



New anodizing line

As part of our commitment to monitor and control quality during every step of manufacture, we have recently invested in an anodizing line for aluminium parts.

Anodizing is an electrolytic passivation process which increases the thickness of the natural oxide layer. Aluminium oxide forms rapidly and is many times harder than pure aluminium. While anodizing can be done on many different metals, aluminium is the most commonly used material.

The oxide lattice formed by the process means that deep, scratch resistant colour can be impregnated into the material without altering the dimensions of the finished product.

We can currently offer a variety of colours including clear, yellow, blue and black and will be adding more colours according to customer demand.

Having our own anodizing line also means that it is cost effective to hard-anodize our aluminium moulds and jigs for improved wear resistance.

Anodizing joins our other surface treatments, including chromium-free and phosphate-free conversion coating, electroless nickel plating, copper plating and silver plating.



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Vertical manufacturing proves essential for business stability

In these uncertain times with disrupted supply chains, the advantages of Buckley Systems' investment in vertical manufacturing has played a key part of ensuring we have been able to maintain our delivery schedule during recent disruptions.

From the early days, founder, Bill Buckley always had the philosophy of being closely involved in every step of the manufacturing process. An engineer by trade and curious about how things work, he had the attitude that there was nothing that couldn't be understood and improved on. Designing specialised manufacturing equipment from scratch or modifying existing machinery, gave him insights into how to do things better and faster for less.

While conventional wisdom suggested that outsourcing was the way to increase production with minimal investment, Bill saw the risks in relying on others to match his own determination to make the best product. Instead, he ploughed profits back into the business, building a dedicated manufacturing operation focussing on turning raw materials into finished magnets. By

purchasing directly from the raw material suppliers, holdups and shortages could be better anticipated and managed. Strong relationships built up over decades now means that suppliers are aware of our requirements and reserve stock for us based on our forecasts rather than waiting for purchase orders. When others would have said they can't supply because of supply chain issues, we have arranged to fly in essential components to make sure delivery is made on time.

Vertical manufacturing also gives Buckley Systems complete control over the final product. Expecting outside manufacturers to understand the unique cleanliness and precision requirements of such a specialised industry can lead to delays, extensive rework or increased costs to compensate for doing work outside their normal capabilities.

Control over manufacturing allows Bill's "Can do" attitude to flourish, using the combined experience, knowledge and skills of his staff to successfully manage the most challenging projects from design to delivery.

Buckley Systems International

Buckley Systems International (BSI) is a wholly owned subsidiary of Buckley Systems Ltd of Auckland New Zealand.

Established as a Massachusetts corporation in 2002, BSI functions as a warehouse, customer service facility, sales office, US purchasing arm and operates a limited, value-added manufacturing workshop.

Located in the heart of the semiconductor ion implant industry in the Boston Massachusetts area, it is ideally suited to serve this key industry as well as all US and European customers. A small crew of employees provide 24-hour shipment, on site customer service, international logistics and procurement of parts and materials.

Increasing staff

Unprecedented demand for our services from our key industries has meant that we are busier than ever.

To cope with design work we have employed two new draughtsmen and are training two existing design staff in magnetic field design in order to assist our physicists.

Our purchasing department has been expanded to assist with sourcing, pricing and shipping of materials to make sure our supply chains stay intact.

New planning roles have also been established to manage workflows and to identify bottlenecks.

Our investment in training an effective team leader network is paying dividends as manufacturing staff are able to be quickly trained in the specific requirements of our industry.

A solid foundation of both standard operating procedures and job specific documentation means that upscaling of production is possible while maintaining high quality and consistency.

Our quality department has also steadily expanded over recent years to make sure that regular production sampling and final product inspections are maintained.

Work is underway to increase afternoon and night-shift numbers to ensure greater productivity of our existing machinery while still maintaining a buffer for the unexpected orders that our customers sometimes surprise us with.



Wendy Liu manages our Design department. From Shanghai, China, Wendy graduated from university with a Bachelor of Engineering majoring in Mechanical Design. She started her career in the design office of a large petrochemical company in Shanghai that employed over 10,000 staff. A move to a related business, that designed equipment for manufacturing synthetic fibres from oil by-product, introduced her to draughting software. Back then, DOS based AutoCAD® was a far cry from the sophisticated software used today, but it showed the way of the future.

Moving to New Zealand in 1996 for

Wendy Liu

Design manager

a change of lifestyle, Wendy started at Buckley Systems in 1997. At the time the company consisted of around eighty staff but with no design office. Her first position was as an assistant to the production manager, helping draw jigs and tooling for the rapidly expanding business. The position quickly grew into heading a small design team that in 2004, enabled the company to land a design-and-build contract for the Australian Synchrotron project. The success of the project led to opportunities with other research institutes and helped cement Buckley Systems' position as a trusted leader in this type of collaborative work.

