ScionConnections

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A kāuta at Tikapa marae, Ngāti Porou rohe. Located east of Ruatoria. Pokai meeting house, December 2010.

The disappearance of kāuta

Modern cooking and heating appliances have reshaped marae kitchens and whare kai (kitchen and dining hall). Open fireplaces, known as kāuta, were the traditional places for Māori to prepare and cook kai. They also served as a place to gather, share news, tell stories and relive memories. Today, kāuta have largely disappeared from marae, due in part to the need to meet modern environmental, building and fire regulations. As memories fade of kāuta being used, so does the mātauranga Māori knowledge, tikanga traditions and reo or language, associated with their use.

Tau Iho I Te Po Trust, working with kaitiaki in Northland and Kaipara have partnered with Scion's rural fire research team to address this loss of Māori heritage and culture. Together, they plan to bridge the gap between regulatory and cultural needs, by creating a set of engineering design requirements for modern kāuta.

Why reinstate kāuta?

Traditional kāuta were once central to marae culture and were the heart of important Māori hospitality and hosting traditions. The kāuta was a place for intergenerational learning, for passing down of mātauranga Māori, relationship building, and forming and remembering whenua and whānau history and tikanga.

Reinstating kāuta will enable the retention of traditional practices and knowledge while there is still a generation that has grown up with functional kāuta.

New regulations

New Zealand's national and regional standards for buildings, air quality and fire safety will need to be factored in to any new designs. As of 2020, there are no specific regulations for kāuta, and researchers have had to base design requirements on the existing regulations for solid fuel burners (including cooking stoves). These requirements will also account for fire risk and will meet emergency services' needs for fire risk reduction.

Evolving uses and value

To understand the cultural needs for a contemporary kāuta (for example, for how many people a kāuta needs to cater for, construction, running and maintenance costs, location on the marae, how it can enable people to gather around it), the project team is engaging with Māori communities who experienced traditional kāuta.

Initial interviews revealed that as modern appliances have been adopted in marae, and kāuta have been decommissioned, there are few people with experience using traditional kāuta. Associated traditions, practices and

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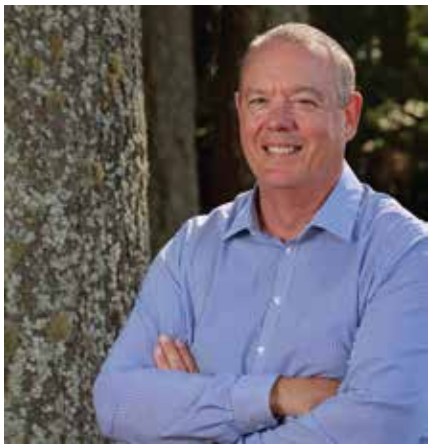
Paving the way for transformation



As the COVID-19 pandemic forced us into lockdown, commentators, influencers and leaders alike started to talk about a future New Zealand using concepts Scion has long paraded. We read about rebuilding our economy sustainably, making our primary industries carbon neutral, rejuvenating manufacturing industries with innovative green technologies, exporting value rather than volume, reforming investment systems, thinking differently to achieve SDGs and so on.

Amongst the hardships of lockdown, we experienced pleasure from the new quietness, hearing bird calls, taking time to chat, exploring our neighbourhoods and so on.

We enjoyed cleaner air too in urban centres. During Alert Level 4 our daily CO_2 emissions fell up to 41 per cent according to a new study[1], a drop second only to Luxembourg. While achieved by our collective confinement, which no one wants to repeat, this impressive drop marks a moment in time for us to reflect on what could be possible.

The R&D sector will be crucial to that possibility, just as it is crucial to informing New Zealand's response to the pandemic. The sector will be vital in our recovery phase and has much to contribute to the rebuild phase by helping to reshape a post-COVID New Zealand.

Finding solutions to challenges is the cornerstone of R&D, and I am proud of Scion's hands-on role during lockdown. We helped to repurpose technical equipment to produce face shields for our local district health board and began making enzymes crucial for COVID-19 research. Now we are focussed on the country's recovery and rebuild phases to bring about better outcomes (economic, environmental and social) for New Zealand.

Scion's strategy is already well aligned with this once-in-a-lifetime chance our country has for an economic transformation to a better way of living based on a more resilient, productive, diverse and low carbon economy. Transformation in the forestry, wood processing and manufacturing sectors will bring new economic opportunities that support recovery. Now is the time to accelerate our strategy.

