### NZ NATIONAL TESTING FACILITIES

**Universities, Polytechnics and CRIs**

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<tr>
<th>LABORATORY</th>
<th>KEY CONTACT / FACILITIES</th>
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<tr>
<td><strong>AUT UNIVERSITY</strong></td>
<td>Andy Hilton</td>
</tr>
<tr>
<td></td>
<td>Tensile testing (temp. controlled to 1200oC)</td>
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<td></td>
<td>Macro/micro Hardness Testing</td>
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<tr>
<td></td>
<td>Impact Testing</td>
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<td></td>
<td>Fatigue Testing (MTS 505G2 SilentFlo HPU)</td>
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<td></td>
<td>Metallographic Examination</td>
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<td></td>
<td>Surface Texture Analyser</td>
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<tr>
<td>Conrad Lendrum</td>
<td>Mechanical testing (we also use Quest integrity as a commercial provider of some services in this area).</td>
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<td>Electrochemical (Potentiostat + Quest integrity sub-contracts)</td>
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<td></td>
<td>Electrical/ Magnetic testing (including HV and high B-field. We also use Powerlabs (ChCh-based) as a commercial sub-contractor for some HV work)</td>
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<td>Surface/coatings tests also includes profilometer and thin-film reflectance</td>
</tr>
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<td>Margaret Leonard</td>
<td>Reactivity thermal testing (TGA, DSC, various reactors esp. fluidised bed)</td>
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<td></td>
<td>Materials density, Optical, Wetting behaviours</td>
</tr>
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<td><strong>CALLAGHAN INNOVATION, GRACEFIELD</strong></td>
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<td>Notched Izod Impact is a single point test that measures a materials resistance to impact from a swinging pendulum.</td>
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<td>Capillary Rheometry - measures apparent viscosity (resistance to flow) using shear rates at specific temperatures. Useful in mould flow design analysis, processing parameters, for quality control, degradation, thermal stability etc</td>
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<td>Dynamic Mechanical Analysis determines elastic modulus (or storage modulus, G'), viscous modulus (or loss modulus, G'') and damping coefficient (Tan Delta) as a function of temperature, frequency or time</td>
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<td>Melt Flow Rate - rate of extrusion of thermoplastics through an orifice at a prescribed temperature and load. Determines the extent of degradation of plastic as a result of molding</td>
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<td>Thermogravimetric Analysis - Loss in weight over specific temperature ranges provides an indication of the composition of the sample, including volatiles and inert filler, as well as indications of thermal stability.</td>
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<td>Tensile tests measure the force required to break a specimen and the extent to which the specimen stretches or elongates to that breaking point. Tensile tests produce a stress-strain diagram, which is used to determine tensile modulus</td>
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**CHRISTCHURCH POLYTECH INSTITUTE OF TECHNOLOGY**

|                                    | Margaret Leonard                                                                        |
|                                    | · Tensile Tester                                                                        |
|                                    | · Impact Tester                                                                         |
|                                    | · Optical Analyser                                                                     |
|                                    | · Melting Flow Index                                                                    |
|                                    | · Shadow graph                                                                         |
|                                    | · Accelerated UV tester                                                                 |
|                                    | · Miniature injection moulder                                                           |

**GNS**

|                                    | John Kennedy                                                                            |
|                                    | Micro hardness testing system                                                           |

**SCION**

|                                    | Dawn Smith                                                                              |
|                                    | Anti-fungal and anti-microbial                                                         |
|                                    | Rheometry                                                                               |
|                                    | Brookfield Rotational and Cone& Plate Viscometers                                       |
|                                    | Polymer Labs GPC                                                                        |
|                                    | Instron & Zwick Testing Machines                                                       |
|                                    | Impact Tester                                                                          |
|                                    | Cyclic Creep/Humidity Testing                                                         |
|                                    | Box/Packaging testing                                                                  |
|                                    | QUV                                                                                    |
|                                    | Biodegradation & Compostability testing                                                |
|                                    | Injection Moulder                                                                      |
Gas analysis systems: permeation analyzers of polymers, leak detectors and headspace analyzers of products. For production environments and quality control applications.

Cone calorimeter measures heat release rate, total heat released, effective heat of combustion, mass loss rate, time to ignition, specific extinction area, CO and CO2 production during exposure to fire.

Universal Testing Machine (Instron UTM) - Static (Model 5567, 1185, 1186)

Impact Tester - Charpy (Ceast Resil 25)
Impact Tester - IZOD (Drop-weight Impact Tester)

Instron UTM - Dynamic (Model 8802)

HDT - Heat Deflection Tester

Hardness Testing, Shore A, D
Hardness Testing, Barcol, Hardness Testing, Rockwell B, C

Corrosion test facilities
Accelerated Ageing Tester (Contherm)
Capillary Rheometer
Cone Calorimeter (Mass loss)
Gas permeation tester
Linear Thermal Expansion by TMA or Dilatometer
MFI - Melt Flow Index / MFR - Melt Flow Rate
QUV Tester (Accelerated Weathering)
Thermal conductivity tester (TC-30)

UV Transmission
Cone and Plate Rheometer
Environmental Chamber (Contherm)
Cone & Plate Rheometer

