbon Ltd (NZCC) from the Coal Association of New Zealand Inc. NZCC is New Zealand's largest privately-owned coal mining company.

NZCC wanted to ensure that independent and high-quality science and technology services remained available to this important sector of New Zealand's economy. NZCC also owns CRL Energy's spin-off company Nuenz, based at CRL Energy's Gracefield site.

## ENVIRONMENTAL COMPLIANCE

**A focus for CRL Energy this year** has been providing Environment Compliance Services to industry. CRL Energy is now offering contaminated-land investigation and workplace-monitoring services.

Workplace monitoring aims to evaluate the effectiveness of existing control measures and also identify and assess the source of potentially harmful workplace hazards including dusts and fumes, chemical vapours, asbestos, toxic gases, and noise. Testing is completed at fixed locations or using personal sampling devices that can be attached to employees during the course of their shift. The results help identify and evaluate the cause of a hazard in order to eliminate, isolate or minimise the hazard.

Capabilities have been expanded to include domestic environments. Two projects are underway, the first is over 18 months and looks at VOC emissions in building materials and is funded by the Building Research Levy. The second project is over four months and involves monitoring CO<sub>2</sub>, humidity, particulates and temperatures in several commercial premises across the Hutt Valley.

## IMPACTS OF MINING ON ENVIRONMENT

### **CRL Energy hosts the Centre for Minerals Environmental Research (CMER),**

which recently launched a website to provide research information and data to minerals sector stakeholders and the New Zealand public interested in the impacts of mining on the environment. The site boasts over 50 peer-reviewed scientific publications by members of the consortium, over 60 conference publications, and around a dozen student theses. A series of MBIE and industry-supported projects - the latest called *The New Zealand Mine Environment Life Cycle Guide* - brought the CMER research team together. The team is led by CRL Energy and made up of researchers from CRL Energy Ltd, Landcare Research, University of Canterbury, University of Otago, and University of Auckland.

A CMER programme successfully took out the top award at the 2014 Minerals West Coast Environment Awards. Research



carried out in the programme includes what can be predicted about acid mine drainage (AMD) and how this can be used to improve mine planning; what the environmental impacts of mine drainages are on ecology; and what management treatment and rehabilitation options are available, as well as how the best options are selected and applied.

*The Centre for Minerals Environmental Research team, which includes scientists from CRL Energy, specialises in the impacts of mining on the environment. Photo: CMER.*

## REDUCING GHG EMISSIONS

**For the past 12 years,** CRL Energy has provided synthetic-greenhouse-gas accounting to MfE as part of the annual New Zealand Greenhouse Gas Inventory. The programme requires detailed information gathering, gap filling for equipment retirement models and a close relationship with a range of industries in order to develop the quality dataset required by the UN Framework Convention on Climate Change.

Synthetic gases are used mainly in the refrigeration and electricity industries; CRL Energy scientists have noted that some emissions are increasing at a concerning rate.

The synthetic-greenhouse-gas accounting project is part of CRL Energy's commitment to the field of greenhouse gas mitigation, which also includes research into renewable fuels, carbon capture and storage, and industry consultancy on the impact of Government policy and carbon prices.

Policy and prices are at the forefront of thinking right now for CRL Energy's industry partners within the coal producer and user sectors.

After several years of relatively low prices in the New Zealand carbon market, prices have risen sharply. Many emitters,



## CB3 MINE SERVICES

A new company has been established in Australia, CB3 Mine Services Pty Ltd (CB3). CB3 is a joint-venture partnership between CRL Energy and B3 Mining Services Pty Ltd.



CB3 in conjunction with CRL Energy, provides a range of advanced laboratory tests that are leading practice in quantifying the spontaneous-combustion propensity of coal, metal concentrates and other materials. The research underpinning the development of services was supported by the Coal Association of New Zealand and Callaghan Innovation.

CB3 offers practical industry expertise in developing effective mitigation and spontaneous combustion management plans across the spectrum of operations including at the mine, in trains, at the port, and on ships. CB3 has two operational laboratories: one in Brisbane, Australia and one in Wellington, New Zealand. With customers from across Australia, Europe and the US, CB3 also offers expertise on gas, ventilation, dust, and friction ignition hazards in mines.

Over the past three years, more than 10 papers on spontaneous combustion, including the development of the new SponComSIM™ and SponComGAS™ tests, have been presented by CRL Energy and CB3 at conferences in the USA, New Zealand and Australia as well as Beijing, China (2013), Antalya, Turkey (2015) and Hohhot, Inner Mongolia (2015).

including coal users, are expecting further upward movement in carbon prices, perhaps as high as the current \$25 cap within two years.

Industry sectors are responding to these changes and CRL Energy is assisting them through business-led applied research and development to incorporate more renewable fuels, such as wood waste, into industrial energy systems. CRL Energy has research programmes developing blended biomass/coal fuels in pellet form from a variety of renewable resources and waste products and reconstituting biomass fuels for improved combustion properties.

CRL Energy, along with industry partners, has led the development of CCS initiatives in New Zealand. Capture technologies have been an ongoing research priority for CRL Energy, with developing Bio-CCS technologies and other negative emissions technologies (NETs). An increase in carbon prices will hopefully see a refocus of research funding for greenhouse gas mitigation that will provide practical solutions for industry.

## NUENZ MATERIALS

*Stronger, Lighter, Faster*



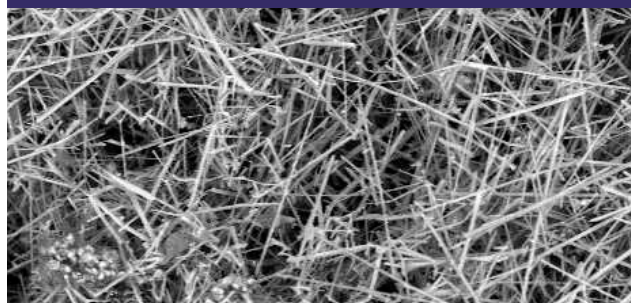
Nuenz, a CRL spin-out company from TechNZ-funded research work in coal-based nano-materials, specialises in a patented process for producing silicon nitride nanofibres.

The company is now the leading global supplier of silicon nitride fibre, which is supplied in various purity grades. Silicon nitride fibres are a technical ceramic with performance characteristics beyond most other materials.

The fibres are super-hard with a smooth crystalline morphology. They provide a superior composite performance due to the virtual elimination of crack-inducing angular structures. Unlike carbon fibres they are stable at high temperatures, so they can be used to reinforce metals and ceramics.

Nuenz's Chief Scientist presented work about Nuenz's advanced fibre additives in metal matrix composites - especially titanium and titanium alloys using powder metallurgy - at the TMS Powder Metallurgy of Light Metals Symposium in Nashville, Tennessee on 16 February 2016.

Dr Murray McCurdy, Chief Engineer at Nuenz and CRL Energy GM Research Strategy, addressed MPs at the Speaker's Science Forum in May this year about how Nuenz's silicon nitride nanofibres made from New Zealand sand, lignite and air are set to create a new class of titanium composite materials for the increasingly demanding material requirements of new technologies.



Scanning Electron Microscope image of F90 silicon nitride nanofibres. Photo: Nuenz.



**TiDA**

**TiDA Ltd is at the leading edge of titanium-based products** using powder metallurgy consolidation processes.

Titanium has the highest strength-to-weight ratio of any metal. Titanium metal is a light metal that is corrosion resistant, non-magnetic, non-toxic, biocompatible, it has a

high fracture toughness and it is one of the most abundant elements in the Earth's crust.



*Electron scanning microscope.*

leading-edge advances in complex parts and products. The metal is used to great effect in aerospace – 85% of the mass of the Lockheed SR71 Blackbird was titanium, enabling it to be the fastest air-breathing manned aircraft, a record still remaining unbeaten after 40 years. More recently, around 15% of the mass of the latest Boeing 787 Dreamliner is titanium,

Demand for titanium products has greatly increased over recent years, with consumer demand in laptops, mobile phones and sporting goods beginning to be significant.

Aerospace, medical and automotive industries use titanium to provide leading-edge advances in complex parts and products. The metal is used to great effect in aerospace – 85% of the mass of the Lockheed SR71 Blackbird was titanium, enabling it to be the fastest air-breathing manned aircraft, a record still remaining unbeaten after 40 years. More recently, around 15% of the mass of the latest Boeing 787 Dreamliner is titanium, contributing significantly to the performance and efficiency gains demanded by the aviation market. These and other drivers support a global titanium-metals market of approximately 230,000 tonnes in 2016, with compound growth being around 4.4% per annum.



*Sintering furnace.*

Exploiting the high-performance characteristics of this metal is strongly supportive of the wider drive in New Zealand away from commodity products, towards more value-added products, services and exports.

The opportunities to use titanium are limited only by imagination, and TiDA provides ground-breaking research and technology to provide industries with the best that titanium has to offer. TiDA's focus is on titanium alloy powder metallurgy. However, they can also apply their expertise to the broader topic of powder metallurgy and materials science.



