

**UNSW
Nuclear
Innovation Centre**
Advancing Australia's nuclear technology for global impact

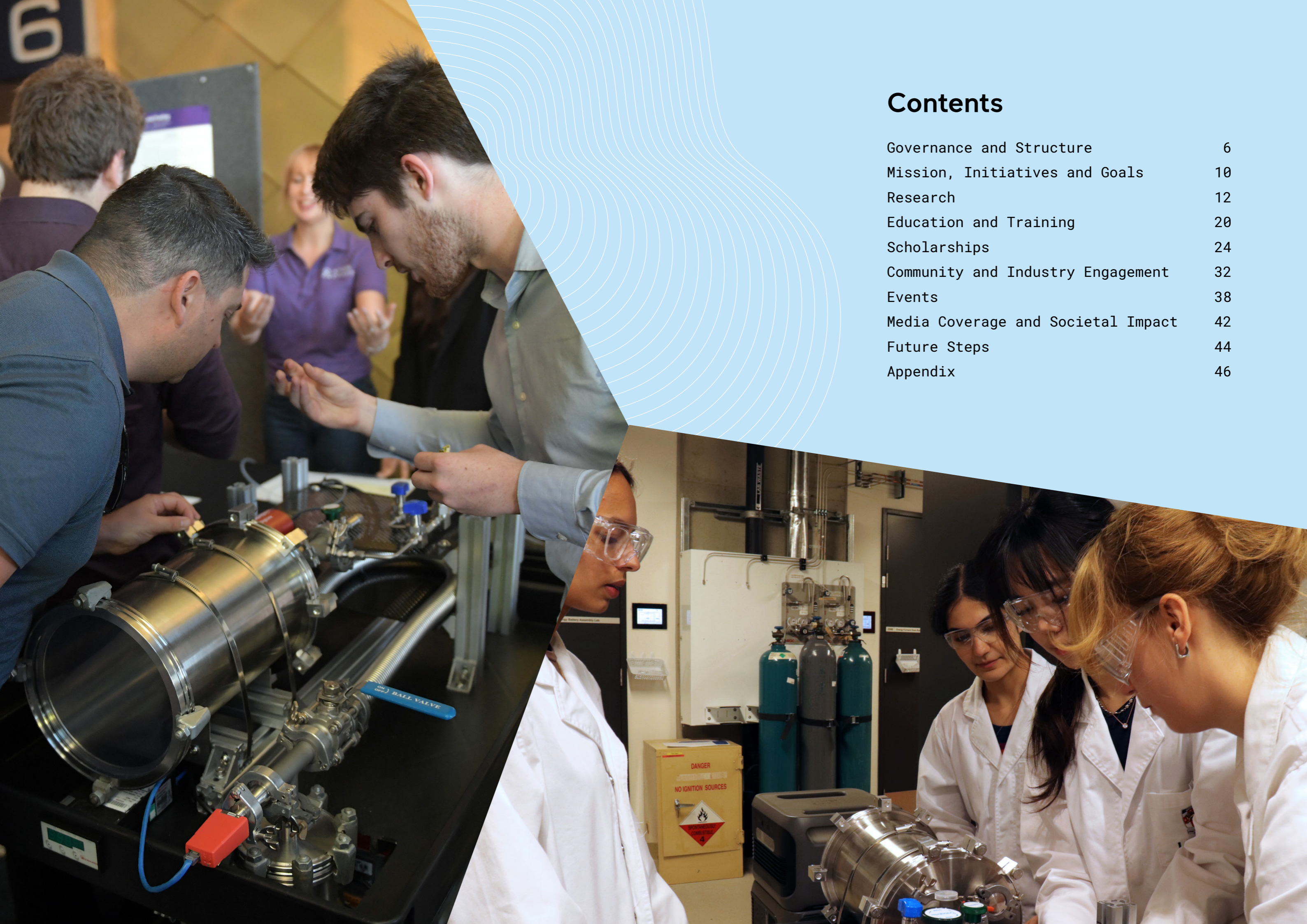


UNSW
SYDNEY

2025 Annual Report

Building our Nuclear Future





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Acknowledgement of Country

UNSW respectfully acknowledges the Bidjigal, Biripai, Dharug, Gadigal, Gumbaynggirr, Ngunnawal and Wiradjuri peoples, on whose unceded lands we are privileged to learn, teach and work. We honour the Elders of these Nations, as well as broader Nations that we walk together with, past and present, and acknowledge their ongoing connection to culture, community and Country.

Message from the Director

It is my pleasure to present the UNSW Nuclear Innovation Centre's 2025 Annual Report. This year has been full of exciting developments, and none of our progress would be possible without the continued support and guidance of the Sir William Tyree Foundation, which has been instrumental in advancing nuclear initiatives in Australia for decades. Beyond the Foundation's essential financial support, the board members have generously contributed their time, energy and insight, helping to shape the Centre's direction and guide its growth.

We continue to build a strong team dedicated to strengthening nuclear expertise and inspiring innovation around Australia. In the past year, we have expanded our research programs, launched Australia's first comprehensive Bachelor of Engineering (Honours) in Nuclear Engineering (p.21) – which is welcoming 20 students in its first cohort in 2026 – and continued to grow our suite of education and training initiatives. These programs are creating meaningful pathways for students and graduates to build the skills and expertise needed to progress Australia's nuclear future.

The Foundation's generosity has also made an extraordinary difference through scholarships (p.24). In 2025, 17 students and researchers had the opportunity to attend international conferences and workshops and learn from industry and academic mentors. These experiences have enriched participants' learning and inspired them to contribute to cutting-edge research, helping to cultivate the next generation of nuclear leaders.

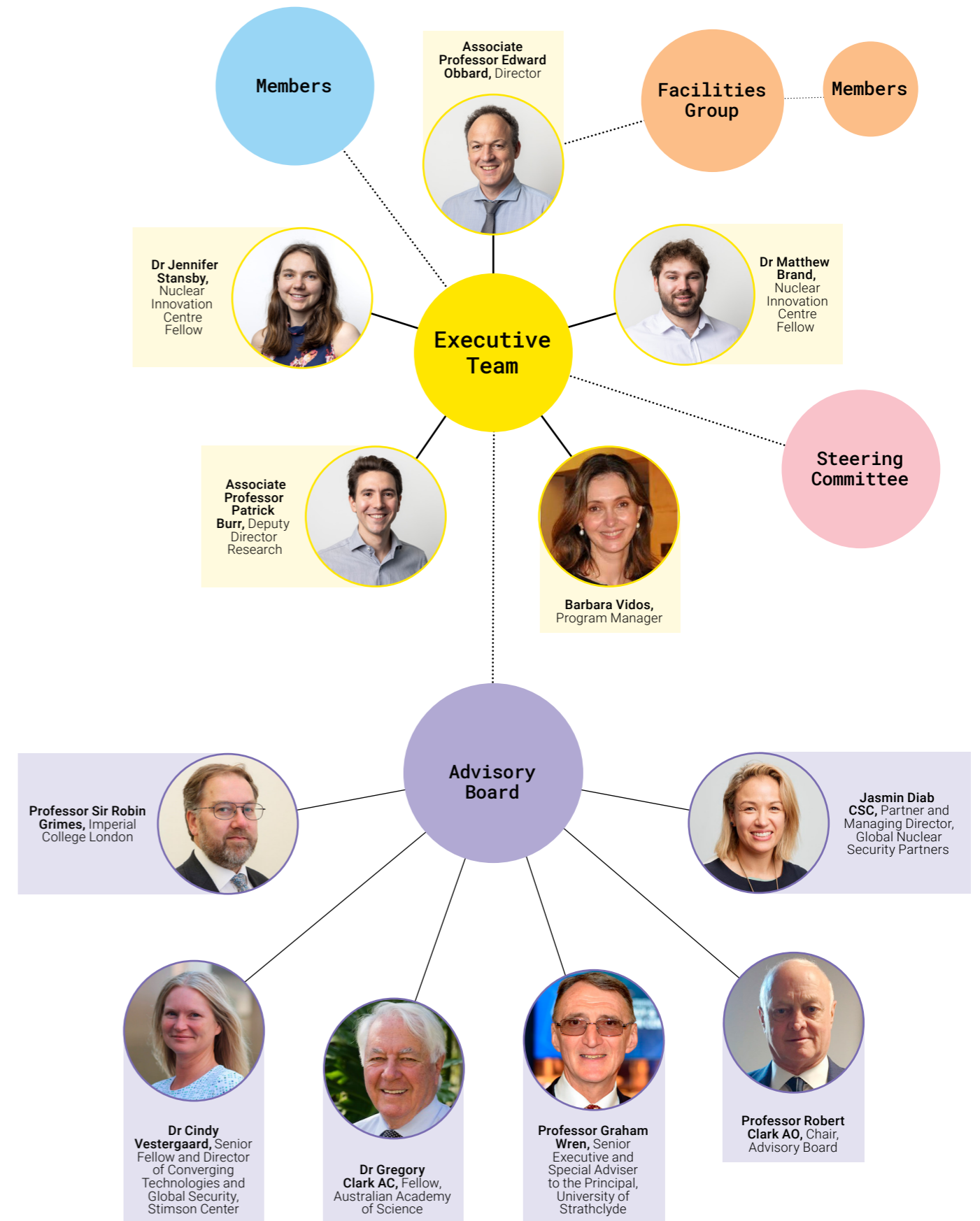


The report also highlights the impactful research projects (p.13) that our academics, early-career researchers and students are undertaking. From pioneering studies in nuclear materials to innovative applications across energy, medicine and industry, these projects are solving complex technical problems to enable real-world nuclear applications.

Throughout this report, I hope you will see how the Centre is fostering a vibrant, collaborative community of scholars, students and industry partners across the globe. The continued support, advice and engagement of the Sir William Tyree Foundation remain central to our journey, and we are deeply grateful for your commitment to advancing nuclear research, education and innovation in Australia.

Associate Professor Edward Obbard
Director, UNSW Nuclear Innovation Centre

UNSW Nuclear Innovation Centre Executive Team



Governance and Structure

Members

Members of the UNSW Nuclear Innovation Centre comprise experts, researchers and industry partners committed to advancing nuclear science and technology in Australia.