John Duncan
Acoustic lab facilities include:
- Reverberation room
- Transmission loss suite
- Low noise wind tunnel
- Duct noise wind tunnel
- Anechoic room
- Automotive
- Instrumentation room
- Control and robotics lab

Industrial aerodynamics lab
Thermodynamics and advanced energy and material systems lab

John Duncan or Kevin Stobbs
Hardness testing
Fatigue testing

Corrosion test facilities
- Heat flow measurement using Differential Scanning Calorimeter
- Material Characterisation using Dynamic Mechanical Analyser
- Impact testing

Tensile and Compression testing

UNIVERSITY OF CANTERBURY

Cryostat Microtome - a small, portable and convenient instrument with a hand wheel/lever. The compact chamber ensures rapid cool-down times. An insulated cover is used to ensure maximum efficiency of the refrigeration system & to reduce frosting when the unit is not in use.

Thermal Conductivity: The TCP advanced / TC-30, is a non-destructive testing - measures the thermal properties. Measurements - TC and Effusivity (VApCp) Other factors - density (p) heat capacity (Cp), sample thickness & temperature. TC: ability of a material to conduct heat while TE is defined as the square root of the product of density and heat capacity.

Xenon-Arc - Accelerated weathering simulates the damaging effects of long-term outdoor exposure of materials & coatings by exposing samples to varying conditions of aggressive components of weathering - light, moisture & heat. A xenon arc light source provide a radiation spectrum that simulates natural sunlight. Moisture is provided by a humidifier & direct spray & temperature is controlled by heaters. No direct correlation between accelerated weathering duration & actual outdoor exposure duration.

UNIVERSITY OF AUCKLAND

DID YOU KNOW

Accelerated Weathering (QUV) - simulates damaging effects of long-term outdoor exposure of materials & coatings to most aggressive components of weathering - UV radiation, moisture and heat. Moisture is provided by forced condensation, and temperature is controlled by heaters. No direct correlation made between accelerated weathering duration & actual outdoor exposure duration.

Cone calorimeter measures heat release rate, total heat released, effective heat of combustion, mass loss rate, time to ignition, specific extinction area, CO and CO2 production during exposure to fire.

Gas analysis systems: permeation analyzers of polymers, leak detectors and headspace analyzers of products. For production environments and quality control applications.

John Duncan
Chem Dept iso-trace facilities include:

- Certification of sucrose adulteration in honey (AOAC 1999 protocol)
- Thermal maturity and genetic characterisation of natural gas (Mud gas isotope logging, carbon and hydrogen isotope ratios of C1-C3 hydrocarbons)
- Determination of Individual Components in Spark Ignition Engine Fuels by High-Resolution Gas Chromatography (ASTM D6730)

http://neon.otago.ac.nz/consulting/isotrace/applications.php

Craig Grant (Research Office) or Rachel Laing (Textile Research)

- tensile tester - Instron bench
- impact rig
- thermal resistance
- vapour resistance
- thermal conductance
- climate chamber/human testing
- abrasion resistance
- dimensional change
- accelerated light aging
- visual change/assessment

Brian Gabbitas (HOD)

- Instron 8801 100 kN Axial Servo-Hydraulic Dynamic Testing System
- Instron 33R4205 50kN tensile machine
- 100 tonne vertical press
- 300 tonne extrusion press
- Vacuum furnace
- Charpy impact testing machine
- Accelerated weathering tester
- Injection moulder
- Extruders x 2, Pelletiser
- Batch compounding, Compression moulder
- Heated press
- Differential scanning calorimeter (DSC)
- Dynamic mechanical analyser (DMA)
- Raman spectrometer - hyphenated with DSC
- Thermal gravimetric analysis
- XRD, including heated stage and 3D imaging
- BET surface area
- Bomb calorimeter
- Compression moulder

CALLAGHAN INNOVATION, GRACEFIELD

- Atomic force microscopy (AFM) - a technique for analyzing surface of a rigid material all the way down to the level of the atom. Magnifies surface features up to 200 times & produces 3-D images of the surface. Used to solve processing & materials problems in electronics, telecom, biology and other high-tech industries.

DID YOU KNOW

- Large scale forgings and extrusions of alloys can be carried out. Current work is mainly using titanium and titanium alloys.
- Servo-hydraulic tensile machine enables fatigue pre-cracking for fracture toughness testing. Fatigue testing in tension and compression with a non-zero mean stress can be done.
- Batch compounding - used for processing rubber.
- DSC - differential scanning calorimeter / Tg = Glass Transition Temperature - amorphous polymer changes state from a hard brittle state to a soft rubbery state. Tm = melting point of crystalline polymer melts, Tc = polymer crystallizes upon heating or cooling. \( \Delta H_m = \) absorbed energy (joules/gram) in melting, \( \Delta H_c = \) released energy (joules/gram) while crystallizing.
- XRD - X-ray diffraction provides most definitive structural analysis information - interatomic distances and bond angles
- X-ray photoelectron spectroscopy (XPS) - a surface-sensitive quantitative spectroscopic technique that measures elemental composition. Can be used to analyze surface chemistry of a material with or without fracturing, cutting, scraping in air etc
- Microtome - is a tool used to cut extremely thin slices of material allowing for the preparation of samples for observation under transmitted light or electron radiation. Microtomes use steel, glass, or diamond blades.