Scion's strategy is direct and quite simply summed up at enabling New Zealand to transition to a circular bioeconomy. This is the rebuild we are championing, and to that end we are looking for investment to establish biopilot facilities that will allow the scale up of technologies around new biomaterials.

I see a future where forests are a valued part of our landscapes being grown for three clear purposes. Some forests are planted primarily for their environmental benefits, some forests are grown for timber to be better used in our buildings and some forests are grown for fibre and chemicals to replace the products we make from finite fossil fuels. In this future, New Zealand is sustainable, carbon neutral and waste free.

Such transformation of forestry offers huge potential for New Zealand, nationally and regionally. In my opinion, the potential is larger than what was offered when refrigerated shipping began 138 years ago. The way was paved for our trade in frozen meat and dairy products with tremendous impact on our 20th century economy.

By boldly unleashing the power of forestry, New Zealand could repeat such a transformational impact. New Zealand is well positioned to be part of the future sustainable, global, circular bioeconomy. We are already seen as environmentally good, we have a strong Māori culture to integrate into this story, we are great at growing trees and have yet to fully start moving up the value chain. Part of this narrative is the statement I have adopted from global renewable materials company Stora Enso "Anything made from fossil-based materials today can be made from a tree tomorrow".

Scion's strategy is direct and quite simply summed up at enabling New Zealand to transition to a circular bioeconomy. This is the rebuild we are championing, and to that end we are looking for investment to establish biopilot facilities that will allow the scale up of technologies around new biomaterials. A biopilot centre is a national need and will return huge potential around new industries and new jobs.

We have another area of urgency that we are also now concentrating on. The future of both plantation forestry and conservation forestry relies on modern and efficient nurseries serving a wide range of indigenous and exotic trees. If we are going to take hold of the opportunities in front of us we must address this rapidly growing need. Our 'Nursery of the future' initiative and proposals to expand this are an important contributor to the forestry sector's success.

I wish all our partners and customers the very best as we collectively tackle the COVID-19 recovery and rebuild phases.

As always, I welcome your thoughts on this topic and any other matter raised in this newsletter.

Dr Julian Elder
Chief Executive

FOR FURTHER INFORMATION
contact Dr Julian Elder at
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[1] Le Quéré, C., Jackson, R.B., Jones, M.W. et al. Temporary reduction in daily global CO_2 emissions during the COVID-19 forced confinement. *Nat. Clim. Chang.* (2020). https://doi.org/10.1038/s41558-020-0797-x

Dr Dawn Smith demonstrates moulding bioplastics and bioplastic composites.

Scion joins XLabs - New Zealand's first circular economy lab

The promise presented by a circular economy model is staggering. It offers a world without waste, where value stretches beyond monetary value. For organisations and designers that are looking to 'go circular', the first question is, where to start?

Prominent Kiwi businesses like Haka Tourism and the Warehouse Group have enrolled in the nation's first circular economy lab, named 'XLabs'. Auckland-based, XLabs is the brainchild of Louise Nash (from Circularity) in partnership with Auckland Tourism, Events and Economic Development (ATEED). The strength of the programme is that it has been designed by circular economy practitioners and it has a powerhouse line up of experts, engaged to mentor businesses making the shift. Scion is proud to be involved in this group, with Dr Dawn Smith and Marc Gaugler advising XLab's participants on the use of innovative materials for circular products, namely bioplastics. Dr Florian Graichen also participated as an expert panelist.

A circular methodology

XLabs are described on their website as "A series of collaborative workshops at the necessary intersection of sustainability, technology and science. Together, we will help you unlock pathways towards a more regenerative future in Auckland – a circular economy worth up to $8.8 billion."

XLabs uses a methodology developed by circular economy specialist company, Circularity. With their tried and tested six methods, participating businesses can apply circular economy principles to begin their circular journey. The methods include closed loop systems, smart materials, service-based usage, regenerative behaviours, networked participation and embedded intelligence. Weekly workshops focusing on these methods were helped along by presentations and advice from experts, such as Scion's materials scientists, Dawn and Marc. At the end of the workshops, participating businesses took part in online pitch sessions, where they presented their redesigned business models, products and services to stakeholders and potential funders.

Sharing our circular expertise

Dawn and Marc presented during the 'How might we grow our World' themed workshop day. They helped participants to understand how bioplastics can fit into the circular bioeconomy. Their intent was to spark thoughts and ideas and get attendees excited about new possibilities, rather than offering solutions at this stage.