Name	Faculty or organisation
Associate Professor Neda Aboutorab	UNSW Canberra
Professor Christoph Arns	Engineering
Professor Seher Ata	Engineering
Professor Julian Berengut	Science
Dr Dhriti Bhattacharyya	Science/ANSTO
Dr Jessica Veliscek Carolan	ANSTO
Associate Professor John Daniels	Science
Dr Art Cotterell	Law & Justice
Professor Andrew Dempster	Engineering
Dr John Doan	Science
Dr Juan Pablo Escobedo-Diaz	UNSW Canberra
Professor Clinton Fernandes	UNSW Canberra
Professor Michael Ferry	Science
Scientia Professor Victor Flambaum	Science
Dr Paul Fraser	UNSW Canberra
Dr Nicholas Gilmore	Engineering
Professor Bernd Gludovatz	Engineering
Scientia Professor Ewa Goldys	Engineering
Associate Professor Ehab Hamed	Engineering
Dr Tracey Hanley	UNSW Defence Research Institute (DRI)
Dr Kenneth Kam Chung Hong	Radiochemistry Laboratory
Dr Tzong Hung	Research & Enterprise
Dr Emmanuel Flores Johnson	Engineering/ANSTO
Professor Salil Kanhere	Engineering
Professor Matthew Kearnes	Arts, Design & Architecture
Dr Taehwan Kim	Engineering
Andrew King	Radiochemistry Laboratory

Name	Faculty or organisation
Professor Natalie Klein	Law & Justice
Associate Professor Pramod Koshy	Science
Professor Jay Kruzic	Engineering
Professor François Ladouceur	Engineering
Associate Professor Kevin Laws	Science
Associate Professor Xiaopeng Li	Engineering
Professor Lucas Lixinski	Law & Justice
Mr David Lyons	UNSW Canberra
Dr Graeme Melville	Science
Professor Brett Molesworth	Science
Professor Lyria Bennett Moses	Law & Justice
Adjunct Professor Ondrej Muransky	Engineering/ANSTO
Dr Luiz Bortolan Neto	ANSTO
Associate Professor Robert Niven	UNSW Canberra
Conjoint Associate Professor Giancarlo Pascali	Science/ANSTO
Dr Carl Power	Research & Enterprise
Professor Hamid Roshan	Engineering
Dr Ivo Seitzzahl	UNSW Canberra
Professor Neeraj Sharma	Science
Joshua Sherman	UNSW Defence Research Institute (DRI)
Conjoint Associate Professor Ivan Ho Shon	Medicine & Health
Associate Professor Warren Smith	UNSW Canberra
Dr Kay Song	Engineering
Dr Esmat (Anna) Ghorbanpour Tamajan	Engineering
Dr Bronwyn Thomas	Engineering
Dr Minh Ngoc Tran	ANSTO
Scientia Professor David Waite	Engineering
Dr Zhiyang Wang	ANSTO
Professor Guan Yeoh	Engineering
Professor Jianqiang Zhang	Science

Steering Committee

The Steering Committee oversees the strategic direction of the UNSW Nuclear Innovation Centre, supporting alignment with broader university priorities, compliance obligations and cross-disciplinary collaboration.

- **Professor Julien Epps**, Dean of Engineering
- **Scientia Professor Sven Rogge**, Dean of Science
- **Professor Andrew Lynch**, Dean of Law & Justice
- **Professor Cheryl Jones**, Dean of Medicine & Health
- **Professor Frederik Anseel**, Dean of Business School
- **Professor Emma Sparks**, Dean and Rector, UNSW Canberra at ADFA
- **Professor Claire Annesley**, Dean of Arts, Design & Architecture

Facilities Group

A collaborative effort between UNSW Sydney and Australian Nuclear Science and Technology Organisation (ANSTO), the UNSW Nuclear Innovation Centre Facilities Group aims to advance nuclear research and education through shared facilities and minimising resource duplication.

Members

- **Associate Professor Edward Obbard**
- **Dr Jennifer Stansby**
- **Scientia Professor David Waite**
- **Associate Professor Pramod Koshy**
- **Professor Neeraj Sharma**
- **Dr Daniel Gregg (ANSTO)**

Growing our team

Meet our newest post-doctoral fellow, Dr Kay Song



When Dr Kay Song took part in the Nuclear Innovation Bootcamp (NIB) at UNSW in July, it became a catalyst for the next phase of her career. Two weeks spent working alongside early career researchers and students from across the nuclear community consolidated a decision Kay had been toying with for months.

"Prior to taking part in the NIB, I was considering the option of returning to a research-focused position (from an operational role). The program of the NIB really reignited my passion for nuclear research, and I enjoyed meeting many members of the UNSW NIC team, which allowed me to see how the NIC is driving the growth of nuclear research and education in Australia. This was instrumental to consolidating my decision to apply for the post-doctoral research role in the group, which appropriately aligned with my previous work in materials for nuclear fusion."

Kay has been researching materials for nuclear since 2018, beginning with her honours project at the Australian National University, where she investigated plasma interactions with tungsten for use in the ITER divertor. She went on to complete a PhD at the University of Oxford, focusing on ion-irradiation damage in steels for fusion. She then took up a post-doctoral position, also at Oxford, examining zirconium alloys for nuclear fuel cladding. After returning to Sydney to begin a research operational role in materials engineering at the University of Sydney, Kay next decided to apply for the fellowship at the UNSW Nuclear Innovation Centre.

At the Centre, Kay is driving the experimental stream of the Linkage Project between UNSW, Tokamak Energy, ANSTO and Imperial College London, focusing on characterising the effects of irradiation on tungsten boride materials designed for nuclear fusion shielding components. Kay says she is looking forward to pursuing science with a practical, industry-relevant focus.

Before starting her post-doctoral role, Kay visited Tokamak Energy in the United Kingdom, where she connected with key collaborators in the Linkage Project and toured their flagship compact spherical tokamak, ST40.



Kay during her visit to Tokamak Energy before beginning her role at UNSW.

Mission, Initiatives and Goals

Vision

Scale and excellence in nuclear research, education and training in Australia.

Vision

Mission

Mission Statement

To grow world leading research groups producing nuclear innovation and nurture Australia's top nuclear education programs to achieve regional significance.

Centre Initiatives

The UNSW Nuclear Innovation Centre seeks to advance its mission by pursuing the following objectives:

1. Grow portfolio of funded research projects.
2. Deliver Australia's top nuclear education programs.
3. Foster an interdisciplinary nuclear community of practice.
4. Establish regional significance for Australia's nuclear education and research.

Goals

1. Create new funding streams for nuclear research in Australia.
2. Expand academic offering to meet demand and generate more experiential learning opportunities.
3. Expand industry network and member engagement.
4. Collaborate with top tier regional nuclear institutes.



Projects

Members of the UNSW Nuclear Innovation Centre deliver innovative and world class research using nuclear techniques and supporting nuclear outcomes.

Optimising the fabrication of next-generation nuclear fuels

The high uranium density and thermal conductivity of UB_2 and uranium nitride (UN) provides opportunities to increase the efficiency of nuclear power generation, but before any next-generation fuel can power a reactor, its fabrication must be mastered. This project seeks to optimise the synthesis and fabrication of these fuel compounds to advance their commercial implementation.

For UB_2 , a reproducible lab-scale synthesis method via arc-melting was developed. By understanding the behaviour and volatilisation of boron during the melt process, UB_2 can now be consistently fabricated. The next stage of the project will involve high-throughput characterisation and testing of this promising fuel material. The experiments in this project were conducted in the state-of-the-art facilities at the University of Texas at San Antonio (UTSA).

For UN, *in situ* neutron diffraction was used to characterise the chemical reactions used to convert uranium metal into UN, marking the first time these reactions have been observed in real time. The data show exact temperatures and time of conversion, providing unprecedented insight into phase evolution and reaction pathways. Samples were prepared by overseas collaborators at Los Alamos National Laboratory (LANL).

- > **Principal Investigator:** Dr Jennifer Stansby
- > **Involving:** Associate Professor Edward Obbard, Melody Ranger (PhD candidate)
- > **Partners:** ANSTO, UTSA, LANL



Associate Professor Edward Obbard, Melody Ranger and Dr Jennifer Stansby

Neutron scattering methods

Neutron scattering methods are essential for materials characterisation. These techniques provide unique insights into materials structure and dynamics. The team has been using neutron-scattering techniques to understand materials for a variety of applications. Furthermore, the investigators have been able to interrogate real-world devices, such as batteries, while they operate. This provides unparalleled insight into materials and device function.

- > **Principal investigator:** Professor Neeraj Sharma
- > **Involving:** Dr Jennifer Stansby, Dr Matthew Teusner, Zhao Chen (PhD candidate), Liam Mckinlay (PhD candidate), Professor Vanessa Peterson (ANSTO), Associate Professor Jitendra Mata (ANSTO), Professor Max Avdeev (ANSTO), Dr Nicolas de Souza (ANSTO)
- > **Partner:** ANSTO

Professor Neeraj Sharma

Professor Sharma focuses on designing new materials and understanding their structure-property relationships. With a PhD from the University of Sydney and post-doctoral experience at ANSTO, he has held prestigious fellowships, including an ARC Discovery Early Career Researcher Award, Future Fellowships and an AINSE Research Fellowship.

Neeraj has received numerous accolades, such as the Society of Crystallographers in Australian and New Zealand Mathieson Medal (2023) and NSW Premier's Prize for Science and Engineering (2019), based on the neutron and synchrotron X-ray scattering work he undertakes at ANSTO. With more than 200 publications and 40-plus invited talks, his highly collaborative research often involves *in situ* or operando studies of materials, particularly in batteries, to uncover structural features driving superior performance.



Research

Scaling the impact of nuclear innovation

Investigating the stoichiometry of the ϵ -phase of boron-11 enriched tungsten boride derived from arc melting for radiation shielding application

The ϵ -phase of the tungsten boride (W-B) system is investigated for its use as a high energy neutron shielding material in compact spherical tokamak reactors. The determination of accurate phase boundaries for this system is particularly important to fusion energy technology, because B concentration will have a decisive influence on shielding performance and lifetime. Three W-B compositions from both B-lean and B-rich peripherals of the ϵ -phase were produced from metallic W and isotopically enriched B-11 by arc melting to investigate the stoichiometric range of the ϵ -phase and phase evolution pathways in both as-solidified and homogenised conditions at 1500 °C. The B concentration of the ϵ -phase in B-lean and B-rich samples are reported, along with their crystallographic space group, site coordinates, and B occupancies, as determined by neutron powder diffraction and complementary scanning electron microscopy and X-ray diffraction characterisation.

- > **Principal Investigator:** Sercan Çetinkaya (PhD candidate)
- > **Involving:** Associate Professor Kevin Laws, Dr Jennifer Stansby, Dr David Miskovic, Professor Vanessa Peterson, Dr Samaneh Setayandeh, Associate Professor Patrick Burr, Associate Professor Edward Obbard
- > **Partners:** ANSTO and TENMAK (Turkish Energy, Nuclear and Mineral Research Agency)

Sercan Çetinkaya

Sercan fabricated W-B samples using arc melting and performed neutron diffraction experiments at ANSTO for this research. When attending the TMS2025 conference, he gave an oral presentation and discussed his research findings, highlighting the impact of the work conducted with ANSTO at UNSW.