DID YOU KNOW

- Confoocal Raman/ Atomic Force microscope (Wintec Alpha 300RA (2))
- High Resolution Scanning Electron Microscope with EDS & EBSD (Hitachi SU-70 (2))

Conrad Lendrum

- Imaging – (2 SEMs + 2 operator FTEs – 1 Hi-res + 1 environmental chamber, + various optical microscopy options)
- Chemical elemental (EDS, XRD, FTIR, NMR (liquid and solid) etc.)
- Phase crystal structure (EBSD, XRD)

DID YOU KNOW

- Callaghan Innovation, Gracefield
- Large scale forgings and extrusions of alloys can be carried out. Current work is mainly using titanium and titanium alloys.
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<tr>
<th><strong>DID YOU KNOW</strong></th>
<th><strong>John Kennedy</strong></th>
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<tbody>
<tr>
<td><strong>Gel Permeation Chromatography (GPC)</strong> - a high performance liquid chromatography technique for the separation of components based on their molecular size in solution, characterizing the molecular weight distribution of polymers, separation of discrete components.</td>
<td><strong>Wall Thickness</strong></td>
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<td><strong>Humidity testing</strong> - data generated by can be important in planning materials selection, paints and coatings, and expected lifetime of a product.</td>
<td><strong>Tape Shaping Test System</strong></td>
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<td><strong>Humidity Chambers</strong> - continuous measurement of ambient humidity in the natural atmosphere on a stationary platform.</td>
<td><strong>ATR</strong></td>
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<td><strong>Resin infusion and RTM light facilities</strong> - Stereo-photogrammetry system for dynamic thickness measurements during flexible mould processes.</td>
<td><strong>Attenuated Total Reflection</strong> (ATR)</td>
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<td><strong>Liquid chromatography-mass spectrometry (LC/MS)</strong> - technique with high sensitivity and specificity. Used to analyze compounds that are too large, too polar, or too thermally labile for the GC technique. Application is oriented towards the detection &amp; identification of chemicals in a complex mixture.</td>
<td><strong>Attenuated Total Reflectance</strong> (ATR)</td>
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<td><strong>Fluidized bed reactor</strong> - A device for heterogeneous (multiphase) catalytic reactions in which the fluidized catalyst is allowing extensive mixing in all directions with excellent temperature stability and increased mass-transfer and reaction rates.</td>
<td><strong>FTIR</strong></td>
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<td><strong>Fatigue Test</strong> - Behaviour of materials under fluctuating axially, in torsion, or in flexure loads.</td>
<td><strong>X-ray Diffraction (XRD)</strong> facilities</td>
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<td><strong>Hardness testers</strong> - a material's resistance to indentation by measuring the permanent depth or projected area of the indentation.</td>
<td><strong>ESEM/EDS</strong> - multiple facilities</td>
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<td><strong>Surface Texture Analyser</strong> - evaluate the cohesiveness, spreadability, fracturability, tackiness, gumminess, firmness, pliability, consistency and other texture characteristics of foods, rubber, foams, coatings, grease, asphalt etc.</td>
<td><strong>ICPMS</strong></td>
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<td><strong>Dawn Smith</strong></td>
<td><strong>FE-SEM</strong></td>
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<td><strong>FTIR Microscope</strong>, <strong>LaserConfocal/Fluorescent Microscopes</strong></td>
<td><strong>Dynamic Mechanical Thermal Analysis (DMTA)</strong></td>
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<td><strong>Dielectric Thermal Analysis (DETA)</strong></td>
<td><strong>Foaming and moulding equipment</strong></td>
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<td><strong>Differential Scanning Calorimetry (DSC)</strong></td>
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<td><strong>Melt Flow Index (MFI)</strong></td>
<td><strong>Micro-imaging</strong></td>
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<td><strong>Dawn Smith</strong></td>
<td><strong>Synchrotron</strong></td>
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<td><strong>Ice Chamber</strong></td>
<td><strong>Karnika De Silva (may direct to Research Centres)</strong></td>
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<td><strong>FE-SEM</strong></td>
<td><strong>Ashing furnace</strong></td>
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<td><strong>FTIR Microscope</strong>, <strong>LaserConfocal/Fluorescent Microscopes</strong></td>
<td><strong>Colour Spectrometer</strong></td>
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<td><strong>Dynamic Mechanical Thermal Analysis (DMTA)</strong></td>
<td><strong>DMTA</strong> - Dynamic Mechanical Thermal Analyser</td>
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<td><strong>Dielectric Thermal Analysis (DETA)</strong></td>
<td><strong>DSC</strong> - Differential Scanning Calorimeter</td>
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<td><strong>Foaming and moulding equipment</strong></td>
<td><strong>FTIR</strong> - Infrared Spectrophotometer</td>
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<td><strong>Differential Scanning Calorimetry (DSC)</strong></td>
<td><strong>Microscope</strong> (with digital camera and heated stage)</td>
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<td><strong>Thermogravimetric Analysis (TGA)</strong></td>
<td><strong>Micromtome</strong></td>
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<td><strong>Moisture Content Analysis (Sartorius MA??)</strong></td>
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<td><strong>Micro-imaging</strong></td>
<td><strong>Starlet 2212 Cryostat Micromtome</strong></td>
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<td><strong>Dawn Smith</strong></td>
<td><strong>Stereo Explorer (used with Leica Microscope)</strong></td>
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<td><strong>Synchrotron</strong></td>
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<td><strong>Xenon Arc</strong></td>
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<td><strong>Ashing furnace</strong></td>
<td><strong>Xenon Arc - Fresh Water per hour</strong></td>
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<td><strong>Colour Spectrometer</strong></td>
<td><strong>Xenon Arc - Lamps per hour</strong></td>
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<td><strong>DMTA</strong> - Dynamic Mechanical Thermal Analyser</td>
<td><strong>XRF (Contact Geology Dept)</strong></td>
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<td><strong>Microscope</strong> (with digital camera and heated stage)</td>
<td><strong>XRD</strong> (Single crystal, Powder) facilities</td>
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<td><strong>Micromtome</strong></td>
<td><strong>Optical Microscope Facility</strong></td>
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<td><strong>Kevin Daish (ASAS)</strong></td>
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<td><strong>Stereo Explorer (used with Leica Microscope)</strong></td>
<td><strong>ICPMS</strong></td>
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<td><strong>TGA</strong> - Thermo Gravimetric Analyser</td>
<td><strong>Raman Spectrometer</strong></td>
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<td><strong>Laser diffraction particle analysis</strong></td>
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<td><strong>Carbon, nitrogen &amp; sulfur analysis</strong></td>
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<td><strong>Size exclusion Chromatography (SEC-MALLS)</strong></td>
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<td><strong>GC-MS Shimadzu</strong></td>
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### UNIVERSITY OF AUCKLAND

