Apprenticeship program

Buckley Systems is committed to training technicians for the future, currently employing 20 apprentices in the machining, welding and electrical trades. We get the pick of students from our local colleges and lead them through our in-house training program that has been developed in conjunction with apprenticeship certification boards.

Apprentices get experience in all aspects of our manufacturing processes, helping ensure the knowledge of senior staff is passed on. Hands-on experience working with skilled tradespeople, combined with the latest developments in manufacturing technology, is building future leaders within the company.

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Upcoming 2018/19 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.

- **August 27-31 WTTC 2018 Coimbra, Portugal**

  Workshops on Targets and Target Chemistry

- **September 3-7 NIBS 2018: Novosibirsk, Russia**

  Negative Ion Beams and Sources

- **September 24-27 SNEAP 2018: Madison, Wisconsin USA**

  51st Symposium of North Eastern Accelerator Personnel

2019

- **April 1-5 IMRP19: Strasbourg, France**

  International Meeting on Radiation Processing,

  Organised by the International Irradiation Association (iia)

- **May 19-24 IPAC19: Melbourne, Australia**

  10th International Particle Accelerator Conference

Flying high with Air New Zealand

Buckley Systems' apprentice Alisha Taupo, recently featured in an advertisement for the apprentice training organization, Competenz. Appearing in the August edition of Kia Ora, Air New Zealand's in-flight magazine, it was a great opportunity to tell some the 1.4 million passengers who fly with the airline each month, what Buckley Systems does.

Alisha is one of two young women currently completing a fabrication apprenticeship with us and is proving that being a woman is no barrier when it comes to mastering an industrial trade.

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If you would like to subscribe to an email edition, please contact us at: info@bucklevsystems.com

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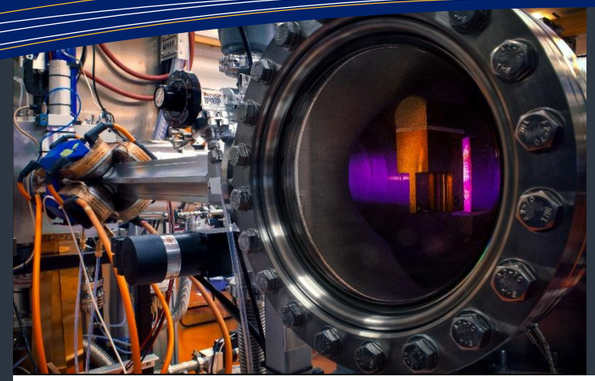
BUCKLEY SYSTEMS
Ingenious at work

Buckley Systems Technical Bulletin



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Large diameter cyclotron coils

A recently completed project has been two, 130-inch (3,318mm) diameter solid wire coils destined for use in a cyclotron.

Great care was taken to ensure the coil was kept within a strict dimensional envelope and that the enamel wire insulation remained undamaged.

With each coil weighing 3.43 tons (7,566 lbs.) when complete, special handling techniques were employed to make sure it did not distort under its own weight. Heavy steel shipping frames weighing more than the coil were designed and manufactured in-house to ensure safe delivery.

… to tiny, specialised magnets

While we have the ability to make large, 30 ton magnets, and are uniquely skilled in manufacturing medium to large coils, we enjoy the opportunity to manufacture small coils as well. Recent work has included 2.1 kg (4.6 lbs.) projected field magnets destined for laboratories and a couple of 310 gram (11 oz) deflector magnets for a prototype cancer treatment device.

Product development and consultancy

While some of our customers present us with production ready drawings, specifications and test plans, many clients approach us at the concept or early design stage for our advice.