*EOS 270 3D SLM Printer.*

With the support of New Zealand's Ministry of Business, Innovation and Employment (MBIE), the Tertiary Education Commission and a number of private sector companies, TiDA has evolved to support ongoing research and development in its field.

Working in close collaboration with Callaghan Innovation, GNS science and University of Waikato, TiDA contributes towards New Zealand's industry and economy by supporting commercialisation of high-value-added products and processes. This year has seen TiDA contributing to many projects in fields as diverse as aerospace, medical/dental, composite materials and high-energy particle physics.

TiDA's key roles are:

- » To introduce and promote titanium powder technology to the wider New Zealand industry;
- » To help companies improve their technology and techniques by providing the best possible product options;
- » To manage a research and testing facility, and conduct research programmes;
- » To support education in powder metallurgy and advanced manufacturing processes;
- » To attract and manage skills to the industry; and
- » To strengthen existing international links and help forge new ones.

On-site facilities include:

- » Electron scanning microscope;
- » Large vacuum furnace with de-binding system;
- » EOS 270 SLM 3D metal printing system;
- » Energy-dispersive X-ray spectroscopy (EDS) system for elemental analysis;
- » Electron backscatter diffraction (EBDS) system for crystallographic analysis of specimens;
- » Mount and polish for metallurgical microscopy samples;
- » Tensile testing, hardness tests, and laser particle sizing; and
- » 200 tonne press for sintering.

TiDA is located in Tauranga, and is well positioned to work with companies throughout New Zealand. It has strong



commercial ties with many international partners, maintaining its leading-edge technology and research.

TiDA is governed by a trust, overseeing the organisation's strategic

direction, and assisting in maintaining the close working relationships that have been forged with New Zealand researchers and businesses. These partners have a common aim in promoting and pushing the boundaries of titanium and powder metallurgy.



## RAM OUT GROWS ITS TiDA HOME

This year has seen TiDA spin-out company **Rapid Advanced Manufacturing (RAM)** develop to be a market-leading provider of 3D printed titanium, and other metal parts in New Zealand. RAM operates four advanced manufacturing systems based on the Selective Laser Melting (SLM) process, championed in New Zealand by TiDA.

The design flexibility and ability to customise parts on an individual basis has the SLM service in high demand from domestic and international customers across many sectors. The ability to provide titanium and other metal parts, with full-function material properties, individual component customisation, and no requirement for tooling offers a great opportunity for the creative design engineer - the flexible SLM process being particularly suited to many prototype and niche products.

As awareness of the process capability grows, demand for the service and growth for RAM is set to expand.

As a result, RAM outgrew its location in the TiDA facility in October this year, and moved to a purpose-built facility at Tauriko on the south western side of Tauranga. The state-of-the-art building has the space for continuing expansion of RAM's manufacturing and product-design services. RAM continues to draw upon the facilities and capability of TiDA to support quality-control testing and scientific developments. The new facility was officially opened by Stephen Joyce on 11 November 2016.



RAM's new home at Tauriko.

## PRINTING OUR WAY TO OLYMPIC GLORY



Printing for Team NZ Cycling; lightweight titanium handlebar extensions.

TiDA's spin-off company Rapid Advanced Manufacturing (RAM) printed the necessary titanium parts to help some of New Zealand's athletes achieve Olympic glory at Rio this year.

Two of New Zealand's 2016 Olympic teams were supported in their pursuit of the ultimate performance with new light-weight titanium parts.

RAM provided custom sailing harness parts to four-time world sailing champions and 2015 International Sailing Federation World Sailors of the Year Peter Burling and Blair Tuke for their Men's 49er gold-medal winning campaign at the Rio Olympics.



When the competition is this hot, shaving off grams on an athlete's gear can be the winning difference. The previous trapeze harness spreader bar used by the Olympic pair weighed 230 grams. RAM managed to reduce this to just 108 grams using a 3D-printed hollow titanium structure. The rules state that the harness must float, so a reduction in mass of the metal parts provided further benefit through requiring less bulky buoyancy material to comply.

RAM also produced handlebar extensions to support the New Zealand cycling team competing in the Rio Olympic Velodrome. The handlebar extensions were optimised for weight, aerodynamic and rider performance on the revolutionary Avanti Olympic cycles used by the cyclists. The New Zealand's sprint trio of Ethan Mitchell, Sam Webster and Eddie Dawkins brought home the silver after missing out on the gold to Great Britain by an agonising 0.102 seconds. The trio clocked the three fastest times of their lives at Rio.



Printing for Team New Zealand Sailing; lightweight titanium trapeze harness.

## LINCOLN AGRITECH LTD

Lincoln Agritech Ltd (LAL) is a multidisciplinary research and development company owned by Lincoln University, but with independent mandate and Board. The company has a long track record of delivering leading-edge innovative science and engineering knowledge and technologies into environmental, primary, processing and new materials applications. LAL employs around 48 staff, including scientists, research engineers and software developers. It has two offices, one on the Lincoln University campus and another on the Ruakura Research Campus in Hamilton.



LAL has five complementary areas of expertise:

- » *Precision Agriculture Technology*: Providing technologies and advice to enable efficient agricultural and horticultural production systems and to respond to intra-field variation;
- » *Sensing Technology Solutions*: What can be measured can be managed. LAL develops smart sensing technologies that reduce costs, introduce new revenue opportunities, and improve decision-making;
- » *Groundwater Processes*: Supplying tools that enable regional and central government, as well as water users, to manage groundwater quality, nitrogen impacts and water allocation to enable a sustainable future for New Zealand's water resource;
- » *Software Consulting and IRRICAD*: Developing software tools for a range of applications to deliver decision-making and visualisations from complex data. LAL developed IRRICAD, a world-leading computer software system for designing pressurised irrigation systems; and
- » *New Materials Science*: Undertaking research to generate transformational opportunities for the coarse wool industry.

LAL delivers research and development contracts both to the private sector and through research funded by the Government, primarily through contracts awarded through the Ministry of Business, Innovation and Employment (MBIE) contestable process, but also through the Ministry for Primary Industries and the Royal Society of New Zealand.



*LAL's Environmental Group installs a shallow groundwater monitoring well using drill mast and skid steer.*

## CURRENT GOVERNMENT-FUNDED PROGRAMMES

LAL is leading the delivery of a number of MBIE-funded programmes:

- » *Optimum-N* is providing New Zealand's pastoral farmers with decision-support systems to optimally apply nitrogen (N) fertiliser in intensive rotationally-grazed dairy pastures by developing new sensors, methods and tools to identify the N demand of typical New Zealand dairy pastures.
- » The *Transfer Pathways Programme* will improve New Zealand's understanding of N and phosphorus (P) transfers, in space and time, from land use (source) to receiving waterbodies (receptor), enabling stakeholders to improve land and freshwater management decision-making.
- » The *Bessel beam sensor* research is using non-contact sensing techniques to develop a prototype for an "on-the-hoof" body condition sensor for assessing the condition of sheep, providing a valuable stock management tool for production.
- » *Agricultural plastic mulch film* research is developing a novel mulch film material that catalyses N fixation directly into the soil, thereby reducing farming's reliance on mineral N fertilisation and resultant nitrate-leaching.
- » *Evanescent sensor* research is using microwave ultra-high resolution evanescent field technology to progress a sensor that measures the percentage dry matter content and images the internal structure of fruit, vegetable and pasture crops in order to improve quality control.



LAL staff are also providing research services to two National Science Challenges (NSC): *Our Land and Water (Sources and Flows)* and *Science for Technological Innovation*, through leadership of:

- » Portfolio 2: Agricultural and Environmental Technologies;
- » a “spearhead project” that is using electromagnetic sensing to determine the spatially-averaged velocity of shallow groundwater - a vector for contaminants; and
- » a “seed project” to develop the science to create a sprayer that senses crop canopy locations and applies agrichemicals to achieve optimal leaf coverage.



*LAL studies the effect of spray drift on farms.*

## NEW RESEARCH PROGRAMMES

This year saw LAL become the lead research provider to the New Uses for Wool Partnership Programme, a joint-funding arrangement between the Government and Wool Industry Research Ltd (a body representing the research interests of the post-harvest New Zealand wool sector). The partnership programme is a seven-year project structured to generate transformational, high-value and high-volume opportunities for the coarse wool industry.

LAL's Precision Agriculture Team is working with Pipfruit New Zealand on a three-year Sustainable Farming Fund programme to investigate fruit development, specifically how thinning flowers and fruitlets can establish or promote the quality and growth of the remaining fruit.

LAL won two MBIE-funded Vision Mātauranga Capability Fund (VMCF) programmes in 2016. LAL scientists are deepening their cultural understanding of mātauranga around freshwater management and water-quality impacts on mahinga kai. Engagement with Ngai Tahu Papatipu Runanga (Otago) and Te Taumutu Runanga (Springston) is facilitating the mutual transfer of physical science knowledge, participation in collaborative nationally-focused research and science-informed processes such as the Resource Management Act, and developing capacity and relationships.