Hybrid input-output scenario analysis of green steel in Australia: Assessing the energy trilemma trade-offs

Steel is a cornerstone of modern economies, with demand steadily rising, especially due to its critical role in energy transition, supporting technologies like reactors, heat exchangers and containment systems in nuclear power plants. Amid growing tensions in the shift to a low-carbon future, supply security concerns, climate pressures and geopolitical instability, this study models the evolution of Australia's steel and electricity sectors across multiple energy scenarios. By examining how these sectors shift under contrasting energy futures, the study provides an integrated assessment of the trade-offs between sustainability, affordability and security that Australia must navigate in shaping its decarbonised future.

- > **Principal investigator:** Hasliza Omar (PhD candidate)
- > **Involving:** Associate Professor Edward Obbard, Professor Matteo Vincenzo Rocco (POLIMI), Dr Lorenzo Rinaldi (POLIMI), Professor Iain MacGill (UNSW), Professor Elizabeth Thurbon (UNSW)
- > **Partner:** Polytechnic University of Milan (POLIMI)



Hasliza Omar

Laser fusion technology for safe and sustainable baseload energy

Laser fusion was pioneered at UNSW by Emeritus Professor Heinrich Hora. It is the most advanced approach to fusion energy, routinely reaching fusion net-energy gain, with the field being driven by a number of private companies now considered an industry. Professor Hora made foundational contributions to this field of high-energy-density physics across a long and decorated career. Of special mention are his pioneering developments in laser-driven electron and ion acceleration, and his theory on achieving fusion gain from laser compression, which underpin laser-fusion science today. His vision for proton-boron fusion energy, and his belief in its practical achievement, led Professor Hora to found HB11 Energy with Dr Warren McKenzie.

The goal of this project is to develop commercially viable fusion energy technology that can be deployed worldwide. In that sense, the project seeks to federate the various experimental and theoretical advances made over the past decades, improve the state of knowledge in non-thermal fusion and, in doing so, help establish the viability of the approach promoted by UNSW's industry partner HB11 Energy.

HB11 Energy's broader activities in Australia aim to establish a national laser facility, which will be the first of its type in the Southern Hemisphere, intended to establish high-energy density physics research. It will enable Australia to participate in international missions to realise the world's first fusion power-plant demonstration.

- > **Principal investigator:** Professor François Ladouceur
- > **Involving:** Professor Dimitri Batani (Université de Bordeaux), Professor Alexander Fuerbach (Macquarie University), Dr Esmat (Anna) Ghorbanpour, Dr Igor Morozov (Macquarie University), Dr Sergey Pikuz (HB11 Energy)
- > **Partners:** HB11 Energy, Macquarie University, Université de Bordeaux



Professor François Ladouceur

Professor Ladouceur's scientific contribution covers a wide area of photonics technologies – from telecommunications to sensing, fabrication to simulation. François has led large-scale projects targeting the development of novel hybrid opto-electronics devices from their early design phase to their commercial realisation. In the process, he has gained considerable expertise in modelling, design, packaging and interfacing.

Dr Esmat (Anna) Ghorbanpour

Dr Esmat (Anna) Ghorbanpour is a Senior Research Associate at UNSW, and her primary field of research is fusion energy. Her work is conducted in partnership with HB11 Energy Holdings, focusing on optimising the parameter space to enable breakthroughs in laser-driven fusion.



During 2025, Dr Ghorbanpour, together with the HB11 Energy team, attended the 5th International Workshop on Proton-Boron Fusion in Belgrade, Serbia. The workshop covered new experimental results, advanced fusion concepts, target-design materials, reactor developments, theoretical modelling, simulations and emerging applications. Alongside Dr Igor Morozov of Macquarie University, she presented a suite of new and updated simulation tools, highlighting recent theoretical advances and the high-gain target designs identified through their work. In September, she also participated in the 2nd Intensive School on Laser, Plasma & Fusion in Montenegro, further strengthening her experimental understanding of laser-driven fusion. The results of Dr Ghorbanpour and Dr Morozov's work were also presented at IFSA conference in France.

Thorium-229 nuclear clock

This project advanced the case for a next-generation thorium-229 nuclear clock based on the Th⁴⁺ ion (Th V). Unlike today's atomic clocks that tick via electrons, this concept uses a transition inside the nucleus, which is naturally shielded from environmental disturbances. The team showed that Th V's closed-shell electrons (total angular momentum zero) strongly suppress key systematics such as black-body radiation and stray fields; they provided practical design data (energy levels, polarisability) and predicted a measurable frequency difference between Th IV and Th V that enables powerful

cross-checks. This work guides worldwide experiments following the first laser excitation of the 229Th nucleus in 2024.

- > **Principal investigator:** Scientia Professor Victor Flambaum
- > **Involving:** Dr Vladimir Dzuba (UNSW), Dr Ekkehard Peik (PTB)
- > **Partner:** Physikalisch-Technische Bundesanstalt (PTB)



CMRP conference: Advancing nuclear technology in Australia

Chaired by Professor Anatoly Rozenfeld, the Centre for Medical Radiation Physics (CMRP) at the University of Wollongong successfully hosted and delivered the Mini-Micro- Nano- Dosimetry & Innovative Technologies in Radiation Oncology (MMND-ITRO) conference at the Sheraton Grand Sydney Hyde Park from 18-22 February, 2025. The conference was attended by more than 200 delegates from around the world.

CMRP post-doctoral and PhD students performed multiple experiments in Japan this year, including at a Heavy Ion Therapy facility in QST HIMAC, Chiba, and at Kansai Boron Neutron Therapy (BNCT) Medical Centre in Osaka. Other experiments were conducted in Europe at the Galactic



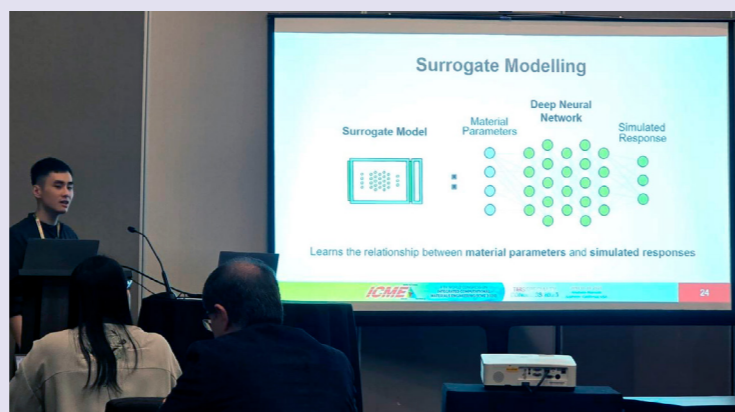
Cosmic Ray simulator at GSI Helmholtz Centre for Heavy Ion Research in Germany, the PSI Proton Therapy Centre and an experiment with MOSkin detectors on very high dose rate energy electron beam at DESY synchrotron, also in Germany.

Multi-objective surrogate-assisted calibration of CPFEM models using macroscopic response and *in situ* EBSD measurements of grain reorientation trajectories

Crystal plasticity finite element method (CPFEM) models are widely used to simulate the deformation behaviour of polycrystalline materials, but their calibration is often limited by their high computational cost and the nonconvexity of the optimisation landscape. This study develops a multi-objective surrogate-assisted calibration workflow that couples a multi-objective genetic algorithm (MOGA) with an adaptively trained deep neural network (DNN) surrogate model to efficiently identify CPFEM parameters from experimental data. The workflow was demonstrated on three crystal plasticity (CP) formulations of increasing complexity – Voce hardening (VH), two-coefficient latent hardening (LH2), and six-coefficient latent hardening (LH6) – using *in situ* electron backscatter diffraction (EBSD) measurements of Alloy 617 under uniaxial tensile loading. The CPFEM models were calibrated against the experimentally observed stress-strain response and reorientation trajectories of eight grains, then validated against eight additional trajectories and overall texture evolution. Across the CP formulations, the macroscopic response was reproduced reliably, while differences emerged in the robustness and accuracy of the grain-scale predictions. Including grain reorientation trajectories in the multi-objective calibration improved texture evolution predictions and filtered out

physically inconsistent parameter sets that could arise from calibrating against only the stress-strain data. The workflow also demonstrated good transferability of calibrated parameters from a low- to a high-fidelity microstructural model. These results provided practical guidance for integrating *in situ* microstructural data into CPFEM through efficient, repeatable, and physically meaningful multi-objective calibration.

- > **Principal investigator:** Janzen Choi (PhD candidate)
- > **Involving:** Dr Ondrej Muransky (ANSTO), Dr Mark Messner (ANSTO), Dr Tao Wei (ANSTO), Dr Tianchen Hu (Argonne National Laboratory), Professor Jay Kruzic (UNSW), Dr Michael McMurtrey (INL)
- > **Partners:** ANSTO, Argonne National Laboratory, Idaho National Laboratory (INL)



Supporting nuclear medicine research: The power of radiochemistry and preclinical imaging

In modern medicine, the most effective treatments start with being able to see exactly what is happening inside the body at a molecular level. This is where radiochemistry and preclinical imaging come together. Radiochemistry enables the manufacture of radiopharmaceuticals (or radiotracers) that can find specific diseases, and imaging provides the “map” that allows us to watch them work in real time. By attaching safe, medical imaging and therapeutic isotopes to biological molecules, experts can transform a standard scan into a live-action window into metabolism, receptor binding and disease progression, and subsequently treat the disease.

The UNSW Biological Resources Imaging Laboratory (BRIL) is proud to be a National Imaging Facility (NIF) site. The NIF is a national collaborative network that provides world-class imaging infrastructure, expertise and training to support cutting-edge research across Australia. It brings together advanced imaging technologies including preclinical, clinical and radiochemistry capabilities within a unified framework, enabling researchers to access state-of-the-art equipment and specialist knowledge. As part of NIF, this facility contributes to a nationwide effort to accelerate discoveries in health, science and technology, helping ensure that innovations move efficiently from bench to bedside. BRIL is led by Dr Carl Power (Director) and supported by four Fellows: Dr Tzong Hung (Preclinical Imaging Fellow) and Dr John Doan, Dr Kenneth Kam Chung Hong and Dr Andrew King (Radiochemistry Fellows).

BRIL launched the Radiochemistry Laboratory in November 2025. The team of radiochemistry fellows work across both UNSW and the Prince of Wales Hospital, bridging the gap between research and patient care. The goal of the laboratory is to produce reliable, high-quality tools that help us understand diseases better than ever before. The team of experts have experience in handling radioactive materials and can radiolabel everything from tiny molecules and nanoparticles to complex antibodies.

Once a radiotracer is created, the preclinical imaging suite takes over. Using advanced PET and CT technology, researchers can capture images that show how a drug moves and changes over space and time. This isn't just a static picture; it's a way to measure exactly how well a new drug or therapy is working before it ever reaches human trials. As the lab is fully integrated – with everything from imaging systems to animal care all in one PC2-rated facility – it can run complex, multimodal studies that give



BRIL's Synthesis Equipment Trasis.

researchers a complete picture of biological health and response to treatment.