With decades of experience, our design team considers all the factors involved in building a magnet that performs to specifications including:

- Material selection – do the selected materials have the right properties?
- Coil design – physical limitations of the material, insulation requirements, cooling, location.
- Magnet design – Opera™ Magnetostatic (formerly known as Tosca) and 3D Dynamic Electromagnetic (formerly known as Elektra) software for FEA simulation of magnetic fields of both AC and DC magnets.
- Pole tip design optimisation using the above Opera™ software.
- Engineering design – SolidWorks 3D modelling and FEA backed by real world experience.
- Electrical design – termination, bonding, insulation, and safety devices.
- Hydraulic design – cooling circuits and plumbing.
- Vacuum chamber and beam tube design including friction-stir welded seams (where practical).
- Integration with other structures including stands and frames and fitting in tight design envelopes.
- Allowances for servicing or maintenance access.
- Corrosion control, protective coatings and finishes.
- Tolerance control incorporating practical, real-world, manufacturing tolerances to achieve the required beam characteristic.
- Test & inspection plans for comprehensive quality control and performance measurement throughout manufacture.
- Documentation including installation and servicing instructions (if required).
- Product design optimisation to ensure lean manufacture - minimal material wastage and efficient manufacturing to meet or exceed the desired specifications within closely defined performance, accuracy, reliability, environmental, financial and time constraints.

By keeping our design and manufacturing services in-house, knowledge and experience of how to produce the optimum outcome is always close at hand.

Developing close relationships with our clients' design teams helps improve the product and establishes a mutual trust that the delivered product will deliver uncompromised performance and reliability for the lowest practical cost.

If you have a project you would like help with, please call us for a no-obligation discussion on how we may help.

R & D investment

To maintain our position as the premier supplier of precision electromagnets and associated accelerator hardware, Buckley Systems invests heavily in research and development.

Over $NZ 1.8 million ($US 1.2 million) was spent on R & D initiatives in the 2017/18 financial year. Working closely with Callaghan Innovation, the New Zealand Government's high-tech support agency, we have invested heavily in developing new products and manufacturing techniques to improve accuracy, quality, reliability and efficiency.

Dry-film lubrication for clean rooms

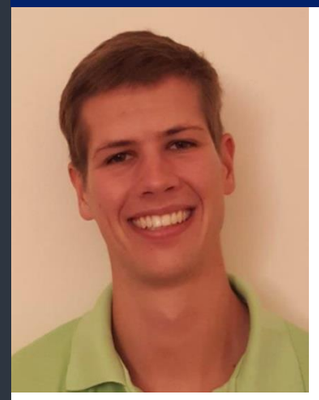
With strict controls around lubricants in clean rooms, Buckley Systems has been investigating alternatives.

Specialist, low vapour pressure lubricants are specified for many of our devices but there is always a risk of over-application and of contaminates sticking to lubricated surfaces.

Trials are being undertaken on dry PTFE coatings to determine their suitability for use in clean-room situations. Testing includes:

- Pre-treatments to provide a strong bond.
- Application methods to ensure complete and even coating.
- Wear tests to make sure no dust is produced.

Research is ongoing with the aim of providing a dry lubricant film option for future projects.



Nicolas Savard

Ph.D. student in residence

Developing a helium^{++} radionuclide production ion source for cancer treatment

Nicolas Savard is the latest PhD student to take advantage of the Buckley Systems / D-Pace ion source test facility (ISTF) at Buckley Systems' headquarters. He will be using the ISTF to develop a He^{++} ion source to produce high-current alpha beams for use in radionuclide production. The aim is to produce an ion source design able to supply commercial quantities of astatine 211, a short half-life radiohalogen with potential applications in radio-immuno therapy.

Born in Canada and raised in Chicago, after gaining a Bachelor of Physics from McGill University in Montreal, Nicolas completed his Masters' degree at the University of Victoria in Victoria and Munich, based on research into plasma wakefield accelerators.

Now with scholarships from UBC and MITACS to help fund his PhD research subject, Nicolas will be using the design and manufacturing facilities at Buckley Systems to help bring his theoretical ion source design to reality. The prototype design has many tuneable features to allow the testing of different plasmas and to optimise beam output for future commercial models.

Nicolas envisages the project and thesis taking another two to three years to complete and is taking advantage of working alongside the physicists conducting experiments on the ISTF and other research projects at Buckley Systems.

Living nearby, Nicolas bicycles to work and takes advantage of the Buckley Systems' gymnasium.

Technology topics

BNCT accelerator installation in Finland

Neutron Therapeutics is currently installing its first BNCT system in the Helsinki University Hospital. Bill Buckley is a majority shareholder and Buckley Systems has been involved in manufacturing many of the components of this multi-million dollar project including the accelerator, bending magnets, lithium target and bismuth shields.