In the recent MBIE contestable round, LAL successfully secured funding to lead a five-year research programme to develop a grape yield assessment system using non-invasive sensing (machine vision, optical and microwaves) to predict yield. The programme includes scientists from LAL,

Lincoln University, Plant and Food Research, University of Canterbury, and Australia and will work closely with New Zealand Wine and a number of New Zealand vineyards.

## DEVELOPMENT PROJECTS

LAL also self-funds selected projects. The *Optical Nitrate Sensor* is a low-cost prototype for measuring nitrates in groundwater more frequently and in a wider range of locations than has previously been affordable. The technology will assist farmers and regional councils to make better decisions about the impact of land-use change on groundwater-nitrate flows. The sensor was showcased in the Innovation Centre at 2016 National Field Days in Hamilton and received positive feedback from farmers and companies in the private sector. ■ ■

## BILATERAL RELATIONSHIPS AND INTERNATIONAL RESEARCH

LAL is involved in two bilateral research programmes with China.

The “Sino-NZ Technical Cooperation on Water-Saving Agriculture” agreement – a Memorandum of Understanding - was signed June 2016 in Beijing and recognises the partnership between China's Ministry of Agriculture and LAL. LAL will provide China's National Agro-Technical Extension and Service Centre (NATESC) with advice on irrigation, soil moisture monitoring and fertigation.

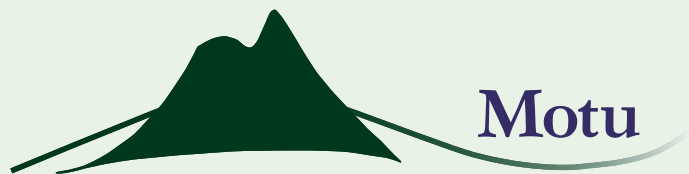
The NZ-China Water Research Centre will be hosted by Lincoln University and recently received \$1.25 M funding over five years from the New Zealand Catalyst Fund. LAL scientists, together with researchers from Lincoln University, AgResearch, Landcare Research, and the University of Otago, will facilitate science collaborations around water quality and quantity with Chinese scientists.



*Peter Barrowclough (LAL CEO) with Mr Chen Shengdou, Director General of the National Agro-Technical Extension and Service Centre (NATESC) from China's Ministry of Agriculture.*

## MOTU - ECONOMIC AND PUBLIC POLICY RESEARCH

Motu is New Zealand's top economic organisation, beating both universities and consultancies alike. Since the beginning, Motu has charged itself with undertaking and – crucially – disseminating high-quality, independent research, as well as developing New Zealand's future researchers and economists.



Motu was registered as a charitable trust on 1 September 2000, and in 2002 was accepted as an affiliate organisation of the Royal Society of New Zealand. It has approximately 20 staff and is located in Wellington.

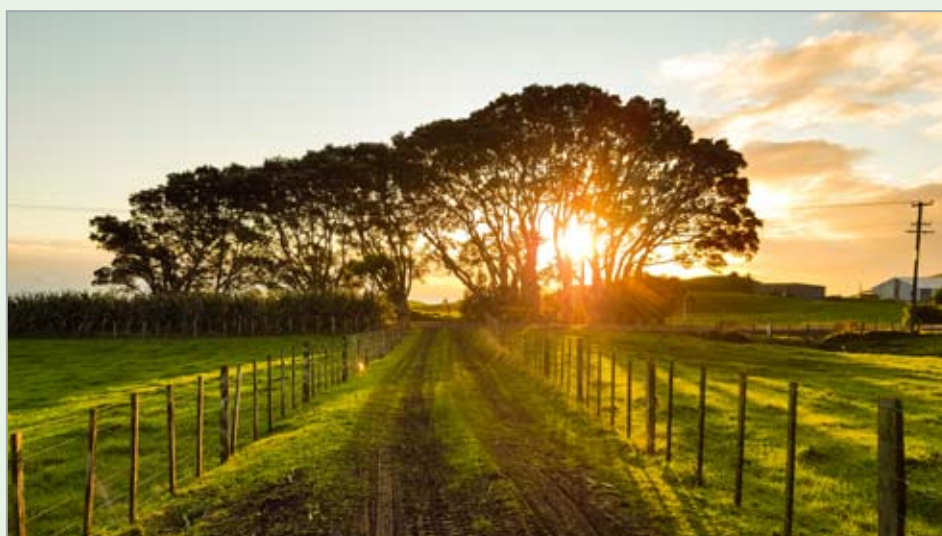
Motu is the top-ranked economics research organisation in New Zealand and in the top ten global economic think-tanks, according to the Research Papers in Economics (RePEc) website, which ranks all economists and economic research organisations in the world based on the quantity and quality of their research publications.

Motu's five senior fellows – who all have PhDs from top international universities, as well as extensive public policy experience – work together as a co-operative: each fellow identifies valuable research questions that they can potentially answer, and finds funding to support their work on these topics, as well as the broader research, training and education missions.

One of Motu's guiding principles is its commitment to freely disseminating research findings. Motu insists on a clause in every research contract stating that the results of the research will be published publicly, rather than allowing the research funder to decide whether the results will be released or not. Motu also invests heavily in the training and intellectual development of young New Zealanders, hiring the cream of university economics graduates for two- to four-year stints before sending them off to top PhD programmes or into important government policy roles.

The board and staff of Motu believe firmly that understanding the facts and analysing the economic forces at work can make a difference in ensuring that policy will work for the long-term wellbeing of New Zealand. Economists and other social scientists in universities are often focused on relatively general, abstract research, rather than research focused specifically on understanding New Zealand. Thus, Motu fills a vital and distinctive niche between the academic researchers and the policy consultants/advisers by undertaking ongoing systematic research on New Zealand.

Motu was founded as a public charity, in order to pursue inter-related missions of engaging in excellent research on public policy issues, disseminating the results of that research, and building New Zealand's capability for this kind of research by training young New Zealanders in research methods. The current environment makes these missions ever more important for the future of New Zealand.



*A New Zealand farm.*





## THE YEAR FOR MOTU

*This has been an exciting year for Motu.* Over the last year, Motu's wide range of projects included:

- » Finishing up a five-year Marsden-funded research project around wellbeing that delivered new measures of wellbeing applicable to both New Zealand and internationally, while providing new understanding of how policies affect wellbeing both within and across countries;
- » A project for the World Bank creating a handbook for any jurisdiction wanting to design or revamp an emissions trading system;
- » An analysis of the Government's '90-day trial period' policy for new employees, which showed that neither the proponents claims for its employment-enhancing benefits nor its opponents worries about harm to workers were borne out in the data; and
- » A number of papers for the Productivity Hub that aim to improve how policy can contribute to the productivity performance of the New Zealand economy and the wellbeing of New Zealanders.

This year has, however, also seen significant challenges for Motu's mission of informed policy debate. Around the globe, we see multiple political movements founded on fear of the future and nostalgia for some image of the past. These movements have explicitly criticized or rejected economists and other evidence-based policy analysts as elitist, and appealed instead to group identity and other instinctive impulses as the basis for policy choices.

Here in New Zealand, Motu researchers have heard some university- and CRI-based researchers express concern about their ability to contribute to public debate. They fear that speaking out about the implications of their research for public policy issues may threaten their ability to get funding for their research or impede their career development. In Motu's government-funded research contracts, despite contractual protections of their freedom to publish, they find that negotiating release of their research findings is sometimes a delicate task. ■■

## CAWTHRON INSTITUTE

The Cawthron Institute is New Zealand's largest independent science organisation, offering a broad spectrum of services to help protect the environment and support sustainable development of primary industries. Cawthron has been making science work in the real world for nearly 100 years and is a major economic contributor to the Nelson region, where it is based, with national and global reach.



Cawthron works with regional councils, government departments, major industries, private companies, and other research organisations throughout New Zealand and around the world.

Cawthron is a diverse organisation, employing almost 200 scientists, laboratory technicians, researchers and specialist staff from more than 20 different countries.

Cawthron's scientists have unique expertise in aquaculture research, marine and freshwater resource management, food safety and quality, algal technologies, biosecurity and analytical testing. Their ground-breaking science is supported by substantial testing and research laboratories, state-of-the-art technology, and a purpose-built aquaculture park.

Cawthron also runs an extensive community and education programme to help foster the next generation of scientists.



## ESTABLISHMENT

The Cawthron Institute was established in 1919 by the last will and testament of Nelson philanthropist Thomas Cawthron, who had a vision – that science could contribute to the growth of a young New Zealand, and was officially opened in Nelson in 1921 following the establishment of the Cawthron Institute Trust Board.

Today, Cawthron is still overseen by the Cawthron Institute Trust Board, which appoints the Board of Directors, who govern the Cawthron Institute and approve its strategic direction.

## SCIENCE SERVICES

Cawthron's science services cover:

- » Algal biotechnology: Cawthron has an international reputation in algal biology – especially in relation to harmful algal blooms, which, for example, can prevent seafood harvest. Cawthron has specialist expertise in microalgae production for aquaculture feed and for the production and extraction of bioactives and in the cryopreservation of microalgae.
- » Analytical services: Cawthron offers an independent testing service for the food and natural products sector, to meet food safety and export requirements. Cawthron has a

fully-accredited laboratory, and also provides consultancy services such as the Cawthron Natural Compounds team that specialise in extracting complex organic compounds from algae and other plants and a specialist research and development team who can develop customised analytical solutions to meet the unique needs of businesses.

