



Skills Highway Champion Employer

The work done by Buckley Systems in educating and empowering staff was recognised at the 2021 Skills Highway Awards.

Run by the Tertiary Education Commission (Te Amurangi Mātauranga Matua), the Awards recognise businesses that invest in upskilling staff. Nominated by The Learning Wave, the company that runs our Growing Leaders course, Buckley Systems was proud to receive a Highly Commended award in the Skills Highway Champion Employer category. With the highly specialised nature of the work undertaken by Buckley Systems, it is vital to bring people with specialist experience up through the company rather than lose knowledgeable staff who feel they need to leave in order to advance their career. Our low staff turnover of around one percent is in part, a reflection of the value we place on retaining and growing staff within the business.



Distance proves no barrier to success

For many people it is quite a surprise that Buckley Systems is based in Auckland, New Zealand, many miles from our main customers in the semicon, research and medical industries.

The reason for our location goes back to the 1960s and a young physicist working on the subject of polarized ion sources for his PhD thesis at the University of Auckland. The discoveries made through his research resulted in the formation of the Auckland Nuclear Accessory Company (ANAC) that sold high precision electromagnets and related equipment to research institutes and the fledgling semiconductor industry around the world.

While the design work was done by ANAC, machining the parts was done by Bill Buckley at what was then Buckley Engineering. Bill's ability to bring complex designs to reality and his determination to troubleshoot problems where others had failed, was a key part of a successful partnership. As the founders of ANAC eventually left New Zealand for positions overseas, Bill's reputation for making accurate, reliable magnets went around the world with them. Those relationships and our ability to perform under pressure means that many of our clients have stuck with us for over 35 years.

A philosophy of "Be the best at what you do best" has allowed Buckley Systems to become an industry specialist in high-precision wire wound, strip wound and hollow core conductor magnets, exporting mostly to North America, Europe and Asia.

Pioneering work in improving the accuracy of pole profiles saw Buckley Systems becoming the major supplier of magnets for Brookhaven, ANSTO and NSRRC 4th generation light sources plus making magnets for numerous other

research facilities. Magnets manufactured by Buckley Systems are also used in equipment for cancer treatment such as radiotherapy, proton therapy and boron neutron capture therapy.

While Bill was the main innovator, his ability to recruit and retain a team of skilled and loyal staff means that experience in the company is both long and deep. The team includes a physics and design department that can design high accuracy magnets with confidence, plus experts in every field throughout the manufacturing process. Long-serving staff have proven essential for one-off or new build projects where the ability to manufacture complex coils first time is critical to success.

The business has grown to employ over 458 full-time staff (328 permanent plus 130 contractors). To ensure quality, delivery and costs are kept under control, almost all manufacturing is done in-house. The range of services includes coil winding, impregnation, laminating, machining, welding, plating, painting, assembly, validation and packing.

New Zealand has many benefits with a favourable climate, a good education system, a stable workforce and free-trade agreements with most countries. Working in a different time zone gives us the ability to solve customer problems and answer technical questions overnight. A sales office and warehouse in Massachusetts USA means we can hold stock for our Northern Hemisphere clients and provide additional service and technical support. Distance has proven no barrier to global success, with clients who want the peace of mind that comes from dealing with a trusted company with a reputation of going the extra mile to ensure satisfaction.

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Recycling

At Buckley Systems we realise the importance of minimising waste, not only from a cost-saving viewpoint, but for lowering our impact on the environment.

In our machining workshop, we segregate our swarf and scrap metals into copper, steel and aluminium, minimising cross-contamination, making it easier to recycle and maximising value.

Our laser cutting department uses nesting programs to maximise the use of each sheet, enabling us to cut smaller parts out of offcuts that would otherwise be sent for recycling.

Copper coil winding offcuts are collected and sent for recycling. Cardboard and soft plastics are also placed in large bins for collection by specialised recycling companies.