"It was a positive experience," says Dawn. "The audience was very engaged and had a lot of questions – sometimes hard questions. It was great to be able to engage with different groups who described their own journey to change their businesses to operate in a circular manner."

Marc agreed, "What stuck with me, was the breadth and diversity of businesses, companies, individuals and approaches at the workshop. There were tourist business operators, e-solution development companies, building products companies, and many more. All had their own plans on how to transition to a circular economy or circular business model."

Scion has been in the circular bioeconomy business for some time, concentrating on growing, harvesting, and developing products at all value scales and utilising side products. The deep technical knowledge gained by the team over decades is invaluable in helping to fast-track industry initiatives. Marc says, "Through this work, we have built domestic and international networks, which we use to connect Kiwi companies with partners that can help to realise their initiatives."

Next steps

The work is not finished although the workshops have been completed and final pitch presentations are over. Dawn and Marc are continuing to provide advice on some of the concepts and ideas that workshop participants have, while they also look to secure additional financial support to drive these initiatives. Marc says, "Some of those ideas also closely align with initiatives of other organisations that we're in contact with. We're connecting people to bring together a coalition of the willing and generate critical mass for new ideas."

XLabs founder Louise Nash says that the results speak for themselves. "The design of the programme enabled businesses to not only build capability in this space but to explore, ideate and prototype circular solutions for a challenge their business was facing. We now have over 12 circular solutions generated across construction, food production, packaging, technology, transport and education.

"It has been fantastic to engage Scion in the inaugural XLabs to provide these teams with experts to help make their solutions a reality."

FOR FURTHER INFORMATION about Scion's participation in XLabs, contact Dr Florian Graichen at florian.graichen@scionresearch.com
For more information on Circularity and future XLabs, contact Louise Nash at louise@circularity.co.nz

Fire researcher Veronica Clifford ignites a plot.

You've got to burn to learn

This March, Scion's rural fire research team completed six experimental burns of gorse scrub in the Rakaia Gorge, Canterbury, that had taken over 18 months of preparation. The burns are part of a set of experiments in different vegetation fuel types to test a new fire spread theory. The burns were carried out safely and a lot of valuable data collected thanks to good planning, firebreaks, pre-burns, and the involvement of Fire and Emergency New Zealand, the Department of Conservation and local fire volunteers. This data will go on to provide insights into fire behaviour in scrub fuels and ultimately help protect people, property and the environment.

How hot?

Gorse is renowned for its heavy fuel loadings that produce high intensity fires. But Scion and international scientists were surprised by just how hot their controlled fires were. An infra-red camera mounted on a drone at the edge of a burn reached the upper limit of its sensing capabilities at around 940°C. In-fire cameras blistered as the water that was supposed to keep them cool boiled off, and data loggers melted inside well-insulated housings. The temperatures in the centre of the fires were measured to have reached almost 1,500°C.

But why is it necessary to light fires to study fire? Fire scientists are testing a new theory about the roles of heat transfer mechanisms in how fire spreads, and studying wildfires under closely controlled, highly uniform laboratory conditions is not very realistic. The best way to study fire behaviour is in situations as close as possible to naturally varying, real world conditions.

Data loggers recording the rate of fire spread succumb to the heat despite being housed in well-insulated, low-to-the-ground, capsules.

New Zealand is one of the very few countries where large experimental burn projects are still possible – largely due to the relationships built up by the Scion rural fire research team with Fire and Emergency New Zealand. The burns attract worldwide interest from fire researchers. The gorse burns were scrutinised by researchers from the US Forest Service, San Jose State University and the University of Canterbury, as well as the Scion fire team. The amount of instrumentation, and the number of cameras and drones watching and recording ensured the recent fires were, according to the research team, the most closely observed burns in New Zealand to date.

How do fires spread?

Flame fronts have been observed to 'pulse', with flames pushing out ahead of the fire front where they can directly come into contact with and ignite new fuels. This has led to a new theory about the way wildfire spreads. Instead of an evenly spreading flame front radiating heat into unburnt fuels ahead, fire scientists are investigating whether the hot air rising from the fire is replaced by colder air sweeping in from behind and propelling the flames forward. The process creates a series of peaks and troughs within the burning flame front, with flame peaks in areas where the air is rising and pulling the flame upward, and troughs formed by the cool air circulating down.