- » Aquaculture: Cawthron's team of aquaculture scientists are world-leaders in shellfish biology, breeding and husbandry. Together with industry, they are working towards a future where farmed fish and shellfish crops no longer depend on wild populations. Cawthron has developed a national centre of excellence for shellfish aquaculture research, development and production at the Cawthron Aquaculture Park. Researchers, industry clients and students work side by side to lift the industry's productivity and sustainability. Cutting-edge science, research and development are adding value to aquaculture exports through selective breeding, improved farming systems and advances in hatchery technology.
- » Biosecurity: Cawthron's biosecurity team provides expertise and consulting services for all marine and freshwater biosecurity threats. This includes managing non-indigenous pests and diseases, and assisting with biosecurity regulatory compliance



and risk mitigation. Cawthron works closely with its clients to provide applied research and services designed to meet their specific needs.

- » Coastal and freshwater: Cawthron has extensive scientific expertise across all aquatic environments and ecosystems, the life forms that depend on them, and the factors that control their health and abundance. Our coastal and freshwater scientists work with a wide range of organisations – from local and central government to large corporations and industries, including the oil and gas, aquaculture and dairy sectors. From detailed analysis to applied science on (or in) the water, Cawthron scientists enable well-informed management decisions. Areas of work include ecotoxicology, freshwater sciences, harmful algae, molecular tools, taxonomy and resource management.
- » Offshore environmental work: Cawthron provides expert consulting services for all environmental aspects of offshore operations including oil and gas, mining, aquaculture, fisheries, and dredging.

## RESEARCH

As well as diverse science services provided to a wide range of clients, Cawthron runs a number of significant research programmes funded by both Cawthron and MBIE's contestable science fund. Excellent research, and associated capability development, is a long-standing and essential foundation enabling Cawthron's real-world impact. Examples include:

- » Safe New Zealand seafood for global consumers: A collaborative programme with other researchers, industry and regulators with international influence.
- » The Cultured Shellfish Programme: Enabling, growing and securing New Zealand's shellfish aquaculture sector. This programme builds on previous programmes, and has enabled significant industry investment that has lifted the sustainability and profitability of the sector.
- » The Cawthron Institute Culture Collection of Microalgae: A nationally-significant living collection which underpins research worldwide and supports vital work to ensure the safety of New Zealand seafood.
- » Revolutionising the scampi fishery: A two-pronged programme targeting both improved wild harvest methods and enabling aquaculture of New Zealand scampi.
- » Feed-efficient salmon for the future: Developing a Food Conversion Efficiency (FCE) toolkit which will allow industry to understand what influences FCE on farm and breed for improved FCE. This

knowledge will improve husbandry, health and fish quality, while reducing environmental impacts.

- » Enabling open-ocean aquaculture: Building on previous work, targeting significant growth of New Zealand aquaculture production in consented but physically-challenging water space.

## PUBLICATIONS

The Cawthron Institute provides research and reports for a wide range of organisations and contributes to journals and publications worldwide. Many of these are available on their website at <http://www.cawthron.org.nz/publications/>.

## CAWTHRON FOUNDATION

The sustainable management of New Zealand's freshwater, coastal and natural environments is one of Cawthron's top priorities. The Cawthron Foundation is a registered charity established to support the world-class, independent research developed and delivered by Cawthron to benefit New Zealand and the global environment.

The Cawthron Foundation is overseen by an independent trust board chaired by Dr Morgan Williams – the current chair of the World Wide Fund for Nature in New Zealand and former Parliamentary Commissioner for the Environment.

The Cawthron Foundation provides an opportunity for everyone to play a part in developing science for a better world. Donations and gifts to the foundation help Cawthron to deliver research into areas important to New Zealanders, and to support emerging and talented New Zealand scientists. ■ ■

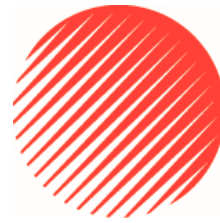


*Cawthron scientists are revolutionising the scampi industry, in the past year the world's first captive scampi have been raised from eggs by Cawthron aquaculture scientists, taking New Zealand a step closer to establishing a scampi aquaculture sector.*

## OPUS RESEARCH

*Committed to making the world work better*

Opus Research provides a broad range of high-quality research, specialist consultancy and laboratory services to improve the design and performance of infrastructure for commercial and government clients.



# OPUS

It has a proud history dating back more than 50 years to the New Zealand Ministry of Works when it provided experimental research that informed the design and construction of major national infrastructure projects, such as hydroelectric power schemes and state highways.

Today Opus researchers work in multi-disciplinary teams to address challenges as diverse as transportation safety, road performance, and the resilience of communities and businesses to major natural hazards.

They also provide specialist consultancy services and materials testing and analysis for engineering construction materials.

Opus Research management and operating practices are accredited to the International Quality Management System ISO 9001, and many of its laboratory services have ISO 17025 accreditation. The Opus team includes engineers, chemists, physicists, materials scientists, environmental scientists, geographers and behavioural scientists.

Their capability and experience in research covers environment, society and business, and transportation.



*Opus recognises that the cities around the world that are getting 'smart' right are doing so not because they have invested in a wide range of technology to run and monitor all aspects of day-to-day life, but because they have invested in the right technology, people and businesses to improve life for the people who call their city home.*

*One aspect of Opus's work around smart cities includes a project led by Louise Baker, Principal Transportation Consultant. She is leading a team of researchers who are writing three strategic research papers for the Auckland Council to set the scene for a 'Smart Auckland'.*

## ENVIRONMENT

Opus Research contributes to creating environmentally sustainable infrastructure. It works to understand the effects infrastructure has on the natural environment and on people and provide advice to minimise adverse impacts relating to noise, ground vibrations, and emissions into the air. It also assesses the likely impacts resulting from wind on buildings and other structures.

For infrastructure developments, Opus Research is called on to identify and assess the environmental effects across the project and how they can be mitigated where necessary. Its clients include transport planners and operators, building developers and managers, as well as central and local government agencies.

In addition to noise assessments, Opus also undertakes research into topics relating to road traffic noise. In one research project for the New Zealand Transport Agency, researchers investigated how communities live with road traffic noise, and in particular what the community regards as acceptable road traffic noise.



*How do communities live with road traffic noise, and what is an acceptable level of road traffic noise?*



## SOCIETY AND BUSINESS

Opus Research contributes to improving the health and resilience of both society and business. Understanding the motivations behind community and business behaviour is key to identifying and prioritising possible mechanisms for change.

It works with government, businesses and communities to build resilience to natural hazards and improve the liveability of cities. Opus is a research partner in the Natural Hazards Research Platform as well as in two National Science Challenges (Resilience and Building Better Buildings, Towns and Cities). Its researchers assist their clients in developing long-term infrastructure strategies and plans, as well as helping to review the effectiveness of existing policies and strategies. Opus Research's applied social researchers examine public attitudes, behaviour and decision making in relation to complex social and economic problems. The results of this work underpin business cases, policy direction, design interventions and targeted social-marketing campaigns.

## TRANSPORTATION

Opus Research helps its clients to get the most from transport-infrastructure assets. For example, it has an MBIE research programme to waterproof chipseal roads and therefore significantly lift the performance and life of the road surface. Opus work with government transport authorities, planning agencies, private developers and transport operators.

Opus Research provides a wide range of research and services in the land transportation sector. This includes research around road networks, public transport, active transport modes such as walking and cycling, and the integration of transport with land use.

While traditionally roading has been a major focus, Opus also works with rail and ports, assisting its clients in the planning, development, operation and maintenance of infrastructure assets.

The Opus Research team can help clients understand transport infrastructure and how people interact with it. They can also assist in assessing what the future is likely to demand of infrastructure assets, to help organisations develop the most resilient and efficient transport solutions. ■ ■



*Water damage plays a major role in “flushing”, the slick bitumen -rich patches often seen on the road surface. Water can disbond the bitumen from the stone surface, which under the action of traffic migrates upwards.*

*Opus has been awarded \$3 million by the Ministry of Business, Innovation & Employment for a research project aimed at modifying chip seals so there's less chance of them being damaged by water. This will reduce annual maintenance and construction costs for water-damaged roads. Photo: Opus.*

## LASRA

### *The New Zealand Leather and Shoe Research Association*

LASRA is the independent research association of the New Zealand hide, skin and leather processing industry. Its members process 100% of New Zealand's cattle hides and over 90% of the nation's lambskins, converting them into part- and fully-processed leather for export. The Industry contributed over \$450m in foreign exchange in 2015. LASRA is supported by voluntary subscriptions and dedicated to fulfilling the industry's vision for sustainably-produced premium-quality hides and skins for export through world-class research and advancement in technology.