Staff are encouraged to use washable cups for hot drinks and water coolers placed in each building allow people to fill their own drink bottles. The lunch areas have recycling bins for cardboard, bottles and cans.

Used batteries from our portable test meters and instruments are collected and sent for recycling, keeping them out of the waste stream.

While we recycle for the benefit of our environment, there is also the financial benefit of reducing the cost of material we send to landfill.



Aluminium swarf



Glenn Schultz is our new Group Manager for Operations. He grew up and was educated in Zimbabwe where he completed a toolmaking apprenticeship. After completing his indenture, he looked for a fresh challenge, working for a time as a fitter and turner before emigrating to New Zealand in 2000.

His work experience eventually lead him into leadership roles in various companies where he enjoyed the challenge of motivating and training staff. In 2014, finding

Glenn Schultz

Group Manager - Operations

himself looking for a new job, he started as a contractor at Buckley Systems as a winder in the hollow-core-conductor department. Originally, it was supposed to be a temporary position but he became fascinated by the technology, innovation and dynamic nature of the company and stayed on. With his background and experience, he worked his way up through the company, first managing the integration department and then taking over management of the coil manufacturing workshop.

His newly established role as Group Manager – Operations is the result of the increasing growth of the business and sees him re-

sponsible for the coil, integration, paint, testing and dispatch department managers with the aim of enabling them to upskill, remove roadblocks and increase productivity. Working alongside the Group Manager – Manufacturing, Tony Misa, they both report to the CEO. Glenn's practical experience of many of our specialised manufacturing processes has proven invaluable in being able to relate to day-to-day problems and find the best, practical solutions to solving production issues.

In his spare time, when not renovating his house, he spends as much time as possible out in his boat, fishing in the Hauraki Gulf.

Technology topics

DISC news

The Buckley Systems / D-Pace Ion Source Test Facility (ISTF) has been installed in its new home at the D-Pace Ion Source Centre (DISC) based on the Selkirk College campus, Nelson, BC, Canada. Designed to test, develop and validate filament and RF volume cusp sources for negative ions and positive ions from a penning ion source, the ISTF has proven to be a valuable research tool since 2015. To complement the ISTF, a D-Pace designed and manufactured, Bernas ion source test stand has been recently commissioned to help develop both the source and positive ion related devices.

Largest magnet to date

We are in the process of manufacturing a 52-ton dipole magnet. This design and build project will be the largest magnet we have

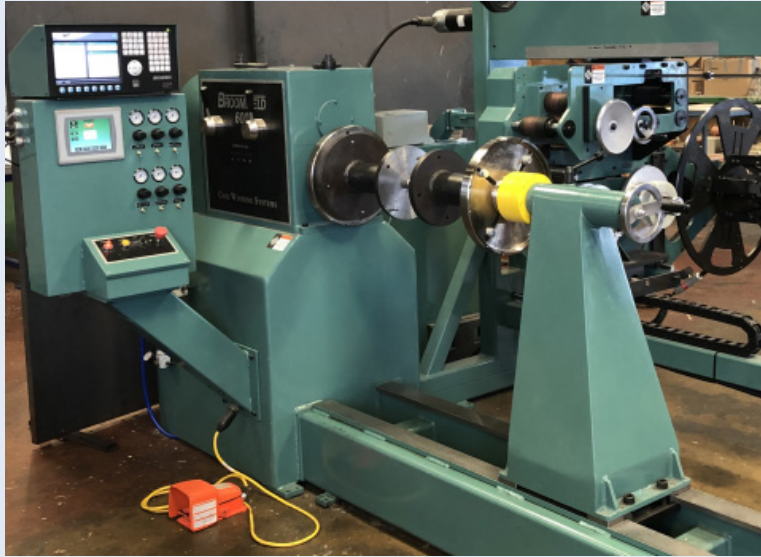
produced so far. Our investment in modern, large capacity CNC machines now enables us to conduct this type of precision work. Once completed and tested, the magnet will be split and shipped to the end user in two containers.