This high-end technology is focused on one thing: advancing the field of nuclear medicine. By linking experts in cancer biology and drug development with imaging specialists, the NIF is accelerating the journey from a laboratory “eureka” moment to a life-saving treatment in the hospital. These images help build the framework for personalised medicine, where every treatment is tailored to the individual patient's unique biology.

- > **Involving:** Dr Carl Power, Dr Tzong Hung, Dr John Doan, Dr Kenneth Kam Chung Hong and Dr Andrew King
- > **Partner:** Prince of Wales Hospital



BRIL's Bruker Preclinical microPET-CT Scanner.

Mechanistic understanding of TRi-structural ISOtropic-coated particle fuel behaviour

TRi-structural ISOtropic (TRISO) fuel, often dubbed the most robust nuclear fuel form, features a multi-layered composite and ceramic composition providing a robust structure and reliable containment of fission products under demanding nuclear environments. These features make the fuel form attractive for high-temperature reactors for industrial applications including hydrogen production and steel smelting, and small/microreactors for dispatchable power such as to power AI data centres, remote locations, military operations and space power reactors.

Despite its promising applications in advanced reactors, a mechanistic understanding of its real-time performance within representative reactor environments remains incomplete. This project brings together the researchers' expertise in *in situ* characterisation techniques such as neutron scattering, multi-scale two-dimensional and three-dimensional imaging, and computational finite-element analysis to observe, interpret and model the fuel's behaviour on a bulk scale. By applying this integrated experimental and modelling approach on representative fuel samples, the researchers aim to bridge the research gap and enhance our mechanistic understanding of TRISO fuel performance.

- > **Principal investigators:** Dr Jennifer Stansby, Associate Professor Edward Obbard
- > **Involving:** Associate Professor Patrick Burr, Harvey Ling (PhD candidate), Clayton Feng (PhD candidate), Alfie Jones (undergraduate student)
- > **Partners:** ANSTO, Canadian Nuclear Laboratories, Oak Ridge National Laboratory, Idaho National Laboratory, University of East Anglia, University of Oxford, University of Wollongong



Alfie Jones

Alfie is an undergraduate mechanical engineering student developing a high-temperature heating rig, capable of temperatures up to 1600°C, to support *in situ* thermal expansion studies of TRISO nuclear fuel particles. These studies are planned to be performed on the Micro-Computed Tomography beamline at the Australian Synchrotron.

Clayton Feng

Clayton is a PhD candidate in nuclear engineering at UNSW. His research aims to utilise *in situ* characterisation techniques to understand failure mechanisms of TRISO fuel particles, on a macroscopic and microscopic scale.



As part of his research, Clayton was able to investigate the atomic and bulk scale thermal expansion behaviour of graphitic materials. By understanding these materials' thermal expansion behaviour on multiple length scales, accurate predictions of their structural stability and performance can be performed over varying temperature conditions. Ultimately, this understanding will be translated to the graphitic carbon layers of TRISO fuel particles to contribute in an improved mechanistic understanding of the fuel's bulk behaviour.

Harvey Ling

Harvey is a PhD candidate in nuclear engineering at UNSW. For this project, he utilised both two-dimensional and three-dimensional microscopy techniques at Idaho National Laboratory to capture the representative micro and macro-structure of irradiated TRISO fuel samples. He used automated computational image analysis techniques to extract critical fuel properties from this data, including material porosity, density and thermal conductivity. In Australia, Harvey led experiments at the Australian Synchrotron (operated by ANSTO), utilising its three-dimensional imaging capabilities to investigate the *in situ* mechanical crushing response of both TRISO particles and fuel compacts.



Harvey is currently developing a capability to extract representative mechanical properties of the fuel's materials by combining his three-dimensional image analysis techniques with inverse finite element modelling. He will then integrate these extracted material properties into the BISON fuel performance code to improve the accuracy of its predictions of in-reactor TRISO fuel performance.

Harvey, Dr Jennifer Stansby and Associate Professor Edward Obbard are also pioneering the very first high-temperature *in situ* thermal expansion experiments on representative TRISO fuel samples at both Oak Ridge National Laboratory and the Australian Centre for Neutron Scattering (ANSTO).

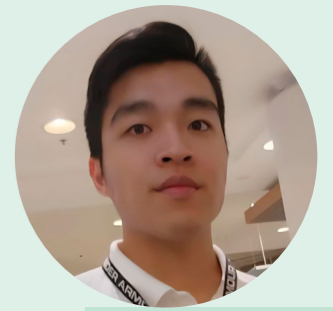
Optimisation of zirconolite glass-ceramics

This project aims to optimise zirconolite glass-ceramics, a material that has gained traction for its compositional flexibility and effective partitioning of waste elements into the stable zirconolite phase. This is particularly evident in immobilising actinides and lanthanides, which have extremely low solubility within all currently used glass matrices. The goal is to optimise both the composition and processing conditions of these materials when produced using hot isostatic pressing (HIP), a method suitable for large-scale manufacturing.

To achieve this, the study will adjust sample compositions to reflect HIP's reducing environment and then use various characterisation techniques to assess phase

purity, composition and grain size. Additionally, both short and long-term tests will be conducted to evaluate the material's resistance to water-based degradation, helping to better understand their durability and dissolution behaviour.

- > **Principal investigator:** Associate Professor Pramod Koshy
- > **Involving:** Frederick Zhang (PhD candidate)
- > **Partner:** ANSTO



Frederick Zhang

Collaborative partnerships

As part of the UNSW Nuclear Innovation Centre's mission, fostering international and domestic partnerships is central to advance the effects of nuclear education, research and policy. Collaborations between partners allow the Centre to build Australia's nuclear capabilities. Partners and collaborators include:

Academic research partners

- Australian National University
- Imperial College London
- Massachusetts Institute of Technology
- University of Wollongong
- University of Sydney
- Curtin University
- Adelaide University
- University of Texas at San Antonio

Nuclear regulator partners

- The Australian Safeguards and Non-Proliferation Office (ASNO)
- Radiation and Nuclear Safety Authority (STUK), Finland
- The Swedish Radiation Safety Authority, Strålsäkerhetsmyndigheten

Industry partners

- ANSTO
- Australian Department of Defence
- Babcock International Group
- Bechtel
- Boss Energy
- Los Alamos National Laboratory
- Stimson Center (USA)
- Tokamak Energy
- Westinghouse
- ASA Defence
- HB11 Energy
- Oak Ridge National Laboratory
- Idaho National Laboratory
- Australia's Submarine Company (ASC)

International organisations

- The Organisation for Economic Co-operation and Development Nuclear Energy Agency (OECD NEA)
- Nuclear Innovation Alliance (NIA)
- International Atomic Energy Agency (IAEA)

Visits to Oak Ridge National Laboratory

ORNL highlights

- Guided tours of ORNL's Particle and Fuel Fabrication Facilities, showcasing advanced fuel manufacturing and fresh-fuel characterisation capabilities.
- Visits to ORNL's hot cell facilities, gaining perspective on infrastructure for handling irradiated materials.
- A private tour of the Spallation Neutron Source (SNS) with Dr Matthew Tucker, focusing on its beamline capabilities for diffraction and imaging experiments on nuclear materials.
- Strategic meetings with Dr Tyler Gerczak, Dr Will Cureton and Dr Tucker to define a roadmap for future TRISO collaboration involving ORNL, UNSW and ANSTO.

Building the future workforce of nuclear experts

The UNSW Nuclear Innovation Centre is building the pipeline of graduate students who are highly skilled in nuclear knowledge and problem solving, ready to advance Australia's nuclear capabilities across multiple sectors. Our suite of education programs has now grown to include:

Bachelor of Engineering (Honours) (Nuclear Engineering)

Officially launched in August 2025, the Bachelor of Engineering (Honours) (Nuclear Engineering) degree is welcoming its first cohort of 20 students in semester one, 2026. The degree is Australia's first comprehensive program for nuclear engineering, designed to provide students a multifaceted and adaptable skill set to contribute to the future of nuclear applications in Australia and abroad.

Nuclear Engineering Minor

The Nuclear Engineering Minor allows students to combine expertise from traditional engineering disciplines with specialised knowledge to solve the challenges facing nuclear technology.

AtomCraft

AtomCraft is the world's first student-led fusion energy reactor. The project aims to design, build and operate a small tokamak reactor, done entirely by undergraduate engineering and physics students. This is made possible due to support from the UNSW Nuclear Innovation Centre, the Digital Grid Future Institute and the Australian Research Council.

Postgraduate degrees

Our Postgraduate offerings include:

- **Master of Engineering Science (Nuclear Engineering)**
- **Graduate Diploma in Engineering Science (Nuclear Engineering)**
- **Graduate Certificate in Engineering Science (Nuclear Engineering)**

Executive Education programs are also available, providing custom in-person and virtual courses in nuclear science, engineering and leadership.

Australian Graduate School of Engineering courses

The Australian Graduate School of Engineering (AGSE) short courses at UNSW seek to deliver practical, industry-informed learning to enhance technical knowledge and leadership skills. These engineering short courses help students advance their career and stay ahead in a rapidly evolving industry.

Education and Training

Eminent researcher seminar series

The Centre hosted leading nuclear professionals in 2025, continuing the seminar series from 2024. These seminars encouraged collaboration and knowledge sharing and strengthened the Centre's international and domestic relationships.

Dr James Vohradsky, a Post-doctoral Research Associate at the Centre for Medical Radiation Physics at the University of Wollongong, delivered a talk examining the renewed global interest in Boron Neutron Capture Therapy, focusing on silicon-based technologies developed for neutron dosimetry and microdosimetry.



Dr Ishita Trivedi, a Computational Scientist, presented on modelling and simulation tools for advanced nuclear technology systems. She highlighted her team's work in multiphysics modelling and simulation of nuclear thermal propulsion reactor designs for space applications, activation analysis of fusion blanket materials to assess tritium breeding and radiological implications and safeguards-focused studies for microreactors, where small size and unique deployment scenarios introduce new non-proliferation considerations.

Dr Mia Maric, a Rolls-Royce Research Fellow in Nuclear Fuel Cladding at the University of Manchester (UoM), presented on the current and future challenges in the nuclear sector. She focused on the collaborative research of UoM's team in partnership with Amentum, Rolls-Royce, Westinghouse and EDF Energy and the development of novel, automated and standardised machine learning-based methods for quantifying damage from life-limiting processes in claddings, including hydride precipitation, crack formation and irradiation-induced damage.



Dr Esmat (Anna) Ghorbanpour, a research associate at UNSW and **Dr Igor Morozov**, a research fellow at Macquarie University, presented their work on inertial fusion energy using proton-boron fuel. They focused on state-of-the-art theoretical studies and computer simulations that highlight the potential for proton-boron fusion in the framework of the inertial confinement concept.