The theory was first proposed by the US Forest Service based on lab-scale fire

tests carried out in the Missoula Fire Sciences Laboratory. The next stage was experimental burns carried out in cereal crop stubble fields near Christchurch in 2018 and 2019, with the evenly spaced crop rows and uniform stubble height closely mimicking laboratory fire conditions.

Each of the two to four-hectare stubble burn sites was also wired and monitored with in-fire temperature and wind sensors, cameras and high-speed thermal imaging equipment. The fire behaviour observed during the stubble burns was similar to that seen in the laboratory.

The experimental burns are a part of a larger programme preparing New Zealand's response to extreme fire. Extreme fires are unpredictable and deadly, with any fire having the potential to become an extreme fire at any time. They can generate phenomena like fire tornadoes where rapidly rising heated air is sucked into a central hotspot, creating a rotating vortex of flame.

Gorse, with its heavier fuel loads, was next chosen to model fire behaviour in less uniform scrub-type fuels. Beyond that, the team plans to continue their work in more complex vegetation, such as wilding pines, which can form dense thickets that also have very high fuel loads that contribute to crown fires with even larger flames.

Why do we need to understand fire behaviour?

The experimental burns are a part of a larger programme preparing New Zealand's response to extreme fire. Extreme fires are unpredictable and deadly, with any fire having the potential to become an extreme fire at any time. They can generate phenomena like fire tornadoes where rapidly rising heated air is sucked into a central hotspot, creating a rotating vortex of flame. They can also throw embers ahead of the fire front to start spot fires. A bushfire in a plantation forest near a Canberra suburb destroyed houses in 2003. Although flames did not cross the 125 to 150 metre gap separating the forest from the houses, flying embers led to the loss of 250 homes.

Up until recently, our maritime climate has mostly protected New Zealand from large extreme fires. However, recent examples include the 2017 Port Hills Fire, where a fire tornado was reported, and the 2019 Pigeon Valley forest fire near Nelson. More local extreme fires are expected with climate change. The number of hot, windy, low humidity days – or extreme fire risk days – will increase. Beyond the traditionally dry east coasts of both islands, more extreme fire days are expected in Manawatu, coastal Otago (Dunedin and surroundings) and Wairarapa.

The country's emergency services need to be ready to respond to the increased risk and possibility of extreme fire. The focus of the experimental burns and the wider research programme is on being able to predict when extreme fires might occur and how they might behave. Fire researchers look for patterns in fire behaviour, such as how updrafts and downdrafts are pushing flames into the fuel. Predicting extreme fire spread rates in different weather, terrain and vegetation types will help to improve firefighter safety and prevent loss of life and property, as well as getting fires under control quickly.

Fire conditions are changing rapidly as the climate and land uses also change. The results of Scion's rural fire research will help ensure communities and the country are more aware of fire risk and better prepared for extreme fire. By the end of 2020, the team hopes to have a prototype system ready for testing that links fire detection, fire growth prediction and smoke models with weather forecast data for near real-time prediction of fire spread and its effects. Incorporating this into fire responders' everyday operations will give organisations like Fire and Emergency New Zealand faster, more accurate information on fire occurrence, spread and potential effects allowing firefighting resources to be mobilised rapidly and effectively.

Funders

The Extreme Fire Research Programme is funded by the Forest Growers Levy Trust and other stakeholders (Fire and Emergency New Zealand, Department of Conservation, NZ Defence), and the Ministry of Business, Innovation and Employment.

FOR FURTHER INFORMATION on the experimental burns, contact Dr Tara Strand at tara.strand@scionresearch.com

Observations of the smoke from fires will help improve smoke modelling and forecasting.

Award winning researcher shifts from biomechanics to packaging

"I've been interested in how things work and what they're made of, for as long as I can remember," says Dr Kelly Wade.

As a child, he was always tinkering with something. His parents were happy for him to pull things apart and try to fix them or improve them before putting them back together again. Looking back, Kelly thinks these were the habits that started his love of engineering.

A lot has happened since then. Kelly has gone on to begin a successful career punctuated with accolades, the latest award being Young Professional of the Year in the Australasian Packaging Innovation and Design Awards.

But Kelly didn't start his career in packaging. Following a Chemical and Materials Engineering degree from the University of Auckland, he undertook groundbreaking research on intervertebral discs (the discs within the human spine).

Biomimicry, biomechanics and biomaterials

Choosing to concentrate on materials engineering because it "sounded like the most interesting specialisation", Kelly went on to get a PhD in biomechanics.