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<td><strong>Rheosense m-VROC viscosity meter - High Shear, Small Sample Viscometer</strong> - Coatings, Cosmeceuticals, Food &amp; Beverages, Fracking, Conductive inks, Ceramic, Oils &amp; Lubricants, Rechargeable Battery and Fuel Cells etc.</td>
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volumetric calculations of depressions and elevation, volume of dents and 2D stereo microscope images. From this data, extract profiles. Roughness or undulation can be determined with high precision, fractal dimension & composition of alloys precipitation & grain boundaries, and examine local changes to structure identify alloy & SS resistance to inter EPR is non destructive, can identify alloy & SS resistance to inter-granular corrosion, study precipitation & grain boundaries, and examine local changes to structure & composition of alloys

Electrochemical potentiodynamic reactivation (EPR)- a test created to evaluate susceptibility to inter-granular or non-uniform corrosion, an effective method of testing alloys & SS. EPR is non-destructive, can identify alloy & SS resistance to inter-granular corrosion, study precipitation & grain boundaries, and examine local changes to structure & composition of alloys

Electron spin resonance (ESR) spectroscopy is a technique for studying materials with unpaired electrons. The basic concepts of EPR & NMR are similar, but it is electron spins that are excited instead of spins of atomic nuclei. As most stable molecules have all their electrons paired, EPR is less widely used than NMR.

Color is a key indicator of the quality of a product, color consistency & accuracy in paints & coatings, freshness & quality in foods etc. Color measurement can extend past transmitted or reflected spectral data to include CIE L*a*b* Color, Yellowness, Haze & other appearance related attributes.

Leica Stereo Explorer - automatically creates 3D data records from two 2D stereo microscope images. From this data, extract profiles. Roughness or undulation can be determined with high precision, fractal dimension & volumetric calculations of depressions and elevation, volume of dents and peaks can be calculated.

Electrochemical potentiodynamic reactivation (EPR)- a test created to evaluate susceptibility to inter-granular or non-uniform corrosion, an effective method of testing alloys & SS. EPR is non-destructive, can identify alloy & SS resistance to inter-granular corrosion, study precipitation & grain boundaries, and examine local changes to structure & composition of alloys
Quadrupole Inductively Coupled Plasma Mass Spectrometer (Q-ICP-MS) (Agilent 7500 cs/ce, Agilent Technologies, U.S.A.)

193 nm Excimer Laser Ablation System (Resonetics Resolution system, Resonetics Ltd, U.S.A. with Lauren Technics Ltd, Australia laser ablation cell)

213 nm Laser Ablation System (New Wave Ltd, U.S.A.)