Inquiries for precision permanent magnet

Following interest in our trials of a precision permanent magnet, we are currently engaged in producing preliminary models for a customer to ascertain performance and feasibility of a concept magnet. The design uses neodymium magnets coupled with copper coils for steering, balancing and temperature compensation. While the proposed magnet won't be completely power-free, it will result in significantly reduced power use and generated heat.

High Flux Accelerator-Driven Neutron Facility

The proton accelerator used in the Neutron Therapeutics NuBeam BNCT machine, is being installed at the University of Birmingham to help support research into neutron interactions in materials. Many components such as the high frequency alternators, beam shaping magnets, 100kW beam dump for the >30mA DC / 2.6 MeV accelerator were made at Buckley Systems then shipped to Neutron Therapeutics' facility for final assembly and fitting of power, support and control systems. It is expected to be commissioned by summer 2022. Buckley Systems' President, Bill Buckley, is a founder and shareholder in Neutron Therapeutics, and our partner, D-Pace is licensed to sell the proton accelerator for non-BNCT uses.



New strip coil winding machine

Buckley Systems has just taken delivery of a new strip coil winding machine. Custom built in the USA to our specifications, the automated machine is capable of winding wider, bigger diameter, heavier and more complex coils than any of our existing machines. Precision controls for the insula-

tion film and copper strip means that winding consistency is improved, with even tension applied to the materials even on complex shapes. With more control of the winding process, coils are wound faster and to even higher standards. Loading copper strip is quicker

and fitting the winding mandrels is easier and safer. Removing wound coils is more efficient and minimises any potential damage. The efficiency gains from the new machine have already flowed through the entire coil workshop significantly speeding up production and improving quality.

More new machinery

Mazak i200-ST

Embracing the philosophy of “work smarter” our new Mazak i200-ST CNC mill-turn lathe represents the latest technology in high-speed production machinery. A little sister to our i400-ST purchased in 2019, it represents another step forward in technology with double the tool capacity, faster spindle speeds and control over nine axes of movement. Fitted with the latest “Smooth Ai” controller it allows CAD models to be directly imported into the machine. From there the AI software can program the machine to produce the part using the available tooling with very little operator input required. An on-screen simulation can be run

to check for any clashes before a part is loaded. This offers significant time savings over traditional programming plus minimises potential errors. Equipped with a 60 mm diameter bar-feeder and robotic part-catcher, the machine can be set to make multiple parts overnight without stopping.



Mazak HCN 8800

Investment in the latest production

machinery continues with the addition of a new Mazak HCN 8800 horizontal machining centre. With a high-precision rotating table, increased rigidity and more powerful servo drives than our older machines, it is ideal for the high-speed metal removal involved in machining aluminium vacuum boxes. It has already proved itself by reducing the setup and machining time of our most common vacuum boxes by more than half. With a five-station pallet changer, the machine can either be set up with custom work-holders for commonly done jobs or run identical jobs overnight, unmanned.

Electrochemical weld cleaning of stainless steel

When stainless steel is welded, the heat burns off the protective chromium oxide layer and allows corrosion to occur.

The most common way to clean stainless welds was by using a “pickling paste” containing highly corrosive nitric, sulfuric and hydrofluoric acids. While we have been using hydrofluoric-free weld cleaning paste for some time, it is not as effective and still remains highly corrosive.

Electrolytic weld cleaning uses an electric current and a mildly acidic fluid to remove contamination. It is quick, safe and portable. Only a small amount of fluid is used and clean-up is quick and easy.

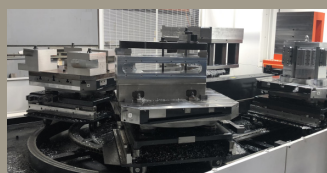
The cleaning machine has a range of conductive brushes for different applications and the output power can be adjusted to suit each job. Another feature is a polishing setting that can be used to give surfaces an even, bright finish.