"I took a course where we discussed the materials for knee replacements. I remember being impressed with the far superior performance of natural biomaterials when compared to engineered metals and composites."

When the PhD opportunity came up with Prof. Neil Broom at the University of Auckland, Kelly began work on his intervertebral disc research. Kelly explains: "Intervertebral discs are the main component in the joints of the spinal column. They allow vertebrae to move while bearing substantial compressive loads.

"We were able to show that the soft, mobile centre (nucleus) contains a highly convoluted fibre network that is integrated with the surrounding outer wall (annulus). Knowing that the disc contains structural gradients is key to understanding how it behaves under load and how it fails or degenerates."

Further research into disc failure and understanding how the herniation process affects the disc at the microstructural level, landed Kelly a prestigious fellowship from the Alexander von Humboldt Foundation. During this time Kelly also won the International Society for Study of the Lumbar Spine (ISSLS) Prize and the AG-Grammer prize, the two major awards in spine research.

Back home to New Zealand

At the end of his fellowship, Kelly heard more about Scion. He liked the idea of working towards more sustainable products and industries, as well as the challenges of working with different biomaterials.

At Scion, Kelly's focus has been on packaging material trials in the WHITE room for industry and for research (Scion's humidity and temperature-controlled facility, the WHITE Room is used for testing the performance of cardboard boxes in chilled supply chain conditions).

Currently, Kelly and the team are looking into how the moisture content of cardboard boxes is influenced by their environment and they believe this will result in new insights into the process that leads to boxes failing in storage.

Industry for the future

Packaging is one of the key enablers for any nation undergoing the transition from linear to circular economy.

All science and innovation within Scion's packaging programme are based around circular principles. Transition of an export/import dependent nation like New Zealand to a circular bioeconomy without appropriate packaging solutions is impossible.

Packaging, particularly single use plastic packaging, has been under scrutiny recently. It is seen as a major contributor to today's waste problems, but also essential to protect the products within. As such, it is an area ripe for innovation as we look to apply the principles of the circular bioeconomy in our products and systems.

For the packaging industry to make the shift to a circular bioeconomy, Kelly says we need to "move towards more easily recycled packaging, fewer multi-material packages and a dramatic reduction in single-use plastic packaging. Use of biobased polymers to replace petrochemicals, will also be part of the solution and I expect to see growth in traceability to ensure safety and origin of goods."

If we don't innovate, there could be trouble for New Zealand's economy. "As an export nation, it is important for New Zealand manufacturers to meet the increasingly high environmental standards for packaging that are demanded by our overseas markets, while also protecting products. I believe we are well placed to support this effort here at Scion."

FOR FURTHER INFORMATION
contact Dr Kelly Wade at
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Transforming the humble toilet

Scion has created a new sewer-less toilet with a high-tech back end that can treat human waste in a new, safe, sustainable and affordable way.

The toilet and its built-in waste treatment tech is Scion's answer as a successful participant in the Reinvent the Toilet Challenge initiated by the Bill & Melinda Gates Foundation. The challenge was created to develop solutions for developing countries where sanitation-related problems are a leading cause of child mortality.

At the core of Scion's toilet technology is a process called sub-critical wet-oxidation. The process was originally developed for the treatment of waste water in the pulp and paper industry, and has successfully progressed through three rounds of selection.

The challenge

The specifications for a toilet intended for developing nations present extremely difficult design hurdles. The technology must work with limited (if any) water and electricity and have low running costs. The technology also needs to meet high environmental standards that allow treated toilet waste to be discharged without further treatment.

The team's plan to address these challenges came in the shape of a normal looking toilet. Processing begins when the mixed waste (faeces, toilet paper and urine) is flushed with a low volume of water through pre-treatment, then passed into a wet-oxidation reactor where a combination of oxygen, high temperature and pressure ensures solids are destroyed and bacterial and viral pathogens are sterilised. The last stages are a final treatment of waste liquids and extraction of nutrients.

The team has now prepared its final reports for the Bill & Melinda Gates Foundation. The findings show that sub-critical wet-oxidation can quickly sterilise and destroy solids.

Cost estimates for this technology, applied to single household use, came to 28¢/person/day (US), dominated by capital costs. However, with further design innovation, the target of 5¢/person/day (US) may still be within reach. Scion's work dovetails nicely into the Generation Two Reinvented Toilet programme, which is also supported by the foundation. In generation two, Georgia Institute of Technology leads a group of collaborating organisations selected from the first generation, including Scion, to improve the best technologies from across the challenge.