Sector-Field Inductively Coupled Plasma Mass Spectrometer (SF-ICP-MS) (Nu Attom, Nu Instruments Ltd, UK, to be installed in late 2014)

Otago Centre for Electron Microscopy (Dept Anatomy): Range of scanning (SEM) and transmission (TEM) electron microscopy capabilities and microCT (see: see http://ocem.otago.ac.nz/em_techniques.html)

Shear force measurements of materials (School of Dentistry)

Performance testing of medical devices and textiles (UOW Centre for Translational Physiology)

Immune signalling (in vitro and in vivo)

Anti-bacterial, anti-fungal, anti-viral testing

Anti-biofilm

Flow cytometry

Tissue culture facilities

Bioplex for cytokine/chemokine detection

Fluorescence microscopy

PC3 facility for restricted pathogens

Brian Gabbitas (HOD)

Waikato Mass Spectrometry Facility

MALDI-TOF MS (Matrix-Assisted Laser Desorption/Ionisation – Time Of Flight Mass Spectrometer)

ESI MS (Electrospray ionisation) with Bruker Daltonics micro TOF for high resolution or with Fisons VG Platform quadrupole for lower resolution

ICP MS (Inductively Coupled Plasma)

GC MS (Gas Chromatography): HP 6890 GC with HP 5973 quadrupole

SPR (Surface Plasmon Resonance): Biocore 3000

LC MS (Liquid Chromatography): Bruker amazon X (ESI or APCI)

FPLC (Fast Protein Liquid Chromatography): AKTA and LCC

Electron Microscope Facility

SEM (Scanning Electron Microscope)

TEM (Transmission Electron Microscope): Philips CM30

Stable Isotope Research Facilities

Isotope Abundance Analyser: Europa Scientific 20/20

Isotope Ratio Mass Spectrometer: Europa Scientific Penta 20/20

Waikato Radiocarbon Dating Laboratory

Liquid Scintillation Spectrometer: Perkin Elmer 1220 QuantaPlus

Accelerator Mass Spectrometer

Others

- X-Ray Diffraction (XRD)
- Thermal Analysis (DSC, DTA/ TGA)
- UV Spectrophotometers
- Hoeffer Electrophoresis System
**Materials Processing Equipment**

**DID YOU KNOW**

- **Microcal VP-ITC** - Isothermal titration calorimeter - investigate biomolecular interactions. Measures binding affinity & thermodynamics & the measurement of the heat change determines the binding constants (Kd), interaction stoichiometry (n), enthalpy (ΔH) & entropy (ΔS), provides 1D profile of molecular interaction in a single experiment.

- **Rudolph DDM 2910 Digital Density Meter** - designed to meet the requirements of your laboratory applications in Chemical, Petroleum, Pharmaceutical, and Beverage industries.

- **Resin infusion and RTM light facilities** - Stereo-photogrammetry system for dynamic thickness measurements during flexible mould processes.

- **Brabender** - Melt Rheology characteristics of materials - to the combined influence of temperature & shear. Twin screw combination measures both heat & drive information which is continuously exchanged. The records of torque, time & temperature are displayed on plastogram graphical data software. Statistical data evaluates fusion behaviour, heat & shear stability, flow-curing behaviour of crosslinking, liquid absorption. Twin screw provides data of plastifying, compounding, alloying of polymers, chemical reactions, dispersion of pigments & additives etc.


- **Multiple-Collector Inductively Coupled Plasma Mass Spectrometer** enables the detection of minute variations in the isotopic makeup of metals, allowing questions as diverse as the migration history of commercially-sensitive fish stocks, the fate of metal contaminants in NZ’s waterways and ecosystems, and the pace and amplitude climate change to be investigated.

- **Gas chromatography with FID** can be used for the detection of organic molecules in gases. E.g. HPLC measurements using UV, fluorometrics, E.L.S. or refractive index detectors allows identification of separate components in a chemical mixture, such as biological fluids.

**Materials Handling & Processing**

- **3 and 4 axis CNC Machining**
- **High Precision EDM Wire Cutter (Makino U3)**
- **Laser Cutter (Universal X660)**
- **Water Jet Cutter**
- **Roll-Former, Hydraulic Press**
- **Welding workshop (friction stir, TIG/MIG)**
- **Scale-up chemical reactor (up to 100kg capacity)**
- **Wide range of instrument calibrations (via MSL)**
- **Magnetic properties (Squid, magnetometer etc.)**

**Fabrication Facilities**

- **Metal Ion-implanter**
- **High Energy Ion-implanter**
- **Triple-beam Ion-implanter**
- **Ion-beam Sputtering System**
- **High vacuum Electron Beam Annealer**
- **Old Arc-discharge Chamber**
- **New Arc-discharge Chamber**
- **Direct Ion beam deposition chamber**
- **Pipeline Coating System**
- **Multi-metal Evaporator system**
- **Sputter coater system**

**Callaghan Innovation, Gracefield**

**Andy Hilton**
- 3 and 4 axis CNC Machining
- High Precision EDM Wire Cutter (Makino U3)
- Laser Cutter (Universal X660)
- Water Jet Cutter
- Roll-Former, Hydraulic Press
- Welding workshop (friction stir, TIG/MIG)

**Conrad Lendrum**
- Scale-up chemical reactor (up to 100kg capacity)
- Wide range of instrument calibrations (via MSL)
- Magnetic properties (Squid, magnetometer etc.)