Building a diverse nuclear industry

The 2025 Nuclear Innovation Bootcamp placed a strong emphasis on the relationship between diversity and innovation within the nuclear sector. For the first time in the Bootcamp's history, participants engaged in a dedicated session exploring how a diverse workforce promotes creativity and innovation.

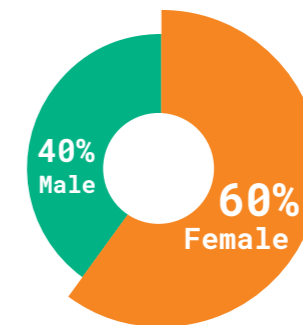
Two keynote speakers contributed valuable insights:

- Jasmin Diab CSC, President of Women in Nuclear Australia, highlighted current trends and statistics on diversity in the nuclear industry, both within Australia and globally.
- Professor Rita Henderson outlined UNSW-wide initiatives designed to promote equity, diversity and inclusion and reflected on their relevance to the future nuclear workforce.

Key themes emerging from the Bootcamp included:

- The role of diverse perspectives in driving innovation
- Active allyship and the importance of supporting underrepresented groups
- The complexities of approaches, such as quotas, to implement diversity, which led to thoughtful discussion among participants.

Notably, 2025 marked the first year in which the majority of Bootcamp participants identified as female, with 17 out of 28 attendees (60%), making it the most balanced cohort to date.



Bootcamp cohort

- 17 female
- 11 male



NIB participants on a social outing to the Sydney Opera House.

Travel, collaboration and connecting with the world

Sir William Tyree Foundation scholarships

The Sir William Tyree Foundation's support for the UNSW Nuclear Innovation Centre places a strong emphasis on nurturing the next generation of nuclear engineers through scholarships that enable travel, professional development and further study. These scholarships connect students with leading experts, industry and government professionals, and peers from around the world.

Tyree Foundation Travel Awards

From March to May, PhD candidate **Hasliza Omar** received the Tyree Foundation Travel Award to collaborate with the Sustainable Energy Systems Analysis and Modelling (SESAM) research group in Milan, Italy. SESAM specialises in mathematical modelling of energy systems and components.

Her research examined how Australian decarbonisation policies impact the energy trilemma – balancing sustainability, affordability and security within national steelmaking pathways. Under the mentorship of Professor Matteo Vincenzo Rocco and Dr Lorenzo Rinaldi, who previously studied EU contexts, one of the key findings showed that a decarbonisation premium is unavoidable. While global green corridors may help mitigate that cost, they also underscore the complex trade-offs involved, particularly in large-scale infrastructure projects like nuclear power development.

Hasliza remains actively engaged with the SESAM group to explore the geopolitical dimensions of material criticality assessment for clean energy technologies.

In March, PhD candidate **Sercan Çetinkaya** attended TMS2025 in the USA to present his research titled, 'Revisiting the composition and crystal structure of WB2-x for fusion neutron shielding' and 'Refractory high entropy metal-borides (Hf, Ta, Nb, Zr, W)Bx – microstructure, crystal structure and phase evolution'. Sercan received valuable feedback on his work and made strong connections with academics from Imperial College London, the University of New Mexico, Pacific Northwest National Laboratory and Commonwealth Fusion Systems.



Hasliza Omar during her travels to Milan in early 2025.



Sercan Çetinkaya at TMS2025.

Scholarships

Ryan Suhardjo and Marcus Borscz travelled to the UK in June to complete an internship with Tokamak Energy. The Tyree Foundation Travel Award allowed them to establish connections abroad, present AtomCraft's work internationally to boost its profile, and develop their technical expertise.

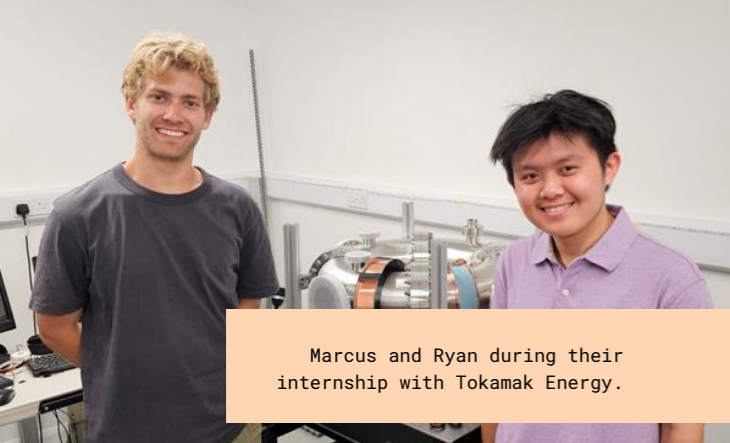
Ryan, an undergraduate student, completed his internship at Tokamak Energy, contributing to the development of the Vacuum, Conditioning and Fuelling (VCF) systems for the Fusion Pilot Plant (FPP). His work focused on three main goals: conducting a literature review of wall conditioning techniques for the FPP, modelling the vacuum conductance using *MolFlow* and gaining hands-on experience with experimental and operational activities across the ST40 tokamak facility. These tasks each provided him a deep technical insight into fusion engineering, complex system modelling and experimental operations within a high-level research environment.

Throughout the placement, Ryan said he was granted significant autonomy to explore new problems while receiving expert feedback and guidance along the way, particularly when developing simulation workflows and interpreting vacuum modelling results.

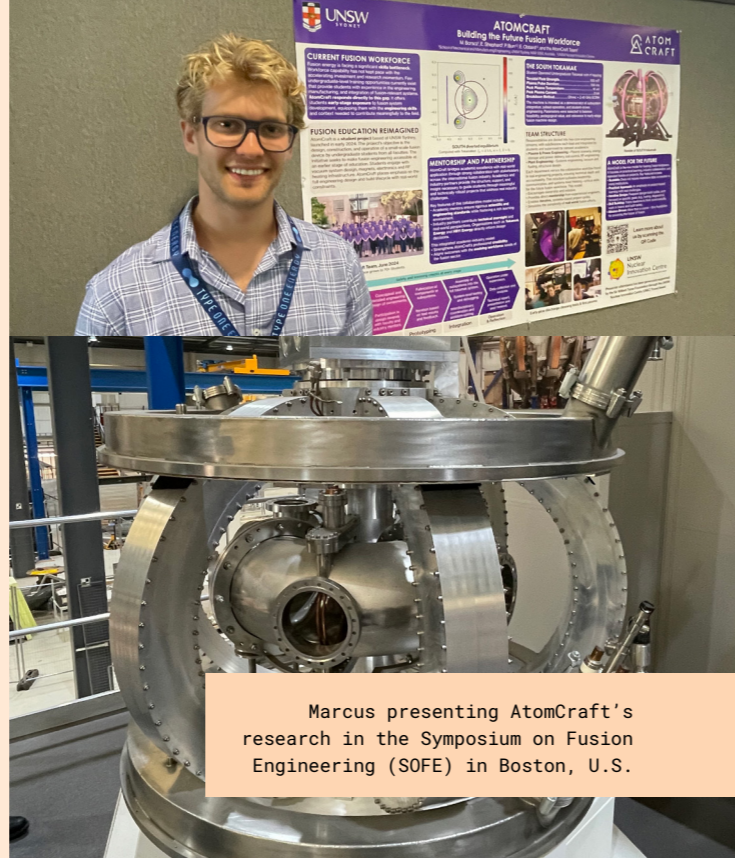
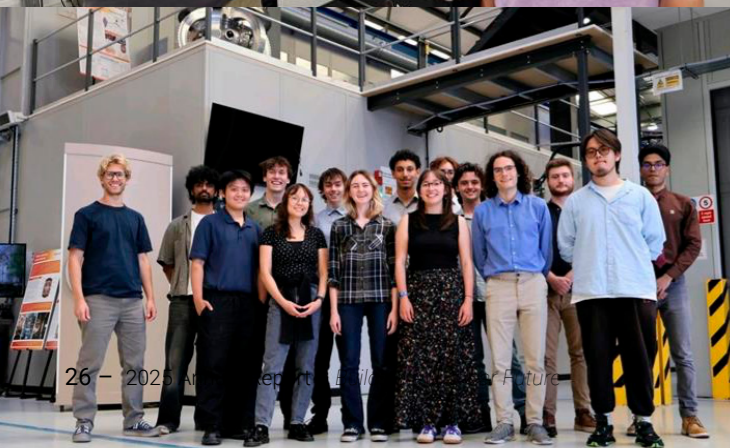
"This internship solidified my ambition to pursue a career in fusion engineering and equipped me with the confidence, curiosity and professional discipline essential for future contributions to the field."

Ryan Suhardjo

Bachelor of Advanced Science (Honours)/Engineering (Honours) (Physics and Aerospace Engineering)



Marcus and Ryan during their internship with Tokamak Energy.



Marcus presenting AtomCraft's research in the Symposium on Fusion Engineering (SOFE) in Boston, U.S.

Marcus's placement with Tokamak Energy also focused on the FPP project. He was responsible for establishing the physics basis of the tokamak and developing a suite of codes for integrated modelling of a net-energy, reactor-relevant plasma. This work provided Marcus with direct experience in bridging plasma physics, systems engineering and magnet design, while also highlighting the complex trade-offs required in the design of a reactor-class device.

Beyond this internship, Marcus also visited the Culham Centre for Fusion Energy, home to the Joint European Torus (the world's largest operating tokamak and First Light Fusion), travelled to Boston to participate in the Symposium on Fusion Engineering as a representative of Atomcraft, and to New Zealand with a group of AtomCraft students to visit OpenStar.

Marcus said the Tyree Foundation Travel Award provided essential support for his professional development and for the advancement of the AtomCraft student project. From these opportunities, he said he has advanced his technical expertise, broadened AtomCraft's profile and fostered valuable international partnerships.

"The award has enabled my internship with Tokamak Energy in the United Kingdom, as well as my travel to New Zealand and the United States to establish collaborations and present AtomCraft's work internationally."

Marcus Borscz

Bachelor of Advanced Science (Honours)/Engineering (Honours) (Mechanical Engineering and Advanced Physics)

AtomCraft's Trip to New Zealand

In May, Dr Matthew Brand, along with six AtomCraft students, travelled to New Zealand to visit a nuclear fusion startup company, OpenStar. Each student was funded by the Tyree Foundation Travel Award, which gave them the opportunity to tour OpenStar's facilities, consult with OpenStar employees and compare their project research with OpenStar's.

Students developed key insights into how a high-functioning research team operates, strengthening their understanding of safety-critical systems such as optical isolation, operational safety systems and proper grounding, and how these are integral to fusion safety design.