LASRA engagement includes:

**Promoting improvements** in raw-material quality through an annually-updated industry-supported National Farm Faults survey, which provides continuous data stretching back over 40 years and has highlighted faults such as cockle on lambskins, which has subsequently been all but eliminated through LASRA research and investigations. A recent focus has been on investigating the heritability of strength, strain and mottle, among other traits that significantly impact on the value of lambskin, in work conducted in collaboration with Silver Fern Farms and AgResearch, which shows huge promise for the future.

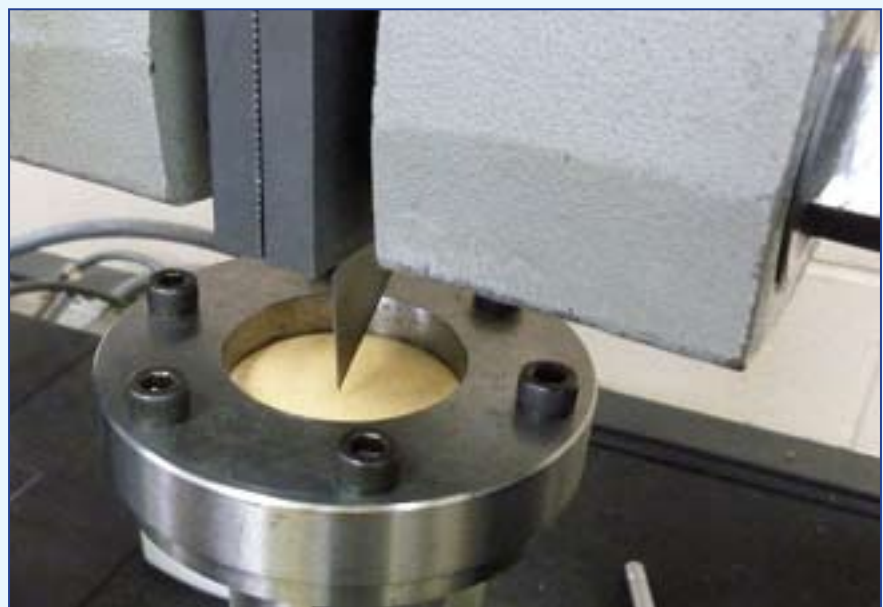
**LASRA research** is driving advancement in the fundamental understanding of leather properties, generating improvements in strength, quality and processing chemistry in support of the industry's aim to be considered as world-class producers. LASRA collaborates with a number of universities and institutes in support of their research; using advanced tools such as the Australian Synchrotron to provide cutting-edge advancement in the field of leather science. Technologies that have resulted from LASRA research, such as ThruBlu and "reverse tanning", have simplified the tanning process and led to a reduction in chemical usage and improved efficiency in the value stream. Its patented, enzyme-based dewooling process offers a sustainable alternative to conventional processing, which gives flatter, stronger and more consistent pelts. This research is on-going, as LASRA seeks to develop even more benign processing technologies for the future.

**The Industry Advisory Group** is a semi-autonomous industry body that meets twice a year to discuss and review research progress with LASRA staff. The annual LASRA conference provides an opportunity to showcase key advancements in LASRA's research to the entire industry.

**LASRA's IANZ accredited laboratories** support industry by carrying out evaluations on export material to ensure it meets market requirements. In 2015, LASRA generated over 700 hide, skin and chemical compliance reports, 250 technical investigation reports and 500 safety compliance reports for finished articles to AS/NZS, ASTM, and other national and ISO standards.

**Training** of industry staff is provided through our NZQA-approved, Primary-ITO supported, private training establishment with introductory, advanced and short training options available and tailored to operative, supervisory and senior management staff requirements.

**Information** on the latest published advances in leather technology is shared with LASRA's membership through a monthly newsletter. The LASRA entire library catalogue is regularly updated to include the latest research and is available as a searchable online resource to all our members. The library database contains over 40,000 industry-related articles.



*A novel aluminium-tanned leather that is three times more resistant to stabbing than conventional chrome-tanned leather. Photo: LASRA.*



## CURRENT RESEARCH

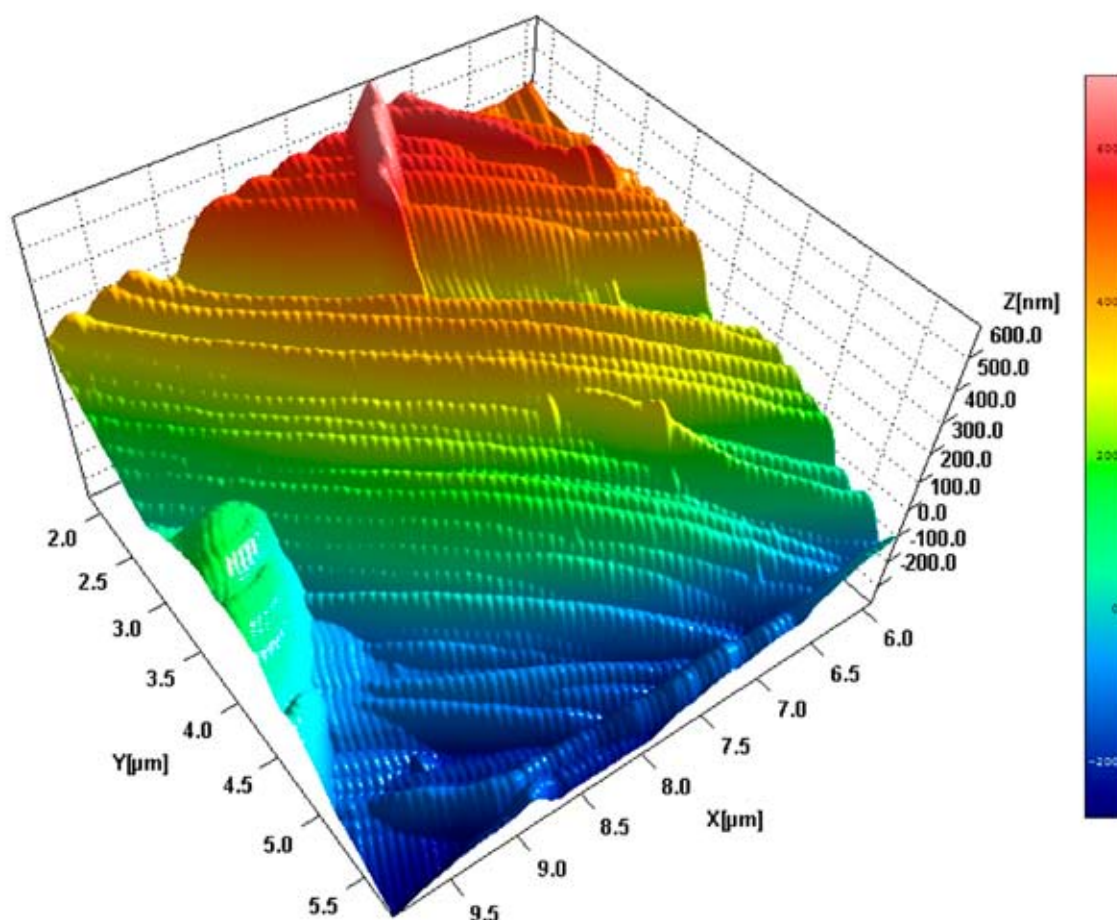
LASRA has always maintained a strong practical background to its research, which is supported by dedicated facilities for trial leather production and product testing.

Its current research focuses on adding value through enhancement of the intrinsic properties of skins and hides to obtain maximum strength, quality and performance in the final product.

With support from MBIE co-funding, the Ovine Consortium Partnership aims to construct new, lightweight footwear from lamb and sheep pelts to build a leather export platform supported by sustainable production systems that will deliver greater revenues to farmers and skin processors within the country, counter market threats, and help sustain the New Zealand sheep industry. The goal is to generate additional export returns of \$125 million per annum by 2017. The proposition is based on a transition from supplying the global garment leather market to supplying the more lucrative and stable footwear market. Typically lamb pelts are too weak to be used for footwear production, but through a series of process modifications LASRA has been able to increase strength by as much as 50%, and reach a goal of

equalling the strength performance of bovine leather. This research is in its final stages of transfer to industry, and fits a current need to increase the value of lambskins in the export market through onward processing. Two major industry players are engaged in the technical transfer and have placed sales and marketing staff in the key European market to help drive demand for this game-changing product.

A second industry, MBIE and IRO (Independent Research Organisation) capability co-funded project is currently underway to investigate and mitigate the impact of looseness on the 7% of bovine hides and deerskins currently affected. Susceptible hides and skins are identified in the raw state and processes are being developed to increase their value in the market as wet-blue and crust leathers. LASRA are building on these modifications to develop a new market for strong thin leathers, ideally suited to aviation upholstery and motorcycle garments with improved stain, fire, cut, stab, vibration, infrared, oil and water resistance through the incorporation of functionalised particles. The research team are developing an advanced technology for traceability to identify these high-value leathers as genuine in the marketplace. ■



*Using AFM (Atomic Force Microscopy) to study the effect of a silica-modified chrome-tanning process on the axial periodicity of the collagen structure in leather. Image: LASRA.*

## HERA

### *Serving the New Zealand metals-based industry*

The Heavy Engineering Research Association (HERA) creates value by being the trusted resource centre for stimulus in research, innovation and development for design, manufacturing technology, upskilling, standards, certification and quality assurance. Helping its members stay one step ahead is strengthened by the company's vision to be the leading catalyst for metals innovation internationally, with its specialists in engineering research, industry development, training, advocacy and marketing allowing HERA to create opportunities and lead bigger-picture thinking across the industry.