**Ian Brown**
- Metal/ceramic processing - for details

**Margaret Leonard**
- Machinery
  - Water tower and ring main
  - Power ring main
  - Compressed Air ring main
  - Blow Film Tower
  - Blow Moulder
  - Rotational Moulder
  - Single screw Extruder
  - Twin Screw Extruder
  - Injection Moulder x 80 tonne
  - Tumbler Mixer
  - Die Tool Heater
  - Small Conveyor System
  - Hopper Dryers x 1
  - Ultrasonic Welder
  - Rotational Frictional Welder
  - Thermoformer
  - Extruder Dryer and Water Cooler
  - Master Batching Gravimetric
  - Granulators x 2
  - Miscellaneous small machinery
  - Surface Modifier
  - Printing Press
  - High speed CNC Machinery (this all sits beside the fitting/turning-tool-making section)

**Callaghan Innovation, Parnell**

**John Kennedy**
- Fabrication Facilities
- Metal Ion-implanter
- High Energy Ion-implanter
- Triple-beam Ion-implanter
- Ion-beam Sputtering System
- High vacuum Electron Beam Annealer
- Old Arc-discharge Chamber
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**GNS**

**AUT**

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**Resin infusion and RTM light facilities** - Stereo-photogrammetry system for dynamic thickness measurements during flexible mould processes.
**DID YOU KNOW**

**Quadrupole Inductively Coupled Plasma Mass Spectrometer** enables the detection of metals and some non-metals to very low concentrations, for example, to ‘fingerprint’ New Zealand’s commercially-sensitive export produce, and to understand how essential nutrients are utilized within the human body.

**Visual change assessment** covers the standard procedures for determining change in appearance of fabrics or garments.

**The flume is an aquatic treadmill**, with excellent laminar flow. This purpose-built circulating water channel has variable water speed (0 - 5.0 m/s; up to 10.0 knots). Although originally built for testing and training of swimmers & other aquatic sports, it can also be used for testing properties of **water flow, boat hull design & other underwater equipment**. For analysis and feedback, data is displayed live and relayed onto a large screen using portable cameras & load cells.

**The thermal maturity and genetic character** of natural gas can be determined by measuring the carbon and hydrogen isotope ratios of C1-C3 hydrocarbons (Mud gas isotope logging).

**An Instron Bench** can be used to evaluate the mechanical properties of materials and components including fibres, yarns, fabrics, using tension, compression, flexure, fatigue, impact, torsion and hardness tests.

**The climate chamber** can be used to determine the effects of apparel systems on human performance.

**An impact rig** is used to determine resistance to impact events.

**193 nm Excimer Laser Ablation System** enables the detection of metals in very small solid samples, for example, in unravelling the complex evolution of New Zealand, including its tectonic and climatic history, and the development of its economic minerals.
### Thermal and Vapour Resistance, Thermal Conductance of Materials

Thermal and vapour resistance, and thermal conductance of materials including textiles provide information on properties relating to warmth, the transfer of moisture, or the transfer of heat (the latter typically in damp fabric). Such information enables manufacturers to optimise the desired material properties, or make informed choices for specific materials.

### Dimensional Changes

Dimensional changes may occur in fabric, typically with cleaning or heat exposure.

### Abrasion Resistance

Abrasion resistance refers to the fabric properties under the influence of rubbing.

### Air Permeability of a Fabric

Air permeability of a fabric measures the passage of air through it. This may be relevant for outdoor clothing or sails.

### Sucrose Adulteration

Sucrose adulteration (adding sugars like fructose to honey) can be detected by stable isotope ratio mass spectrometry.

### Accelerated Light Aging

Accelerated light aging uses aggravated conditions of (sun)light to speed up the normal aging processes of items to help determine the long-term effects of expected levels of (light) stress in a shorter time.

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### Did You Know

- **Thermal and Vapour Resistance, Thermal Conductance of Materials**
- **Dimensional Changes**
- **Abrasion Resistance**
- **Air Permeability of a Fabric**
- **Sucrose Adulteration**
- **Accelerated Light Aging**

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### SCION

- **Supercritical drying**
- **Spray driers/encapsulation and microencapsulation**
- **Emulsion (1L) and various aqueous/polymerisation reactors (up to 20L)**
- **Polymerisation and polycondensation reactors**
- **Bioreactors and microbial polymerisations**
- **Supercritical Fluids Reactor and Supercritical Fluids (CO2) Extraction - various**
- **CO2 mediated processing of polymers and composites**
- **Film casting equipment**
- **Steam explosion apparatus**
- **Wood drying/processing/impregnation**
- **Coating and adhesive preparations**
- **Coatings and adhesive tests**
- **Chemical and polymer extractions**
- **Aqueous and solvent extractors**
- **Biomass processing/pre-treatments reactor equipment**
- **High speed mixer**
- **Laboratory-scale thermoformer**
- **Large drying apparatus**

- **Karnika De Silva (may direct to Research Centres)**
- **Brabender Plasticorder**
- **Extruder - Single screw**
- **Henschel Mixer**
- **Injection Moulder 50 ton Arburg**
- **Injection Moulder 50 ton Bay**
- **V-Cone dry blender**
- **CNC Milling Machine**
- **Kevin Daish (ASAS)**
- **Critical Point Drier**
- **Sputter Coater**
- **Freeze Fracture**
- **Live cell imaging confocal microscope - Andor Revolution**
- **Ultramicrotome - Leica EM UC6**
- **Glass knife maker - LKB 7800**
- **Tissue processor for wax embedding - Tissue-Tek VIP**
- **Wax embedding station - Leica EQ1150 H**
- **Slide staining station - Tissue-Tek II**
- **Cryomicrotome - Leica CM1850**
- **Wax microtome - Microm HM 330**
- **Sliding microtome**
- **Vibratome**
- **Freeze dryer - Edwards EP03**
- **Critical point dryer - Polaron E3000**
- **Sputter coater - Polaron E5000**
- **Dimpling grinder - Fischione Model 200**
- **Ultrasonic disc cutter - Fischione Model 170**
- **Grinding Room Facility**