Overseeing the introduction of SolidWorks® software in 2012 was a big step for Wendy and her team. The new software with

3D modelling and simulation capabilities could be matched with the Opera® magnetic simulations from the Physics department. This allowed much greater confidence in design meeting specification and the ability to fit systems into compact spaces.

Wendy is now responsible for a team of ten designers. She works closely with the Physics team, manufacturing departments and customers to ensure designs meet specification and that any revision changes are checked before integration into production.

With 24 years at Buckley Systems, Wendy has seen a lot of changes over that time. Married, with a grown-up daughter, she appreciates music and art and history.

Technology topics

Anand George wins Mitacs scholarship

While waiting for his PhD thesis on improving H- and D- beam currents to be accepted, Anand George has been granted a Mitacs scholarship to undertake post-graduate research at TRIUMF in BC, Canada. This is a testament to the quality of his research done on the Buckley Systems / D-Pace Ions Source Test Facility (ISTF).

ISTF news

Our ISTF is currently in transit to its new home at D-Pace in Nelson BC. Having the project initially based at Buckley Systems, enabled fast manufacture and modification of parts during the R & D phase. With the ISTF now a mature, commercial product at a high state of development, it made sense to

move it to D-Pace where long-term testing and research into different charge states can be done.

Proposed D-Pace & Selkirk College joint venture

D-Pace is in negotiations with Selkirk College and funding providers, to locate a joint venture ion source research centre in the Silver King Campus in Nelson, BC. The intention is to eventually bring together D-Pace licensed, volume-cusp, ECR, Penning and Bernas ion sources in one location for education, research and commercial development. It presents an exciting opportunity for both organisations with D-Pace providing the machines, expertise, and hands-on training to students and the College providing the space and access to the resources of STAC

(Selkirk Technology Access Centre). It is anticipated that the facility will not only be a hub for the commercialisation of discovery science but will also help fill the shortage of people experienced in ion source and beamline operation.

ToF Spectrometer Research Project

PhD student, Tobin Jones is continuing work on his thesis based on a novel, time of flight mass spectrometer. Built at Buckley Systems, the project is being conducted under the University of Auckland's commercial division. After much experimentation, the spectrometer is working and producing good data. Tobin is now presented with the dilemma faced by many students, deciding when to stop the fine tuning and start writing up his findings.



Embracing digital literacy

Leading industry training organisation Competenz, recently invited Buckley Systems to be a key partner in a pilot program for digital literacy. Ten experienced tradespeople were put through a nine-week course, gaining “micro credentials” in the use and application of digital technology. While many of the candidates had high levels of trade skills in operating sophisticated CNC machinery, most were unfamiliar with using software outside their field of expertise. Each three-

hour course was hands-on, covering tips and tricks to enhance their day-to-day interactions with digital devices.

Topics included using smart search for both internet and local drive searches, spreadsheets, flowcharts and slideshows. Showing how data could be exported, manipulated by software and used to improve performance and efficiency in the workshop was a big revelation. Security and the protection of intellectual property

was also covered. The micro-credential approach to training meant that the course was closely tailored to our specific requirements and helped engage staff who had not undertaken formal training for some time.

From the positive feedback, the course was judged a great success with twenty more staff currently enrolled in a second course and a third course planned to start shortly after.

Environmental care and management

We like to do our bit to keep our part of the world green. While many of our manufacturing processes do have some environmental impact, we are working hard to minimise and offset them. A strict wastewater disposal and monitoring contract with network provider, Watercare, means any discharge into the system is strictly controlled. All contaminated or waste liquids are sent to an approved and certified recycling and disposal company. The contract with our electricity supplier, Merid-

ian, offsets our usage against renewable power generation.

To minimise airborne dust and mists, we employ extensive extraction and filtering systems in the CNC machine shop, bead blasting, painting, plating and welding departments. Consumables such as batteries and toner cartridges are also kept out of the waste stream and sent for recycling.

Research is ongoing into using more environmentally friendly products, not just for RoHS and REACH compliance but because

we can.

Our founder, Bill Buckley, has always taken pride in recycling and repurposing machinery to give it another life rather than see it go to the scrapyard.

While what we do can never be zero waste, we are keen to make our magnets the greenest ones possible.



Custom made field measurement devices.