### *Industry owned and funded. Member driven. Future focused.*

A successful 2016 financial year for the New Zealand metals-based industry, particularly in steel construction, produced strong industry-research levy funding. This, coupled with HERA's own commercial research and market development activities, has allowed the company to drive growth and respond to changing market conditions to support long-term success and improve member value.

HERA has realigned its strategic focus to ensure it improves its value offering to members by driving innovation and business opportunities and strengthening its role as the voice of the industry – achieving this through key offerings in heavy-engineering-based industry development, information resources, structural systems and welding-fabrication expertise and an extensive industry-training programme.



## DRIVING INDUSTRY INNOVATION THROUGH HERA-LED R&D

**Strengthening the innovation culture** and shifting member business models from low-cost tender-based contracting to IP-owned manufactured products and services is at HERA's core. The flagship AGGAT (Above Ground Geothermal and Allied Technology) programme is bringing ingenuity to heat exchange and turbine models to deliver more cost-effective clean-energy technology for niche-market export applications. HERA researchers, with partnering companies, have made progress with the Expert Design Tool, Materials, and Heat Exchange Test Rigs - taking prototypes further along the innovation path and one step further to market for members.

In the steel-construction sector, HERA research is implemented mostly in the form of common good standards and guidelines - where HERA has advanced two major projects this year. Firstly, on behalf of NZTA and in conjunction with Opus, the evaluation criteria and guidance for sheer connectors in existing composite bridges has



*HERA's Dr Boaz Habib and PFS Engineering's Will Taylor with the pilot AGGAT power generation plant.*

been reviewed, enabling transport infrastructure networks to safely support heavier vehicles to improve productivity. Secondly, the harmonisation between Australian and New Zealand standards for the design of steel and composite bridges has aligned New Zealand to international best practices, and allowed members to push boundaries to deliver more cost-effective

solutions. After five years in the making and with HERA's Standards Committee Chairmanship and substantial research input, this year's success story was the joint AS/NZS 5100.6 steel and composite Bridge Design Standard being put to public comment.

New Zealand's seismic conditions continue to challenge construction performance with the competitive nature of construction systems in steel-based construction driving HERA's welding research. HERA's focus in this area is on improving quality assurance, reducing costs and linking the importance level of a structure to the required level of workmanship to ensure design assumptions remain valid. The current programme supports the development and implementation of the draft AS/NZS 5131 Structural Steelwork—Fabrication and Erection standard and is paralleled by a certification programme assisting fabrication members to demonstrate product conformity.

## OPENING THE DOOR TO OPPORTUNITY

Delivering to members' expectations is vital to HERA's success and steps have been taken to foster in-house expertise in marketing and communications, with the appointment of Market Development Coordinator Kim Nugent to achieve this. Tasked with recognising market needs that can be linked to scientific research to create targeted business-development initiatives, a current focus on marine-energy technology development is now being explored and has already connected deep expertise within the industry to innovate thinking and identify potential end-users in aquaculture applications.

The 2016 financial year has also seen HERA continue to strengthen the local steel construction industry in its effort to deliver steelwork that conforms to New Zealand's demanding specifications. Working together with Steel Construction New Zealand (SCNZ), the Steel Fabricator Certification (SFC)





*The Cambridge Bypass composite bridge.*

scheme has been developed with 21 companies now certified - representing around 75% of New Zealand's steel fabrication capability. This industry commitment has created a positive cultural shift to drive quality and workforce upskilling to meet international best-practice standards - promoting this scheme as a mandatory requirement for all critical national steel construction projects is something to achieve as New Zealand looks to grow its relevance locally and abroad.

## BEING THE VOICE FOR THE INDUSTRY

The 2016 financial year saw HERA continue commitments to lead the charge for policy change that benefits members. This has occasionally seen tension arise as it works to deliver member value under the governance of the Research Levy Act which holds HERA accountable as a research association committed to R&D versus an advocacy body. In response, HERA actively continues to formulate policy and build on its strong ties with Metals NZ, SCNZ, NASH, NZSSDA, COMPETENZ and university research partners to fill the gaps outside of their research parameters - ensuring its members always have support, no matter what part of the journey they're on.

Quality-assurance issues around imported steel have been reported in the media and have painted the HERA-led heavy engineering industry in a bad light – despite the reported incidents falling outside of its scope. Acknowledging that the public is unable to distinguish between the various steel applications, steps have been taken to consult with all involved to take the stance that all critical building work independent of material should be third-party verified – a policy that the SFC scheme has since introduced to lead industry to ensure the industry's perspective is clear.

In respect to procurement from the industry's major client

– the public sector, HERA has focused its research to better understand what other WTO Government Procurement Agreement nations are doing in this space and has commissioned BERL to provide international comparisons on procurement practices that can be used to inform stakeholders and policy makers.

## FUTURE OUTLOOK

While the steel construction demand forecast looks stable until at least the 2019 financial year, increased pressure from fabricated-steel imports will push New Zealand to improve its competitive positioning - especially in productivity and quality assurance. In the 2017 financial year, HERA will be focusing on developing a formal steel-construction research roadmap and business model analysis aimed at identifying alternative delivery models, and combining industry capability to export into steel-construction niches.

In the less buoyant and much more diverse general heavy-engineering industry sector, driving IP development and a transition from contracting-based work to manufacturing will continue to be the key, especially in the renewable energy and the newly-established sustainable marine energy sectors. As HERA works to showcase member capability, attract government co-funding, industry commitment and international uptake, it's clear a major strategy review to achieve its commitments going forward is required.

In response to future capability and skill needs, HERA is moving to increase focus on leadership training, and as part of the commitment to build an end-to-end digital model that connects data and expertise to members, HERA is excited to implement website and management upgrades later this year.

For more information, download HERA's 2016 Annual Report from <http://www.hera.org.nz>



## TERNZ & MACKIE RESEARCH

Transport Engineering Research New Zealand (TERNZ) and Mackie Research share offices in Ellerslie, Auckland and together have eight staff plus a number of contractors and collaborators that help with projects as needed.

**TERNZ is an independent research organisation that specialises in transport-related issues**, its mission is to improve the efficiency, safety, and environmental sustainability of the transport sector. This is fulfilled

by providing high-quality, unbiased, independent information and analyses, to both the government and the private sector.

Mackie Research & Consulting Ltd specializes in human-systems research and consultancy projects, mostly in the transport sector and often in collaboration with TERNZ. Mackie Research has specialist expertise in road safety, active travel, project and programme evaluation and other areas of human factors and ergonomics.

## WHY DO PEOPLE DIE IN ROAD CRASHES?

TERNZ and Mackie Research have recently completed a study for the Ministry Of Transport into the factors contributing to why people die in road crashes. The focus of this study was not on why the crash occurred but rather on why the outcome was fatal. The findings of this research have in part informed the latest Safer Journeys Action Plan, a part of Government's road-safety strategy to 2020.

The analysis considered 120 road fatalities which were primarily selected from those which occurred in 2014. These consisted of 70 open-road fatalities and 30 urban fatalities involving trucks and/or cars and 20 involving motorcycles. Pedestrian and cyclist fatalities were not considered in this study.

The vast majority of fatalities involved an impact with some other object. Nearly half of the impacts were with

another moving vehicle. About 30% of fatalities would have or possibly could have been avoided if the victim had been wearing a seatbelt or a crash helmet (for the motorcycle crashes). A further 23% of fatalities would have or possibly could have been avoided if the victims' vehicles had been fitted with the safety mitigation technologies that are readily available on current new vehicles. This latter finding is reinforced by the fact that the victims' vehicles were, on average, significantly older than the vehicles that they impacted which implies that the survival rate in the newer vehicles is significantly higher.