Student takeaways:

"OpenStar represents the kind of team and mission I want to be a part of long-term. Seeing how their leaders think, especially how they define system ownership, encourage rigorous testing and foster a culture of repeated and reinforced communication, was eye-opening. This experience was not just educational, it was incredibly motivating. It gave me insight that cannot be learnt from a textbook about the kind of engineering leader I want to grow into and reinforced my passion for fusion and nuclear."

Cormac Morrison, Bachelor of Engineering (Honours) (Robotics and Mechatronics)/ Science (Computer Science)

"The skills developed in orchestrating the trip and the lessons taken from OpenStar's operating model will continue to guide how I streamline processes, boost team ownership and implement effective communication and control strategies in any future engineering or leadership context."

Anna Koth-Ofoegbu, Bachelor of Engineering (Honours) (Chemical)



"Seeing their emphasis on parallel development and clear, channel-based communication has already influenced how the team and I are communicating."

Eskil Tobias Aune, Bachelor of Engineering (Honours) (Mechanical Engineering) (Minor in Nuclear Engineering)

"The trip gave me a stronger sense of what effective leadership looks like in a fast-moving technical team. I've become more confident in my ability to contribute to both the technical and organisational sides of the project, and I'm excited to keep building on what we learnt as our team continues to grow."

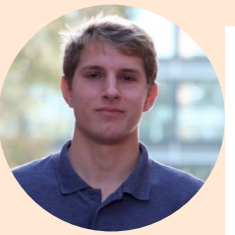
Ben Kernohan, Bachelor of Advanced Science (Honours) (Physics)/Engineering (Mechatronics)

"The trip to OpenStar exceeded expectations and aided us in both technical and process areas of AtomCraft."

Jordan Whittaker, Bachelor of Advanced Science (Honours) (Physics)/Engineering (Aerospace Engineering)

"Engaging directly with engineers who have overcome the very hurdles we now face, provided the real-world context and professional confidence needed to make decisive integration choices and better anticipate risks. Ultimately, this visit transformed my theoretical understanding into practical expertise, equipping me with the validated strategies and a renewed focus to help accelerate our tokamak's development while ensuring robust, safe and efficient integration across all subsystems."

Ishaan Nandurkar, Bachelor of Engineering (Honours) (Quantum)/Science (Computer Science)



Harvey Ling completed an internship with Idaho National Laboratory (INL) in May and visited Oak Ridge National Laboratory in June, with assistance from a Tyree Foundation Travel Award. The trip advanced international collaboration in coated particle (TRISO) nuclear fuel research, provided hands-on experience in post-irradiation examination of nuclear fuels, and created a network of opportunities for partnership between UNSW, ANSTO and leading US national laboratories.

Harvey said his visit to Oak Ridge National Laboratory was a major milestone for him, helping to solidify the collaborative relationship between UNSW Nuclear Innovation Centre and ORNL. **Dr Jennifer Stansby** also visited ORNL for similar reasons later in the year.

"This placement provided an invaluable opportunity to practise radiological control and contamination management, operate within Category II nuclear facilities and engage in day-to-day nuclear research operations at one of the world's leading nuclear research laboratories."



Harvey Ling
PhD candidate

With the support of a Tyree Foundation Travel Award, master's student **Meg Hennessey** had the privilege of attending the International School on Nuclear Security in Vienna, Austria. Organised by the International Atomic Energy Agency (IAEA) for students of the Marie Skłodowska-Curie Fellowship Programme (MSCFP), the two-week program saw 41 women from 37 countries come together to strengthen their knowledge and leadership in nuclear security through a combination of lectures, technical visits and networking activities.

The program provided a comprehensive overview of nuclear security, covering key areas such as international legal frameworks, physical protection systems, transport security, detection and response mechanisms, nuclear forensics and cyber and information security. Meg established strong connections with fellow MSCFP students, IAEA experts and academic researchers.

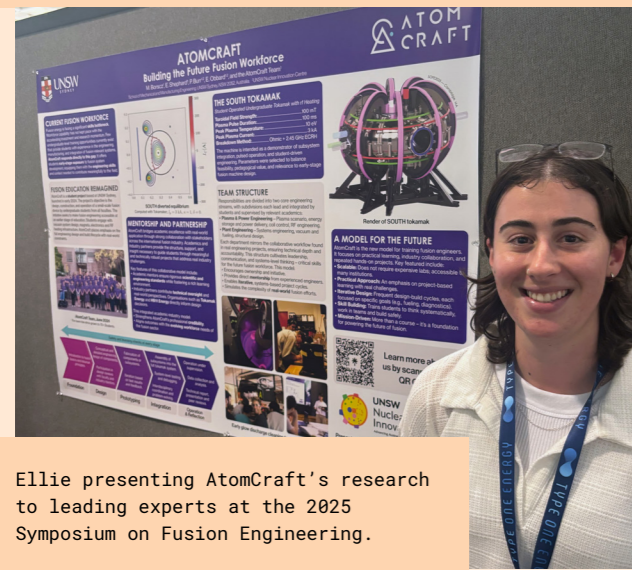
"The program provided an opportunity to connect with an international network of people, and specifically women who are working and studying in the nuclear industry. The knowledge I gained and the global network of connections I made through this experience are an invaluable takeaway, and I am sure that I will continue to use these as I pursue a career in the nuclear industry."

Meg Hennessey
Master of Engineering Science (Nuclear Engineering)



Scholarships

Above and below: Meg Hennessey attended the International School on Nuclear Security in Vienna.



Ellie presenting AtomCraft's research to leading experts at the 2025 Symposium on Fusion Engineering.

Ellie Shephard represented AtomCraft at the 2025 Symposium on Fusion Engineering (SOFE) held at MIT in Boston in June. She was supported by a Tyree Foundation Travel Award. At the conference, the undergraduate student engaged with leaders across academia, industry and government to explore the latest advancements and ongoing challenges in fusion science and engineering. She said travelling allowed her to grow in confidence as both a technical contributor and team leader, gain hands-on knowledge in vacuum systems and project scaling, and discover tools, mentors and global allies who will help shape the future of AtomCraft.

"The opportunity to represent UNSW and Australia's growing role in fusion has been a joy and an unforgettable experience. The conversations I had and relationships I built have already opened new pathways for collaboration, mentorship and innovation that will benefit AtomCraft and my personal development for years to come."

Ellie Shephard
Bachelor of Science

Master's student **Casey Alston** attended the OECD NEA's Nuclear Futures: Shaping Dialogue in a Changing World conference at UNSW in August, funded by a Tyree Foundation Travel Award. For Casey, highlights included the delegates' tour of the OPAL reactor at ANSTO, hearing from leaders in the global nuclear sector and taking part in a collaborative problem-solving session with other early-career professionals and facilitators from more than 30 countries.

"I left the event confident that nuclear can play a central role in meeting global energy challenges and motivated to contribute to Australia's role in that journey."

Casey Alston
Master of Engineering Science (Nuclear Engineering)



Sam Shelton also attended SOFE in June as an AtomCraft representative, with funding from the Tyree Foundation Travel Award. He forged connections with research groups from Columbia University and the UK Atomic Energy Authority and a PhD student from the University of Seville, who invited Sam to collaborate on his SMART tokamak project. Sam said the conference was a useful experience, especially as it highlighted similar challenges for other tokamak projects and offered new approaches to solving these.

"As an early career researcher, I feel particularly grateful to have had the opportunity to attend SOFE and to be able to jumpstart my research career in this way."

Sam Shelton
Bachelor of Engineering (Honours)/Bachelor of Science



Sam presenting AtomCraft's research to leading experts at the 2025 Symposium on Fusion Engineering.

Where Country, culture and policy meet

Lilliana Jarrett is studying a Bachelor of Arts/Law, majoring in Indigenous Studies and Environmental Humanities. She was raised on Darkinung land and is a proud Dughutti-Worimi woman. In October, she attended the NEA's Fourth Stakeholder Involvement Workshop in Paris, which focused on 'Optimisation in Decision Making: From Insight to Action'.

This trip was supported by the Tyree Foundation Travel Award and enabled Lilliana to bring both an Indigenous and environmental justice perspective into the conversations around nuclear waste and energy policies. She says that while nuclear policy wasn't initially on her radar, attending the NEA workshop opened her eyes to how these decisions intersect with Indigenous rights and environmental governance.

"It reinforced for me that legal frameworks need to account for cultural heritage, community consent and long-term environmental impacts in order to integrate these values into global best practice standards."

Lilliana learnt of the travel scholarship through Auntie Tanya from Nura Gili and Auntie Christine from the Chancellor's Office. While she didn't have much knowledge about nuclear energy initially, her curiosity about how companies and governments engage with Indigenous communities when planning waste repository sites inspired her to attend the conference.

"I made strong efforts to share my perspective by emphasising that trust for Indigenous communities is shaped by historical and cultural contexts, not just by providing information or following procedures. Engagement cannot be transactional - it must be relational, grounded in respect for cultural protocols, cultural competence and a genuine understanding of community needs."

By highlighting shared historical realities, such as the Stolen Generations and assimilation policies - which continue to influence how Indigenous communities perceive governments and industries - Lilliana encouraged other participants to appreciate both the diversity of Indigenous people's culture and the unique experiences of colonisation globally.



"Indigenous peoples hold the solutions to the challenges they face; they do not need saving, but collaboration and partnership free from power imbalances. This helped shift conversations from 'educating communities' toward co-designing processes that acknowledge these histories and build genuine partnerships."

When asked how she sees her Indigenous heritage shaping her voice in these conversations, Lilliana said it is her heritage that gives her a perspective that places land and community at the centre of decision-making.

"For Indigenous peoples, Country is not just land; it is identity, culture and our future. My culture shapes my voice to advocate for policies that respect these connections. Importantly, I believe this care for Country should not rest solely on Indigenous people's shoulders; it is an obligation we all share. Mother creates and holds life, and every person should feel a responsibility to protect it with the same depth of respect."

"I acknowledge that nuclear energy may play a significant role in the renewable energy transition, a transition I strongly support. However, this cannot come at the expense of cultural integrity or environmental stewardship - that, to me, seems counterproductive. My focus was on ensuring that as we pursue clean energy solutions, we do so through frameworks that prioritise genuine community engagement, cultural safety and transparency."

Lilliana advocates for governance models that integrate Indigenous knowledge systems, embed cultural competence into regulatory processes and treat the environment as a stakeholder in its own right.



Participants at the NEA workshop in Paris.

ANSTO FutureNow scholarship and Nuclear Innovation Centre support

PhD candidate Tina Baradaran presented papers at several conferences throughout the year. In June, she travelled to the American Society For Engineering Education (ASEE) conference in Montreal, Quebec, to present her research paper, 'What makes a competent nuclear engineer?'.

The ASEE is the largest annual gathering of engineering educators, attracting more than 8000 conference attendees from around the world across all engineering disciplines. Tina's paper was accepted and presented in the Energy Conversion, Conservation & Nuclear Engineering Division (ECCNED) track. This was the first time in the conference's history that all papers in this session were dedicated to nuclear engineering education.