Beyond developing this process further, the team has recommended this technology could be repurposed for multiple dwellings such as an apartment building or a city block. Scale-up of the wet-oxidation to treat waste for multiple households holds significant potential in terms of economics and operability.

FOR FURTHER INFORMATION
on our Reinvent the Toilet Challenge work, contact Dr Daniel Gapes at daniel.gapes@scionresearch.com

The disappearance of kāuta

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language, distinct to regions, whānau and hapū have also declined.

Respondents also conveyed the changing uses for kāuta, explaining that while most were decommissioned because of environmental and fire regulations, change also came from evolving views about convenience and a shift in the way marae and whare kai are used by whānau (fewer people working in the whare kai means that electric and gas appliances are more convenient). These findings will help the project team understand what is needed to develop a contemporary kāuta design. To ensure the research team's conclusions are appropriate, they will be reviewed by a Roopu Tikanga comprised of tāngata Māori that work in fire management and kaumātua me kuia, that oversee the cultural integrity of the overall project.

Publicly available design standards

When complete, this project will have developed a set of engineering design requirements for a contemporary kāuta that meets cultural and regulatory expectations. These requirements will be made publicly available, allowing a resource to design contemporary kāuta prototypes.

Scion's project leader, Ilze Pretorius states, "The relationships we are building with Tau Iho I Te Po enables co-design of a kāuta and helps us to place the design need in the cultural context".

Waitangi Wood, from Tau Iho I Te Po Trust, has high hopes for the project. "Though times are changing, it's this generation's responsibility to ensure that the traditions and culture taught to us by our parents and grandparents are maintained and shared with current and future generations. The ability to manaaki our whānau and manuhiri, and our relationship with fire and other natural elements, are central to our culture and identity. We hope that the discussions informed by this project result in kāuta being reinstated across Aotearoa, and that associated understandings, tikanga and language continues."

The project is supported by Te Pūnaha Hihiko: Vision Mātauranga Capability Fund and is set to be complete in June 2021.

FOR FURTHER INFORMATION
on the contemporary kāuta requirement design project, contact Ilze Pretorius at ilze.pretorius@scionresearch.com or Waitangi Wood at waitangi.wood@gmail.com

Our additive manufacturing lab became a hive of activity while hundreds of face shield head bands were printed for Lakes District Health Board.

Face-shield shortage at Lakes DHB solved by Rotorua companies

In the height of New Zealand's COVID-19 response, a group of Rotorua companies pooled their talents to manufacture 215 face visors for Lakes District Health Board.

Working together, Scion and Kilwell Fibretube came up with a solution that would meet the needs of the DHB, which provided clinical input and advice.

A Prusa face shield design consisting of a 3D printed headband, Perspex shield and an elastic band at the back was agreed upon. High Duty Plastics cut the Perspex shields using their laser cutter. The elastic bands were provided courtesy of AJ's Emporium and the DHB.

With some changes to maximise coverage, improve design and reduce printing time, the final 3D design was agreed upon and production began. The headbands were 3D printed using industrially compostable bioplastic PLA at both Scion and Kilwell Fibretube.

Dave Gower-Rudman, DHB Facilities Manager said the visors were modified after infection control recommendations and are robust, fully re-usable and fit for purpose.

"At the time of receipt there were very few options available for eye protection. Even goggles and safety glasses could not be sourced in sufficient quantities. The receipt of these locally made visors was both well received and excellently timed", said Dave.

The 215 visors were delivered to Lakes DHB between 6 and 9 April. Dr Marie Joo Le Guen, Additive Manufacturing Research Leader at Scion, said this is the type of response you'd expect from a Crown Research Institute.

"We've applied design thinking using the flexibility of additive manufacturing and partnered with companies on our doorstep to solve an urgent and critical problem", said Marie Joo.

Kilwell Fibretube CEO Craig Wilson says, "This was a great example of innovative thinking while working under exceptional circumstances. It also highlighted the value of having a strong local business network. The contribution of some excellent Rotorua firms working together was what got the job done. On a personal note I was very impressed with the number of staff that volunteered to help if needed and extremely proud of the team that worked on the project."

All involved agree that this collaboration was highly successful and demonstrates how ingenuity, science, engineering and manufacturing capability can swiftly provide real solutions that benefit our people and New Zealand.

FOR FURTHER INFORMATION on Scion's additive manufacturing capabilities contact Dr Marie Joo Le Guen at mariejoo.leguen@scionresearch.com

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