- **John Duncan**
- **Differential scanning calorimeter**
- **Biomass integrated gasification combined cycle (BIGCC) system**
- **Reactor/distillation column with fieldbus control system**
- **MegaSpeed CPL MS 50K high speed camera**
- **Wood drying tunnel**
- **Agilent micro gas chromatograph for gas analysis**
- **Niro Spray drier**

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### UNIVERSITY OF AUCKLAND

- **UNIVERSITY OF AUCKLAND**

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### UNIVERSITY OF CANTERBURY

- **UNIVERSITY OF CANTERBURY**

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### UNIVERSITY OF CANTERBURY

<table>
<thead>
<tr>
<th>Equipment/Instrument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Munster fluidised bed drier</td>
<td></td>
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<tr>
<td>Large and small freeze driers</td>
<td></td>
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<tr>
<td>Microtrac X-100 Particle size analyser</td>
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<tr>
<td>Fermentation equipment for aseptic work</td>
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<tr>
<td>Megaspeed CPLL MS 50k high speed camera</td>
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<tr>
<td>Plate heat exchanger</td>
<td></td>
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<tr>
<td>Farm milk vat for heat transfer</td>
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<tr>
<td>Climbing film evaporator</td>
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</tr>
</tbody>
</table>

### UNIVERSITY OF OTAGO

<table>
<thead>
<tr>
<th>Sample Preparation: 96-place rolling ball mill (120 ml unit volume)</th>
<th>Brian Gabbitas (HOD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing and preparation</td>
<td>Twin screw extruder</td>
</tr>
<tr>
<td>Injection moulder</td>
<td>Cold and hot isostatic presses</td>
</tr>
<tr>
<td>Medium scale high energy mechanical milling machine</td>
<td>Laboratory scale high energy ball mills</td>
</tr>
<tr>
<td>Instron and Lloyd tensile testers (100 kN-5 N)</td>
<td>Automatic grinding and polishing facilities</td>
</tr>
<tr>
<td>Vicker’s hardness testers</td>
<td>Laser particle size analyser</td>
</tr>
<tr>
<td>Fermentors (ChemMap 40 L, LG 4L)</td>
<td>Protein Digestion Robot (Bruker Proteineer)</td>
</tr>
<tr>
<td>SuperPro Designer Bioprocess Simulation Software</td>
<td></td>
</tr>
</tbody>
</table>

### UNIVERSITY OF WAIKATO

<table>
<thead>
<tr>
<th>Sample Preparation: 96-place rolling ball mill (120 ml unit volume)</th>
<th>Robert Van Hale</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D printer</td>
<td>Eva Gluyas</td>
</tr>
<tr>
<td>3D printer</td>
<td>Tim Miller</td>
</tr>
</tbody>
</table>

### ADDITIVE MANUFACTURING/3D PRINTING

<table>
<thead>
<tr>
<th>University</th>
<th>Equipment/Instrument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUT</td>
<td>Andy Hilton</td>
<td>Fused Deposition Modelling (Stratasys Dimension SST768)</td>
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<tr>
<td></td>
<td>Selective Laser Sintering (EOS Formiga P100)</td>
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<tr>
<td></td>
<td>Selective Laser Melting (Renishaw AM250, 400W)</td>
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<td></td>
<td>3D Printer (Z-Corp 310)</td>
<td></td>
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<tr>
<td>OTAGO POLYTECHNIC</td>
<td>Eva Gluyas</td>
<td>- Print size: 260x260x200 mm - Print material: ABS like resin in white or blue.</td>
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<tr>
<td></td>
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<td>Zcorp 3D printer, print size: 254x381x203 mm</td>
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<td>Print material: gypsum based powder &amp; binder - Can print on surfaces in full RGB colour.</td>
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<td>Objet Eden 3D printer</td>
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<tr>
<td>UNIVERSITY OF CANTERBURY</td>
<td>Scott Amies</td>
<td>Full machine shop and 3D printing facilities</td>
</tr>
<tr>
<td>OTAGO POLYTECHNIC INNOVATION WORKSPACE</td>
<td>Craig Grant (Research Office) or Robert Van Hale</td>
<td>3D printers</td>
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<tr>
<td></td>
<td></td>
<td>Fusing press, various joining/seaming machines</td>
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<tr>
<td>VICTORIA UNIVERSITY OF WELLINGTON</td>
<td>Tim Miller</td>
<td>Photo-curable Polymer Printers</td>
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<td>PolyJet 3D printer (Objet), PolyJet Multimaterial printer (Objet)</td>
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<td></td>
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<td>FDM – single filament (UP plus, UP Mini), FDM – dual filament BF8 Touch</td>
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<tr>
<td>UNIVERSITY OF AUCKLAND</td>
<td>Xun Xu</td>
<td>Design Lab Infrastructures</td>
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<tr>
<td></td>
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<td>14x UP! 3D Printers, 4x Mini 3D Printers</td>
</tr>
</tbody>
</table>