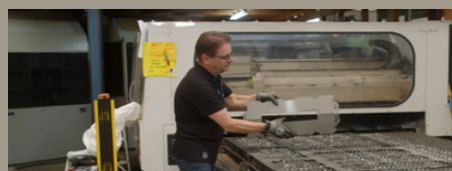
Buckley Systems has gained its reputation as a world leader in precision magnet manufacture, through taking on pioneering projects and making them work. For some of the unique work we do, there are no off-the-shelf instruments available so we modify, design and develop custom solutions to ensure our products meet design specification.

Having physics, CAD design and engineering capabilities in the one location means that equipment can be designed, subjected to analysis and manufactured with high confidence.

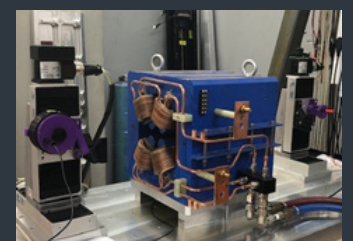
Examples of our in-house equipment include hall probe benches, rotating coil cylinders and stretched wire field measurement devices.

Extensive testing is done using our reference magnets to check that accuracy of the new equipment is within expectations.

Our senior test engineers are adept at getting the best out of the equipment and able to manipulate the data into easy to interpret, analyse and compare formats. While we do not make our test equipment for commercial sale, we are more than happy to discuss the custom manufacture of measurement and alignment instruments for your project.



Laser cut laminations



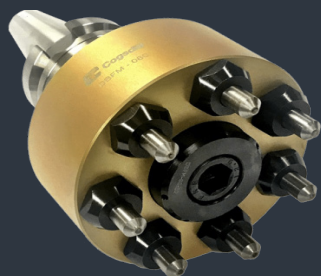
Stretched wire field measurement.

Burnishing pole faces

Machining the relatively soft, low-carbon steels used in magnets can make it hard to obtain smooth surface finishes. Rather than cut cleanly like harder steels, the material tends to tear and deform.

Using special tooling and paying close attention to cutting speed and feed, we can achieve an extremely high-quality finish but sometimes we are asked for better. Burnishing can help smooth out and reduce conventional machining marks by using a non-cutting tool that flows material from the peaks to the troughs.

A recent project involved burnishing pole faces using a multi-point, diamond-tipped face-mill to successfully achieve a specified surface finish and flatness.



Diamond tipped burnishing tool.

Progress at BNCT facility in Helsinki

Commissioning of the accelerator-based BNCT facility at Helsinki University Hospital is well underway. All main sub-systems have been tested separately with end-to-end validation taking place later this year. The hospital is expected to be conducting clinical trials by mid-2022. Buckley Systems has been closely involved in the manufacture of many of the components for the neutron source at the heart of the system.

Upcoming 2021/22 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.

- **September 20-24 ICIS2021: Virtual conference hosted by TRUIMF**

The 19th biennial conference on ion sources. Register at <https://icis2021.triumf.ca>

- **December 7-9 SEMICON West 2021: San Francisco, California, USA**

Electronics and semiconductor supply chain conference.

Documentation capture, control and distribution

While drawings and specifications provide the information, they usually do not cover the finer details on how to achieve a consistent, finished product. To help bridge the gap between design and reality, we have a vast library of documentation covering standard operating procedures (SOP), process instructions, check sheets and other support information.

Our technical writers work with subject specialists, team leaders and managers to identify areas that need clarification and then capture the information using words, images and video.

The collected information is checked against drawings, customer specifications, material information and safety data sheets. It is then compiled, analysed and presented in the best way for the target audience. Outputs may be a written procedure, a marked-up drawing, a captioned image, check sheet, video or HTML file. All information is verified by subject matter experts and department managers before being released.

Our document management system (DMS) links the outputs to the revision numbers of the related drawings and specifications, so that any changes to the source material can be checked to keep information up to date. Where required, our documentation team produces training material so that formal training in the process can be added to the staff skills matrix.

We are currently moving towards presenting many of our production documentation in an HTML format to make it easy to access on handheld devices, simple to navigate and rich with features such as links to supporting information and even short instructional videos.

Being able to capture and easily access the resources of many years' experience in our specialised industry, means best-practice is embedded into our production teams and ensured consistency of our finished products. It has also helped our ability to grow rapidly to meet demand and cement our position as an industry leader.

Covid 19

COVID-19 has produced worldwide disruption to manufacturing and supply chains. One of the results, is that we have seen an unprecedented growth in demand for our services.

Fortunately we have protocols in place to keep our staff as safe as possible.

We are working closely with our suppliers and shipping agents to ensure our supply and distribution chains remain intact but sometimes things are beyond our control.

We thank you for your patience and we will continue to do our utmost to ensure you continue to receive the best service possible.

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Buckley Systems Technical Bulletin is a 6-monthly publication from Buckley Systems Ltd, distributed free to customers and selected, interested parties.

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