Electrolytic weld cleaning has proven ideal for weld cleaning of vacuum box fabrications and other welded stainless-steel parts.



RoHS and Reach compliance

For both customer requirements and our own environmental concerns, we have been working hard on eliminating substances of concern from our production processes. Ongoing investigation, testing and user acceptance of new products means that we can offer Reach compliance on all manufactured products.



HCN 880 pallets awaiting machining

Dr Anand George

Buckley Systems would like to congratulate Dr Anand George on being awarded a PhD on the subject of H⁻ ion sources. Dr George's research was supervised by the University of Auckland using the Buckley Systems & D-Pace joint venture, ISTF.

Subsequently awarded a two-year, MITACS funded, post-doctoral position with the Canadian National Accelerator Laboratory, TRIUMF, Dr George will again be working on the ISTF now based in Nelson BC. He will be solving issues on an RF volume-cusp ion source with the aim of future commercialisation.

SaferMe to tackle Omicron threat

To ensure that high levels of production are maintained in the event of a Covid-19 outbreak, Buckley Systems has invested in the SaferMe contract tracing app and software. All 450 staff in our New Zealand based manufacturing facility are now wearing a Bluetooth equipped tag that records the proximity and time spent with other workers. In the event of an infection, all staff who were in a predefined proximity and contact time over the likely infectious period of the person are contacted and advised to test, isolate or self-monitor depending on their individual exposure risk.

Data driven risk assessment will help us minimise potential spread of Covid and allow us to function as normally as possible during any potential outbreak. The scheme has been approved by Worksafe, New Zealand's safe workplace monitoring authority.

Upcoming 2022 Conferences and Events

Buckley Systems and/or D-Pace will have a presence at all these events. Please contact us if you would like to arrange a specific meeting with us while we are there.

- **May 15-22 LEAPS 2022: La Biodola Bay, Elba Island, Italy**
League of European Accelerator-based Photon Sources
- **June 12-1 IPAC 2022: Bangkok, Thailand**
13th International Particle Accelerator Conference
- **August 7-12 NA-PAC 2022: Albuquerque, New Mexico, USA**
North American Particle Accelerator Conference sponsored by IEEE NPS
- **August 22-26 FEL 2022: Trieste, Italy**
40th International Free Electron Laser Conference
- **August 28-September 2 LINAC 2022: Liverpool, UK**
30th Linear Accelerator Conference
- **October 30-November 2 CAARI/SNEAP 2022: Denton, Texas, USA**
26th Conference on the Application of Accelerators in Research and Industry combined with 53rd Symposium of NorthEastern Accelerator Personnel

Design tip

As contract manufacturers, we often deal with drawings supplied to us by our customers. While most are excellent, we sometimes come across designers who specify very fine tolerances on individual components in an attempt to achieve a very precise tolerance on an assembly.

While this appears good in theory, it greatly increases the cost of machining each individual component. Even then, if several parts are used as supports, small differences in height tolerance can cause problems with parallelism and fit. From a magnet manufacturing perspective, it is far

more cost effective and accurate to use general tolerances on individual components and specify the tolerance for critical features such as pole gap and parallelism at either sub-assembly or top assembly level.

Top level tolerances allow our workshop the freedom to part-machine, assemble and then match-machine sub-assemblies in order to achieve the critical dimensions rather than focus on achieving fine tolerances on individual components. Talk to our design department for more information.

Magnet miles

While New Zealand may be a long way from many of our customers, sea freight is a low carbon emitting form of transport. It is estimated that container shipping emits around 8.4g CO₂/tonne-km. This means that delivering a one-ton magnet from Auckland to the Eastern Seaboard of the United States results in emissions of around 135 kg of CO₂ and delivering to a European port, about 229 kg of CO₂.

While this may sound a lot, when it is compared to the typical emissions of a small motor vehicle emitting approximately 1.4 tons of CO₂ per year (140 g CO₂/km over 10,000 km) the carbon cost of delivering a magnet with a long service life, is comparatively small.

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