During this trip, she also toured the Polytechnique Montréal SLOWPOKE-2 research reactor and the neutron activation analysis laboratory, joined by Dr Ira Harkness, Instructional Assistant Professor in the Department of Materials Science and Engineering at the University of Florida.

The SLOWPOKE-2 is a 20 kW (thermal) sealed-container, in-pool type research reactor located on the University of Montréal campus. It first operated in 1976 with one kilogram of 93% enriched uranium fuel, later refuelled in 1997 with five kilograms of uranium enriched to 20% in U-235. At full power, the neutron flux in the inner irradiation sites reaches 10^{12} n/cm²/s. The reactor is primarily used for neutron activation analysis and the production of radioactive tracers, and also supports training in reactor kinetics for nuclear engineering students. The adjacent neutron activation analysis laboratory houses four state-of-the-art gamma-ray spectrometers equipped with high-resolution germanium detectors and automated sample changers.



Tina Baradaran at the ASEE conference in Montreal.

In July 2025, Tina represented Women in Nuclear (WiN) Australia at the 32nd WiN Global Annual Conference in London, UK. She delivered the WiN Australia Chapter Report at the WiN Global board meeting and presented her technical paper, 'Educating and Empowering the Nuclear Science and Engineering Workforce', in the Leadership and Development session.



Expanding our network through outreach

UNSW Open Day

After the official launch of the new undergraduate nuclear engineering degree, the UNSW Open Day was the first in-person opportunity for prospective students to speak to UNSW Nuclear Innovation Centre representatives at the Mechanical Engineering booth.

Interest in the program has started strong with more than 30 first-preference applications submitted via UAC and more than 200 prospective students

attending Associate Professor Edward Obbard's nuclear specialisation lecture.

The student Nuclear Society also held a stall, handing out approximately 100 STEM Job Kits within the first half of the day to students eager to study nuclear engineering.

UNSW Teachers in STEM Day

In partnership with the NSW Department of Education, the UNSW Nuclear Innovation Centre engaged secondary STEM teachers to raise awareness of nuclear engineering as an emerging study and career pathway. Dr Jennifer Stansby represented the Centre at the Networking Lunch and Curriculum Connections Marketplace, showcasing the study pathways and resources available to help teachers address various curriculum outcomes and priorities.

The session highlighted opportunities to integrate nuclear-related content into the new iSTEM curriculum and showcased how UNSW can support teachers in delivering interdisciplinary courses. Educators also received nuclear engineering job kits to help introduce the topic of nuclear science and engineering to their students.

**Community
and Industry
Engagement**



Australian Nuclear Academics Meeting

Co-hosted by the UNSW Nuclear Innovation Centre and the Australian Nuclear Research and Education Network (ANREN), 41 academic partners from around Australia and the world were invited to participate in an Academics Meeting from 7 to 8 August. The purpose of the workshop was to discuss future research goals for nuclear energy, identify strengths, gaps and opportunities for growth and build collaboration between nuclear researchers and institutions. The workshop fostered a strong sense of community, a shared vision and momentum to move forward together. Key insights from across the two days are below.

National strengths and current challenges

Discussions highlighted Australia's depth of expertise across a broad range of research areas. Despite the absence of a domestic nuclear power industry, research capability remains wide-ranging, supported by advanced infrastructure such as ANSTO's reactor and accelerator facilities. Participants also noted the strength of international collaboration networks, high-quality education programs and Australia's ability to attract skilled researchers and students.

However, access to research infrastructure is uneven and, in some cases, fragile due to reliance on a small number of facilities or experts. Education and training pathways remain fragmented nationally, domestic collaboration is often weaker than international links, and academic input into government decision-making is underdeveloped. Broader challenges around public perception, trust with Indigenous communities and the risk of talent loss overseas were also discussed.

Opportunities for growth and collaboration

Participants emphasised the need to expand access to key research infrastructure, including greater use of the OPAL reactor and improved access to international research reactors, while also developing complementary infrastructure beyond the federal system. Strengthening collaboration with industry was seen as critical.

There was also an emphasis on aligning research programs with Australia's uranium resources to strengthen national capability and develop technical expertise relevant to AUKUS. The value of integrating PhD and master's students into research teams was also highlighted, supporting both research capacity and clear, nationally coordinated training pathways.

The importance of cross-disciplinary collaboration was a recurring theme, particularly the integration of social science with engineering and nuclear science to address issues of trust, risk and public perception. Participants noted opportunities to reframe public narratives through clearer storytelling and international examples, and to design forward-looking regulatory frameworks that support innovation while maintaining safety and community confidence.

The meeting concluded with a shared commitment to sustained engagement, coordinated leadership and collective action to address challenges and leverage community support.

The meeting provided many opportunities for growth in the nuclear sector.

AtomCraft end-of-year showcase

Progress on display

In December, AtomCraft hosted a showcase for industry partners, students and academics to share the year's research progress – from early concept work to verified prototypes, quantified requirements and a clearer integration pathway toward the SOUTH tokamak. The event offered visitors the chance to walk around display tables featuring a series of physical prototypes and to speak directly with AtomCraft students.

The focus of the evening was to highlight the program's value as a training ground for industry. In 2025, the AtomCraft project has shifted from primarily theoretical design to practical engineering work that has been built, tested and used to guide the next design cycle. This progress and AtomCraft's ambitious goals are made possible thanks to the generous donation from the Eden Foundation. The team is grateful to Greg Ainsworth, Jennie Gao and Anna Ainsworth for their continued support.

Research highlights

The team shared how key plasma-enabling capability was advanced through glow discharge experimentation and commissioning work on the POT prototypes, providing a tested foundation for vacuum operations and early plasma conditioning that can be carried into SOUTH.

Significant progress was also made in hardware readiness. Critical mechanical designs were developed and validated using multiphysics analysis and compliance documentation, positioning the project to move into vessel and structural manufacture. Core diagnostic capability was established through development of probes, spectroscopy, and high-speed imaging, with initial integration into the project's data and control interfaces. Early RF heating capability was demonstrated through the design and testing of microwave power delivery hardware, improving

understanding of integration constraints and practical system behaviour.

Pulsed power and magnet capability also advanced materially. Current-drive hardware was scaled from low-current prototypes to kiloamp-level circuitry and closed-loop control was implemented to regulate fast current dynamics. Energy storage testing was established to validate charge-discharge behaviour and inform the next stage of power-system scaling and safety design.

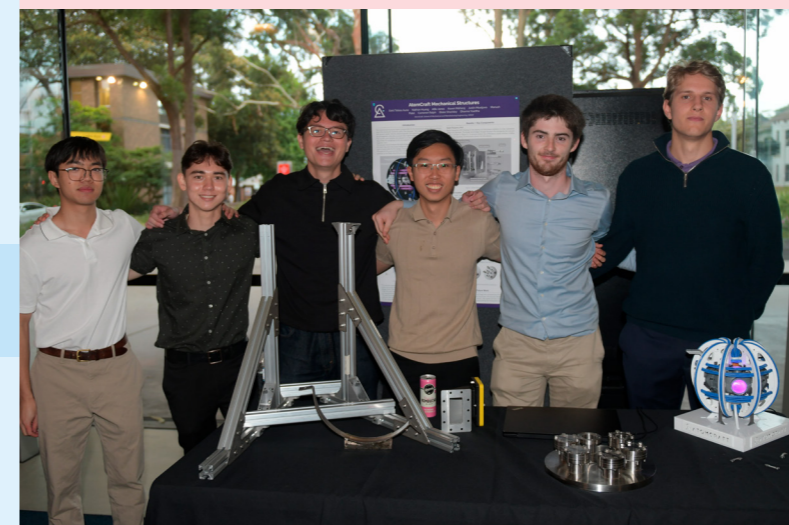
Sustaining growth

Alongside technical outcomes, team members also shared how they have strengthened the structures needed to sustain progress in a large, interdisciplinary program, including documentation practices, onboarding and clearer integration processes to support knowledge transfer and interface management.

AtomCraft ended the year with tested prototypes, better-defined operating requirements and a more safety-driven pathway toward integrating SOUTH and working toward a first pulse. The showcase was evidence that the program is becoming a reliable training ground for industry. Students are gaining experience with safety-critical engineering, disciplined testing and cross-disciplinary integration that mirrors how high-consequence systems are developed in professional settings. This produces graduates who can contribute quickly in fusion and adjacent sectors, and builds a steady pipeline of engineers and scientists with proven, hands-on capability rather than purely academic exposure.

The Eden Foundation's Anna Ainsworth and other family members, and Robyn Fennell, Chair of the Sir William Tyree Foundation Board, learnt about AtomCraft technology.

Members of the AtomCraft team shared prototypes including Langmuir probes and high-speed spectrometers.



From industry to inquiry: Clayton's PhD path

Clayton Feng began his PhD with the UNSW Nuclear Innovation Centre in September 2025, choosing to leave his full-time role as an engineer to better understand the fundamentals of nuclear materials. His curiosity was sparked following a lecture given by Associate Professor Patrick Burr in mid-2024, which led Clayton to attend further lectures organised by Engineers Australia.

"After graduating from university, I wanted to see how my degree could develop within the industry – away from a research focus."

"After working [in industry] for a while, a persistent thought kept coming back to me as I was trying to understand fundamental concepts that govern the technology's functionality."

Clayton first heard about the Centre at the Engineering the Future: Navigating a Future Tomorrow lecture hosted at UNSW in February. Following this, he talked with current students and other industry professionals before choosing to participate in both the Nuclear Innovation Bootcamp and the Nuclear Futures: Shaping Dialogue in a Changing World conference.

"My experience through both the NIB and NEA Nuclear Futures events cemented the idea that, despite feeling like an imposter in the crowd, I felt geared to learn with others and become more of a nuclear advocate through nuclear research."

"Both events supported my curiosity of nuclear engineering capabilities within Australia's space and the potential developments nuclear engineering may hold for the future."

When asked why nuclear engineering interests him, Clayton said:

"Nuclear engineering leans heavily on researchers to understand reaction kinetics, materials compatibility and materials evolution in extreme environmental conditions. These concepts require one to be super materially aware, before safe implementation into the public is performed. It's an exciting journey to pick the brains of others experienced in the field, whilst making my own profound advancements."



Clayton (far right) and fellow NIB participants during a social event.

Australia–UK AUKUS innovation pact

In December, eight Australian and UK universities signed an AUKUS innovation pact, an alliance that will support both the Australian and UK governments' plans to develop a highly skilled workforce, accelerating skills, research and innovation in security and defence.

One of the initiatives is the creation of a joint UK-Australia Centre for Doctoral Training, focusing on security, defence and resilience. PhD students will have the opportunity to undertake research in areas including nuclear engineering and safety, systems design and cybersecurity. This alliance will help build a pipeline of experts, some of whom will support the AUKUS workforce.