The full report is available from the Ministry of Transport website. <http://www.transport.govt.nz/assets/Uploads/Research/Documents/TERNZ-Report-Why-people-die-in-crashes.pdf>

## FUTURE STREETS

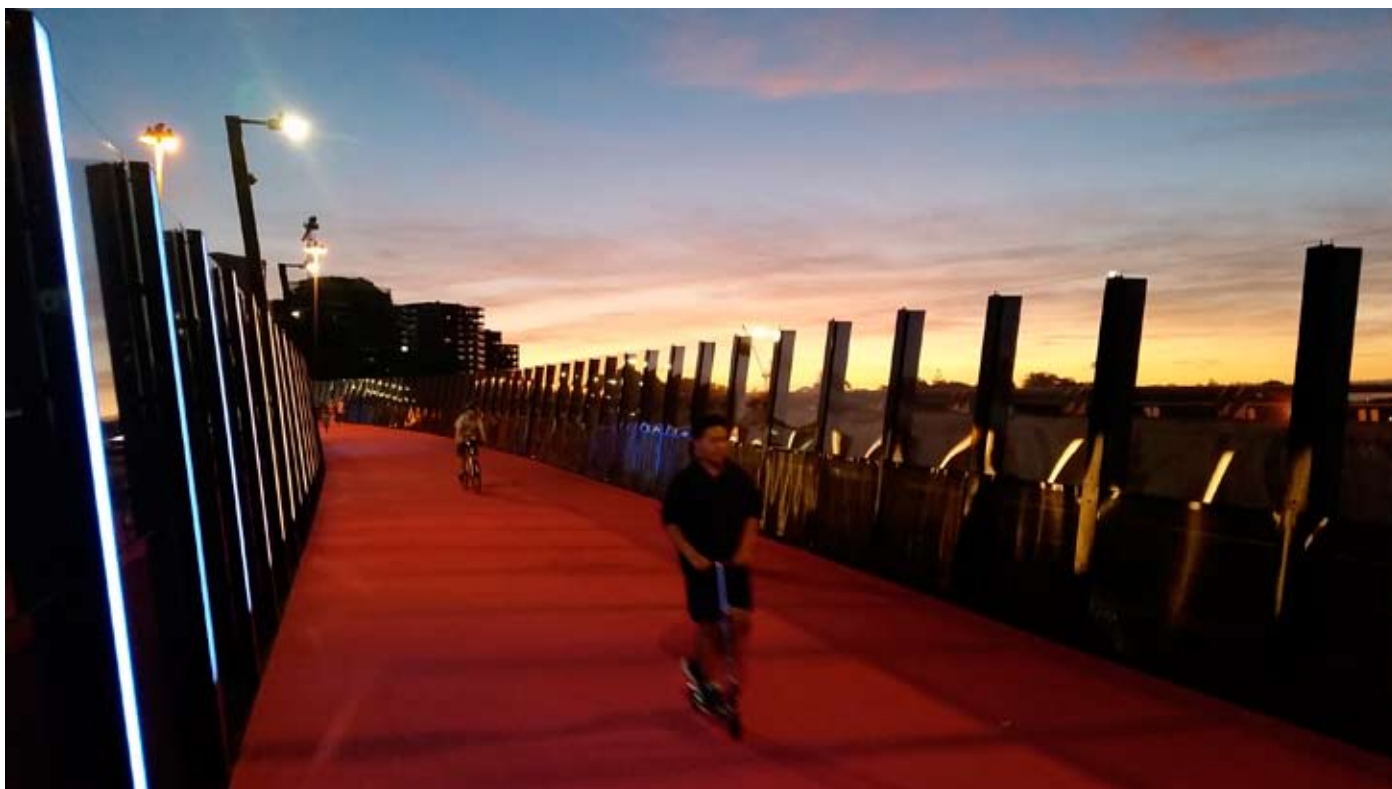
Future Streets – Te Ara Mua is a before/after case-controlled research intervention designed to understand how innovative urban street improvements can contribute to road safety and other interconnected social, health and fairness goals. It has a future focus, extending streetscape planning and design beyond 'business as usual'. The project is strategically located in Mangere, Auckland, which ranks 4th highest of 275 regions in Auckland for road safety risk and has a very high level of obesity-related illness. The research is funded by MBIE. The New Zealand Transport Agency (NZTA), Auckland Transport and the Mangere Otahuhu Local Board are key partners.

The treatments, which include wide footpaths, cycle ways, park improvements and traffic calming measures, have the goal of safer and easier walking and cycling and have recently been completed. Among a suite of measures of effectiveness, a follow-up survey of 2,000 residents will be undertaken in 2017.



*An example of the Future Streets treatments showing the widened footpaths, raised crossing, separated cycle lanes and approach to a prototype bus stop. The treatments include a two-kilometre 'community circuit'.*





*Healthier urban transport. Photo: Hamish Mackie, Mackie Research and Consulting.*

## HEALTHY FUTURE MOBILITY SOLUTIONS

A research programme focusing on healthier urban travel, led by Mackie Research and TERNZ, continues with Healthy Future Mobility Systems. This is a four-year research programme funded by MBIE in partnership with other researchers. It builds on the successful Self Explaining Roads and current Future Streets projects. Healthy Future Mobility Solutions looks at how mobility systems in New Zealand can be future proofed to support health, and enhance social and economic wellbeing in cities and towns. This research will build an understanding of global mobility issues in the face of profound technological and societal change and the opportunities we can seize to maintain healthy, vibrant and productive communities.

There are four interconnected strands of research, and a synthesis workstream to draw out opportunities for healthy future mobility:

- » Optimising Routes: How can health and wider societal wellbeing be incorporated into optimised roads and routes in towns and cities?
- » Future of the Bike: How can bicycle use in New Zealand be encouraged, extended and accelerated?
- » Active School Travel: What is the recipe for maximising active travel to school?
- » Cities for Youth: What are the mobility needs of young New Zealanders, focusing on those not in education, employment or training as an identified priority group?

## SAFER, MORE PRODUCTIVE AND MORE SUSTAINABLE HEAVY VEHICLES

Over many years, TERNZ have provided research and consultancy support for all of the stakeholders in the road transport industry aimed at improving the safety, productivity and sustainability of the heavy vehicle fleet.

Activities that TERNZ's researchers have been involved with include introducing a fuel-efficient driver-training programme, developing and delivering the EECA Fleet Management programme, the pro-forma designs for high-productivity motor vehicles and developing a set of Performance-Based Standards for assessing the safety performance of vehicles. There has been a large uptake of high-productivity vehicles that has resulted in fewer trucks on the road carrying more freight.

Dr John de Pont of TERNZ is currently the President of the International Forum for Road Transport Technology and in November 2016, New Zealand will be hosting the 14th International Symposium Heavy Vehicle Transport Technology in Rotorua. ■■

## AQUALINC RESEARCH

Aqualinc Research Ltd. (Aqualinc) is a specialist, independent provider of water science, engineering and management services. It was established as a privately-owned limited-liability company in 2003. Aqualinc currently has more than 40 staff, working throughout New Zealand from offices in Cromwell, Ashburton, Christchurch, Hastings and Hamilton.



Aqualinc is New Zealand's leading provider of irrigation science, engineering and management services. It is also a leading provider of water management expertise, especially in relation to groundwater investigations and the integrated modelling and management of groundwater and surface-water bodies to achieve specific socio-economic and environmental outcomes.

Aqualinc's core purpose is:

- » To equip natural resource management agencies for world-class water management that maintains or improves the treasured qualities of fresh-water environments and the socio-economic values derived from them; and
- » To equip water and land-users with the tools and knowledge required to comply with consent conditions and industry standards, achieve optimum economic results and achieve irrigation and nutrient-use efficiencies that are world-leading. Aqualinc's experts work with users from week to week to achieve these aims.

Aqualinc provides specialist expertise in the following areas:

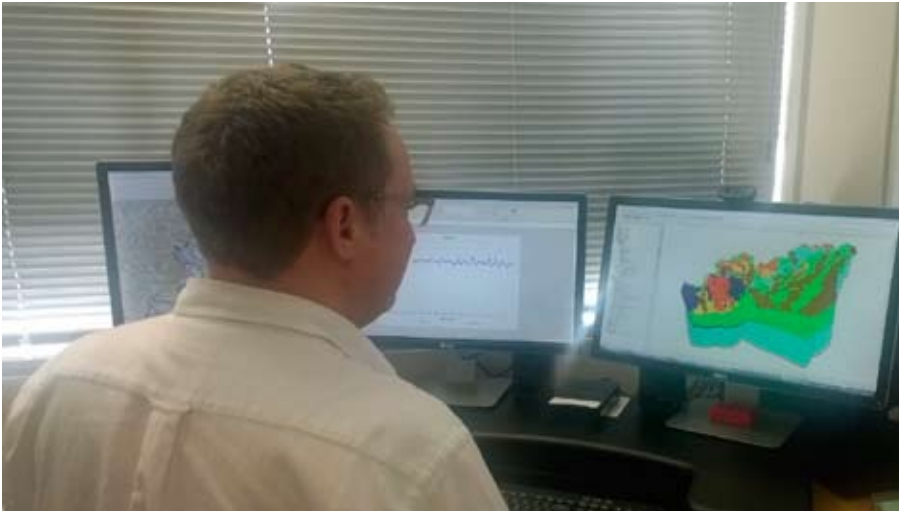
- » Irrigation science, engineering and management;
- » Effluent treatment and nutrient re-use;
- » Land-use impacts on groundwater quality;
- » Groundwater investigations, modelling and management;
- » Water allocation investigations and management; and
- » Strategic and integrated management of surface water and groundwater.

In pursuing its core purpose, Aqualinc takes an inter-generational view and a whole-system approach. It collaborates extensively with universities and other research organisations to tap into expertise and experience that complements its own, in order to build the best team for taking a whole-system approach to realising an opportunity or solving a problem.