### DID YOU KNOW

- **Faro platinum arm with 3D scanner. 3D scanner**: Scan area approximately 1mx1mx1m (surface scan up to 3m x 1.5m approx.) - Produces point cloud data of an object
- **Sample Preparation**: A rolling ball mill is a grinder. The 96-place mill can grind up to 96 samples of up to 120 ml simultaneously, and is typically used for size reduction of organic materials.
- **FDM – single filament (UP plus, UP Mini), FDM – dual filament BF8 Touch**: More information about testing functionalities to be added when available from the testing labs
ISO 17025 certified testing
- Materials testing (tensile, compression, bending, flexural)
- Concrete testing
- Steel testing
- Reinforcing bar testing
- Carbon fibre testing
- Timber testing
- Metallurgy testing
- Mechanical testing
- Building Product testing
- Building sub-assembly testing
- Building component testing
- Bracing testing
- Wall panel testing
- Mechanical coupler testing
- Buckling restrained brace testing
- Viscous damper testing
- Seismic damper testing
- Full scale building testing
- Seismic testing
- Earthquake loading simulation and testing
- Impact testing
- Fatigue testing
- Durability testing
- Abrasion testing
- Fire testing
- Fall protection equipment
- Amusement rides and equipment
- Mechanical products and system testing (full scale)
- Earthquake loading simulation and testing
- Engineering Product testing
- Integrated system testing
- Accident investigation and testing
- Dynamic impact testing
- Roadside hardware testing
- Security product testing
- Vehicle dynamics testing
- Safety equipment testing
- Rail system testing
- Aerospace product and material testing
- Aerodynamic testing
- Fall protection equipment testing
- Environmental testing
- Load measurement
- Wind turbine testing
- Composite structures

**DID YOU KNOW**

**Wind load testing**: Holmes Solutions can perform wind load testing on anything from sculptures to full scale buildings to verify compliance to New Zealand and International codes.

**Destructive Testing**: Holmes Solutions has a wealth of experience in conducting full scale destructive testing on a variety of products at any scale, from railway sleepers to full scale buildings.

**Roadside Hardware Testing**: Holmes Solutions is the only US Federal Highways accredited crash test (roadside hardware) facility in the Southern Hemisphere. Conducting full scale, dynamic testing of a range of vehicles up to 12 tonne trucks travelling in excess of 100kph.

**Seismic Testing**: Holmes Solutions has a range of test apparatus purpose built for seismic testing. The largest testing apparatus has the capacity to test full scale braces up to 5MN in capacity, with a stroke

**Product Refinement**: Holmes Solutions can provide clients with key insights into how they can refine their product improving product performance while reducing costs. This provides the client with a superior product while building intellectual property.

**Product Compliance**: Obtaining compliance of a product is often the final stage in a development process, however requires early consideration and planning to ensure the product can achieve the desired outcomes. To assist this process, Holmes Solutions works with clients to review New Zealand and International Standards, identify Regulatory requirements, assist with product compliance documentation; and can liaise with regulatory bodies on behalf of
<table>
<thead>
<tr>
<th>HOLMES SOLUTIONS</th>
<th>Vibration testing</th>
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<tr>
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<td>NDT and Destructive testing</td>
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<td>Anti terrorist product testing</td>
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<td>Temperature monitoring and measurement</td>
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<td>Mechanical product testing</td>
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<td>Hydraulic test system</td>
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<td>Finite Element Analysis (linear and non-linear)</td>
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<td>Failure mode and effects analysis</td>
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<td>Root Cause Analysis</td>
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<td>Design for manufacture</td>
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<td>Forensic failure investigation</td>
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<td>Computation Fluid dynamics</td>
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<td>Magnetic modelling</td>
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<td>Dynamic impact modelling</td>
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<td>Reinforcing steel characteristics</td>
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<td>Structural dynamics</td>
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<td>Fire behaviour and modelling</td>
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<td>Structural mechanics</td>
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<td>Mechatronics</td>
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<td>Mechanical product and system modelling</td>
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<td>Fatigue modelling</td>
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<td>Virtual prototyping</td>
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<td>International standards compliance</td>
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<td>Freedom to operate</td>
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<td>Patents - Hydraulic system modelling</td>
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**DID YOU KNOW**

**Freedom to Operate:** Holmes Solutions works with a number of clients identifying new opportunities and raising caution over potential infringement with patents already issued or pending patent applications, globally.

**Patents:** Holmes Solutions has first hand experience licensing patents globally. As such, we share our knowledge and experience to ensure clients can secure their intellectual property, then leverage it in the most appropriate manner to achieve their goals.

BUILDING ELEMENT ASSESSMENT LABORATORY LTD (BEAL)  (Colin Prouse)

BRANZ

SGS

http://www.beal.co.nz/why-use-beal.html

http://www.branz.co.nz/cms_display.php?sn=63&st=1