It is hoped to have a neutron beam produced by late 2018 with trials starting shortly afterwards.

Dr Taneli Kalvas

We recently had the honour of a two-week visit from Dr Taneli Kalvas from the University of Jyväskylä, Finland. During his visit, Dr Kalvas held training sessions on the IBSimu, ion optical computer simulation software package he developed for predicting the behavior of ion source plasmas and ion beams. He gave valuable help to the PhD students on tuning RF sources and conducted his own experiment on the ISTF.

Refurbishment

With a production history spanning over 30 years, we sometimes get requests to refurbish obsolete magnets and vacuum components that have suffered damage or require an update.

In consultation with our design team we can either re-manufacture as-is to the old drawings or take advantage of manufacturing improvements to upgrade magnets to better than new.

A recent project involved remaking new sweep magnets for an old, no longer manufactured, beamline. Where possible, serviceable parts from the old model were refurbished and re-used, saving time and money.

Note: *For refurbishment, strict controls are in place to ensure all components are uncontaminated and radiation-free before arrival.*

Bill Buckley inducted into New Zealand Business Hall of Fame

The contribution that Bill Buckley has made to New Zealand business was acknowledged on July 27th as he was inducted into the New Zealand Business Hall of Fame.

With over 40 years manufacturing components for the silicon wafer, scientific and medical industries, Bill has built Buckley Systems from a small engineering workshop to a world-leading manufacturer of accelerator components. Now employing over 350 staff and worldwide exports that have exceeded one billion dollars, Bill's pathway to success was his unwavering commitment to investing in the right people and machinery to make sure customers' expectations were fully met.

Things have not always been easy in such a specialized industry. Volatility in demand has proved challenging at times with Bill personally propping up the company in quiet times, not wanting to shed his skilled and loyal staff, knowing that new orders were on their way.

Not a natural salesman or self-promoter, Bill established his reputation in the physics community as someone who understood exactly what was required to not only bring theoretical designs to reality but to refine and optimize the design to improve manufacturing accuracy and repeatability. Bill's inquiring mind picked up the sort of properties physicists were looking for in a magnet and he became the "go to" man in the early days of the commercial production of particle physics electromagnets.

Much of the specialized coil winding and handling equipment at Buckley Systems has been designed and built by Bill using nothing but a few sketches and calculations on a scrap of paper. Pioneering new engineering technology has also been Bill's passion. Friction-stir welding to fabricate vacuum boxes, EDM wire cutting for pole accuracy and laser cutting lamination steel are a few examples that are now commonplace in the industry.

Having established Buckley Systems as a world leader in magnet manufacture and by putting in place a strong manufacturing and physics design facility, Bill's focus has turned to the future by funding research and the design of groundbreaking technology.

In conjunction with Hilton Glavish, Bill has funded the Buckley Glavish Chair in Theoretical Climate Physics at the University of Auckland. The ion source test facility (ISTF) manufactured in association with partner company D-Pace, is conducting experiments in plasma physics and ion source development. Another partnership with US based Neutron Therapeutics will see its first BNCT cancer treatment facility installed at Helsinki University Hospital late 2018.

Stages 1 and 2 of the ion source test facility (ISTF) installed at Buckley Systems' headquarters, Auckland, New Zealand

Paint workshop improvements

To help remove a bottleneck in our production, a new paint preparation area has just been constructed. Adjacent to, but closed off from the main spray painting booth, the new area allows paint preparation work to be undertaken while painting is in progress in the main spray booth.

Keeping the dust and debris created during preparation, away from the main painting area, means that the main paint bay is easier to keep clean and less time is spent making sure surfaces are free from contamination before painting. The new area has been fitted with a six-ton crane and a high-powered dust extraction system, it has been designed to be multi-functional and has already been put to use as a second spray booth during busy periods and for spraying colours and finishes incompatible with the products being sprayed in the main paint booth.

While a great paint finish does not affect the performance of a magnet, Buckley Systems understands that the painted steel work is the most visible part of a magnet and reflects the care and attention that has gone into the manufacture of the entire system.