*MBIE-funded research has increased understanding of the irrigation water requirements of pasture. Photo: Aqualinc.*





*Over the past twelve months Aqualinc's scientists and engineers have worked with council staff to further improve models of the Canterbury Plains, Upper Waikato, Motueka-Riwaka Plains and Waimea Plains groundwater – surface-water models. Photo: Aqualinc.*

## GROUNDWATER MEASUREMENT, MODELLING AND MANAGEMENT

Aqualinc has long-term relationships with a number of councils, as their trusted developer and user of integrated groundwater – surface-water flow and contaminant transport models for water use and nutrient discharge limit setting. In some instances, these relationships date back to the 1990s, enabling a number of continuous improvement cycles to be completed which have yielded very high quality models. Over the past twelve months Aqualinc's scientists and engineers have worked with council staff to further improve models of the Canterbury Plains, Upper Waikato, Motueka-Riwaka Plains and Waimea

Plains groundwater – surface-water models. Aqualinc has also used Marlborough District Council's Wairau Aquifer model to investigate the effects of sea-level rise on groundwater levels and spring-fed stream flows. MBIE funding is enabling Aqualinc to research a completely new approach to modelling integrated groundwater – surface-water flows and contaminant fluxes, to overcome the expensive time-consuming problems encountered by the current approach of coupling multiple models. Aqualinc's ambitious aim is to develop a single, unified system of equations for modelling flows and fluxes. ■ ■



## IRRIGATION SCIENCE, ENGINEERING AND MANAGEMENT

In 2015, Aqualinc expanded its irrigation research and management capacity by acquiring Hydroservices Ltd., which has delivered specialist irrigation management services since the 1980s. This created New Zealand's largest, and only, fully integrated irrigation science, engineering and management services group. Aqualinc now has well in excess of 1000 sites under management for the 2015/16 irrigation season, and this number is growing by several sites per week.

The issues it encounters through this ongoing involvement at farm-level feed into the planning of its research activities, thus ensuring that Aqualinc's MBIE-funded research is highly strategic. It also enables new findings from its research to achieve impact quickly. For example, MBIE-funded research has increased understanding of the irrigation water requirements of pasture, and how to model these more accurately.

This enabled Aqualinc to update its database on the reasonable irrigation needs of pasture throughout New Zealand in 2015. This information is freely available via Irrigation New Zealand's website and is being used by a growing number of councils to help them manage water allocations within set limits.





## BRANZ

*Inspiring the industry to provide better buildings for New Zealanders*

BRANZ is New Zealand's leading provider of built environment research. BRANZ's core focus is on inspiring the industry to provide better buildings for New Zealanders.

Effective stewardship of the Building Research Levy is a core responsibility of BRANZ. To achieve this, BRANZ is committed to robust decision-making processes, transparency and disciplined management of levy investments.

In 2015/16, BRANZ invested \$12.4 million of Building Research Levy in research and knowledge dissemination projects across 134 initiatives. Just over half of these projects are being led by BRANZ's specialist research teams and knowledge-transfer experts. Sixty projects involve partnerships and collaboration between BRANZ and 28 external research providers.

To ensure investments are targeted and continue to deliver better results for New Zealanders BRANZ has established the following research priorities:

- » Giving the industry tools to deliver medium-density housing that meets the needs of New Zealanders;
- » Helping consumers understand what the minimum standard means and the benefits of exceeding it;
- » Eliminating quality issues; and
- » Creating warmer, drier and healthier homes.

Levy research investment by BRANZ spans a wide arc of project areas. It includes work in areas that have the immediate potential to save lives, such as providing guidance on passive fire protection. It includes research on ventilation and information on how buildings in New Zealand can be made warmer, drier and healthier. It includes unlocking new insights around productivity in our economy. And it supports pockets of pure experimentation and innovation.



## SAFER SUSPENDED CEILINGS

Poor performance by suspended ceilings in recent big earthquakes has seen BRANZ work with industry to research a new code of practice. The code, developed in partnership with the Association of Wall and Ceiling Industries (AWCI), covers best practice in the design, installation and seismic restraint of suspended ceilings. The code will ensure costly and potentially lethal damage can be prevented or minimised in future.

## FIT FOR PURPOSE - TESTING THE USE OF LIGHT TIMBER FRAMING

BRANZ research this year will help extend the use of timber into multi-storey buildings and provide more options for the industry as it responds to demand for more and higher-density housing.

Light timber-framed low-rise buildings are common in New Zealand, but New Zealand standards limit this method. BRANZ's research will help allow light timber framing to be used safely in taller structures and inform guidelines that structural engineers can use to verify the compliance of these buildings.

*Poor performance by suspended ceilings in recent big earthquakes has seen BRANZ work with industry to research a new code of practice. Photo: BRANZ.*



*BRANZ research this year will help extend the use of timber into multi-storey buildings and provide more options for the industry as it responds to demand for more and higher-density housing. Photo: BRANZ.*

## SAFER SCHOOL HALLS AND GYMS

BRANZ research this past year has provided science-based assurance on safe school buildings and also saved the Ministry of Education money. Testing undertaken by BRANZ to investigate the strength and stiffness of walls in typical school gyms and halls delivered good news. The testing proved there is more resilience capacity in the walls than originally thought - meaning further strengthening work was not always required. Engineers had suspected these walls were strong and well braced against shaking. BRANZ testing provided the evidence to back this assumption and deliver accurate assessment.

## A DIGITAL HELPLINE - BRANZ FIND

Last year BRANZ launched BRANZ Find, a new channel to provide easier access for industry and clients to find useful information on building and construction practices. BRANZ Find operates as a digital helpline designed as a complementary resource to existing BRANZ helplines. It offers a directory of more than 6,000 useful building and construction documents for New Zealand from BRANZ, Standards New Zealand, MBIE and others.

## EXTENDING THE KNOWLEDGE REACH – BUILD IN THE HAND

BRANZ is passionate about turning research findings into actionable knowledge, and ensuring this knowledge

is widely accessible. This year *build* magazine is being made available to all licensed building practitioners in New Zealand free of charge. This decision extends the reach of *build* to over 40,000 building practitioners and complements the launch of *build* online, as a mobile resource accessible at the tap of a finger.

## INVESTING IN FUTURE RESEARCH CAPACITY AND LEADERSHIP

BRANZ invests in future capability in research skills through a generous annual scholarship programme. Young scholars with outstanding academic credentials and early-stage researchers pursuing innovative projects in New Zealand academic institutions can apply for scholarships of up to \$25,000 per annum for three years. Currently BRANZ supports a cohort of 18 postgraduate scholars, completing Masters and PhDs. This investment helps ensure a strong pipeline of research capability for the building and construction sector.

## DELIVERING THE NATIONAL SCIENCE CHALLENGE 11

BRANZ is hosting the National Science Challenge 11, Building Better Homes, Towns and Cities, involving the collaboration of over 200 researchers and 26 research organisations across New Zealand. This team will explore issues around housing supply, quality and urban development – all issues directly impacting on New Zealand's economic wellbeing. Over the next decade it will share knowledge, foster innovation and explore new ways of thinking across the sector. ■■

*“Supporting the industry to deliver quality sits at the heart of everything we do.”*



*Testing undertaken by BRANZ to investigate the strength and stiffness of walls in typical school gyms and halls has delivered good news. Photo: BRANZ.*



# IRANZ EXECUTIVE TEAM

## IRANZ CHAIR: DR JOHN BRIGHT



IRANZ's Chair is Dr John Bright. John is the Director, Research and Development, of Aqualinc Research Ltd in Christchurch. He established Aqualinc, a privately-owned water management, science and engineering, research and consulting company – and now the largest provider of irrigation management services in New Zealand, in 2004 and served as its Managing Director until May 2015.

Prior to establishing Aqualinc, John worked for Ministry of Works, New Zealand Agricultural Engineering Institute, and Lincoln Ventures Ltd. He is heavily involved in the ongoing reform of water resource management policy in New Zealand, particularly through his work with Regional Councils on how to establish water allocation and nutrient discharges limits, and how to manage water resources within those limits.

John sees the IRO sector, including industry-linked and regional institutes, as being able to deliver successful and high-impact science. “IROs have ability to punch above their weight and work with industry and other partners to deliver highly-beneficial impacts from targeted and excellent ‘discovery’ research as well as from applied close-to-market research.

## IRANZ EXECUTIVE OFFICER: DR ROB WHITNEY



IRANZ's Executive Officer is Dr Rob Whitney. Rob has had a career with IROs having come to New Zealand in 1972 to join BRANZ. He spent 15 years at BRANZ before moving to CRL Energy (then the Coal Research Association) as Chief Executive from 1988. Rob's first science job was as a research intern at the British Iron and Steel Research Association in South Wales.

Rob is Emeritus Chair of the BusinessNZ Energy Council (BEC) - the New Zealand Member of the World Energy Council (WEC). He has been a member of the WEC Energy Scenarios project for 15 years, chairing the project between 2010 and 2013. He also chaired the BEC2050 Energy Scenarios project. Rob is a past National President of the New Zealand Institute of Chemistry and has represented New Zealand on the IEA Greenhouse Gas R&D Programme, and the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE). Over the years, he has represented IROs on numerous ministerial and government advisory panels and working groups.



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 *IRANZ was formed to promote communication among member organisations and further the pursuit of common interests*



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