Representatives of the Australian and UK governments and the eight universities that signed the MoU.



The alliance will strengthen international collaboration and research.

Nuclear Innovation Alliance Bootcamp

The UNSW Nuclear Innovation Centre co-hosted the Nuclear Innovation Alliance's annual Nuclear Innovation Bootcamp in August. Twenty-four participants from across Australia and around the world joined together for two intensive weeks of collaboration and learning, focusing on the theme 'Innovating in Australia for Global Impact'. PhD students and early-career professionals explored creative idea generation, the global nuclear energy landscape, strategies for adapting to a growing sector, and more.

By the end of the Bootcamp, participants had:

- Forged new international partnerships
- Networked with nuclear industry experts
- Worked in teams to develop business models, pitching their ideas to a panel of judges at the closing ceremony.

'GammAway' was the winning group of the NIB pitch competition, with the team presenting their business plan to irradiate fresh fruit and vegetables for an extended storage life. Melody Ranger, Anne Moncuit, Lachlan Crawford, Hanah Azman and Clayton Feng, who collaborated on this project, will have the opportunity to present their pitch at the 2026 International Youth Nuclear Congress's Innovation4Nuclear competition in Avignon, France.

Other pitches spanned radioisotope production using nuclear reactors, utilisation of renewable energy sources to power nuclear reactors for electricity generation or desalination, an interactive roaming bus to educate communities, and consulting services to take apart existing nuclear reactors.



Back, from left: Lachlan Crawford, Anne Moncuit, Clayton Feng. Front, from left: Hanah Azman, Melody Ranger.



Participants worked in groups to brainstorm creative ideas for nuclear innovation.

"The Nuclear Innovation Bootcamp was a way to learn more about nuclear energy, reactor designs and the potential applicability within Australia's space. As the program was open to people from around the world, it was a valuable opportunity to meet people within the same field, but also across a diverse range of backgrounds. I found it to be a rewarding opportunity."

Clayton Feng
PhD candidate



Twenty-four early-career professionals and students collaborated and learnt over two weeks.



OECD NEA Nuclear Futures conference

From 5–6 August, the UNSW Nuclear Innovation Centre and the Nuclear Energy Agency co-hosted the Nuclear Futures: Shaping Dialogue in a Changing World conference. More than 200 early-career professionals, researchers, industry leaders, academics and policymakers from 31 countries gathered at UNSW for a landmark conversation on the future of nuclear technologies in Australia and beyond.

The two-day conference brought diverse voices together to explore some of the nuclear sector's most pressing issues – from building social licence and growing the nuclear workforce, to defining Australia's role in the global nuclear fuel cycle and contributing to climate change mitigation.

The opening plenary featured William Magwood IV, Director-General of the OECD Nuclear Energy Agency (NEA), alongside Associate Professor Edward Obbard, setting the international and Australian context for the conference.

The event also saw the official launch of the Bachelor of Engineering (Honours) (Nuclear Engineering) degree, which is welcoming its first cohort of students in 2026.

There were 63 selected delegates from 31 countries establishing long-term international links and expanding career opportunities in the Australian nuclear sector. The second day included keynote presentations and workshops, where delegates and industry professionals collaborated on topics submitted as part of the delegates' applications.

Expanding networks

"It was an absolute privilege to be part of the very first cohort of delegates for the UNSW & Nuclear Energy Agency Nuclear Futures conference. Not only because of what I had to contribute, but mostly through what I learnt by being part of a group of passionate individuals from around the world, with an incredible wealth of experience in the nuclear policy and technology industries."

Stefania Lasek
Delegate

"Throughout the workshop, I had inspiring conversations with fellow delegates and experts. One of my key takeaways is the immense potential of nuclear energy in Australia. While there are still many challenges ahead, I sincerely hope this marks the beginning of more open and constructive discussions on its peaceful use."

Taiga Suzuki
Delegate



From left: Aleshia Duncan, OECD NEA Director-General William Magwood IV, Associate Professor Edward Obbard and Dr Tamara Yankovich on the second day of the conference.



UNSW Vice-Chancellor Professor Attila Brungs, Dr Peter Tyree AM and the OECD NEA's William Magwood IV.



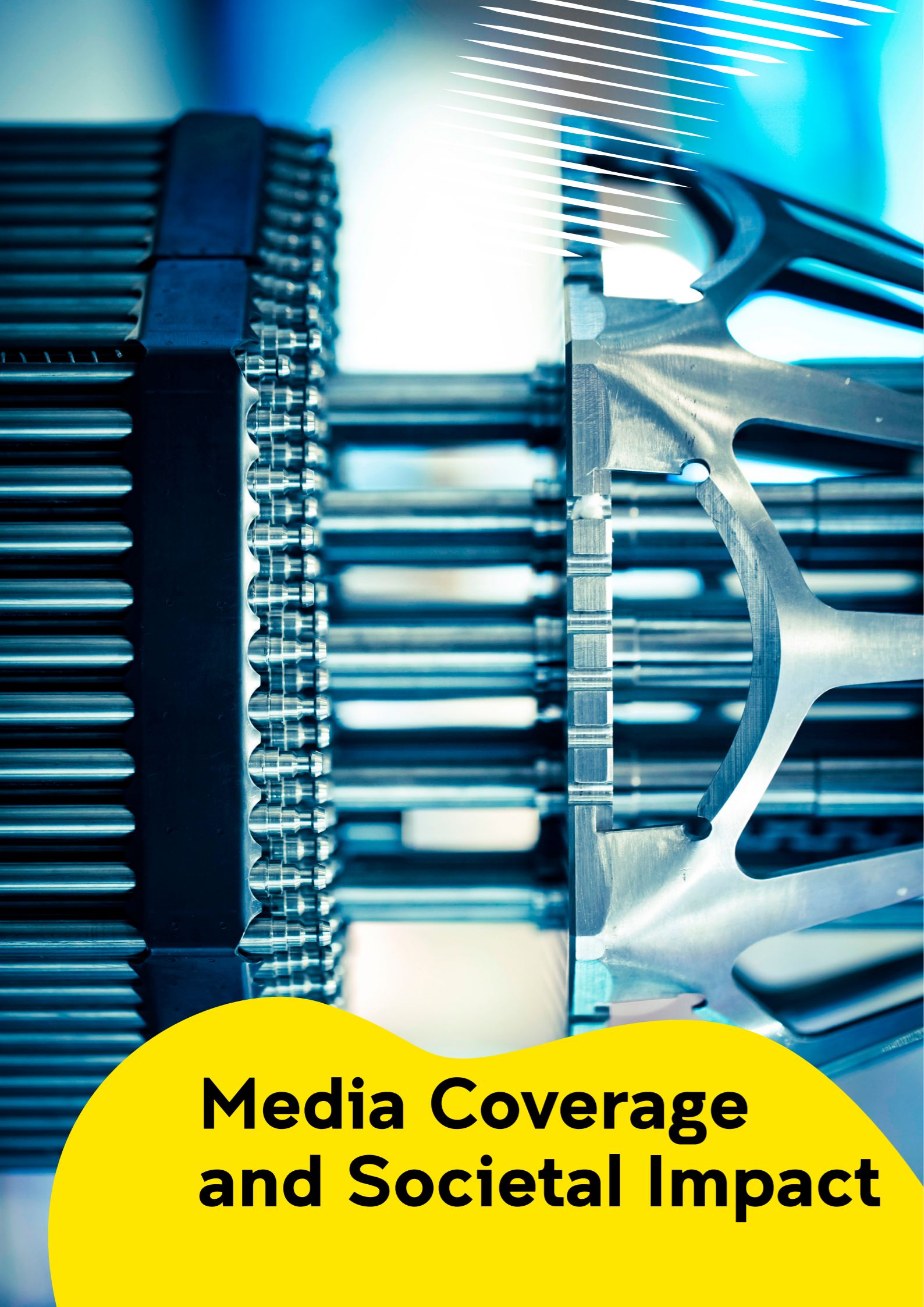
Delegates were selected from across the world.



The panellists discussed 'Nuclear and society – earning trust, building consensus and advancing social licence'.



Panellists at the Nuclear Futures conference. From left: Craig Scroggie, Professor Yves Bréchet, Professor Sir Robin Grimes, Susan Bogle, Lenka Kollar and Dr Kampanart Silva.



Media Coverage and Societal Impact

Media highlights

The Centre's media coverage grew in 2025 as media interest was driven by government and public interest in key nuclear issues. The Australian Federal Election in May, viability of the AUKUS agreement and the launch of UNSW's undergraduate nuclear engineering program drew the most coverage. These topics offered opportunities to position the UNSW Nuclear Innovation Centre as a thought leader in the nuclear sector, with Centre members frequently featured as expert voices in the media.

Edward Obbard and Patrick Burr on Sky News

Jaynie Seal, a journalist for Sky News, attended the Nuclear Futures conference, using footage for a TV feature contributing to the broader nuclear energy conversation.



Associate Professor Patrick Burr

Associate Professor Patrick Burr featured in a social media video explainer on fusion energy and fusion reactors. The video showcased the research the Centre is doing and invited prospective students to enrol in the new Bachelor of Engineering (Honours) (Nuclear Engineering) degree.



Edward Obbard on nuclear reactors in space

Brielle Burns, a journalist for *News.com.au*, asked Associate Professor Obbard about the space race between the US and China – both of whom are trying to build a nuclear reactor on the moon. Edward said that nuclear power was essential for space exploration as it provides a longer-lasting source of power to those in space, as it is energy dense and power dense. This would allow people to stay there longer and do more interesting research.

Edward Obbard on nuclear power's advantages

In an interview with ABC journalist Adam Shirley, Associate Professor Edward Obbard contributed to the public debate around renewables and the role of nuclear energy. Edward said there is a misconception that Australians must either choose or not choose nuclear energy, and argued Australia already has the expertise needed to develop a nuclear power industry.

Edward Obbard in *The Guardian*

The Guardian journalist Ben Doherty featured Associate Professor Edward Obbard in an article exploring why keeping nuclear-powered boats afloat will be the biggest challenge for Australia. Edward said that for the AUKUS deal to work, there needs to be a greater investment in people. This means training a nuclear workforce who are subject-matter experts (in policy, strategy), and another group who are skilled professionals (engineers, scientists, health physicists).



"The AUKUS plan cannot work without building this workforce and the wider engineering community this workforce is drawn from."

Associate Professor Edward Obbard

Continuing our growth in 2026 and beyond

Building education programs

The first students to undertake a Bachelor of Engineering (Honours) (Nuclear Engineering) degree at UNSW are commencing in semester one, 2026. The Centre is also expanding its executive courses, with the next course scheduled at UNSW Canberra at ADFA in March 2026.

Open to policymakers and industry and government professionals interested in learning about responsible nuclear stewardship, it will also strengthen and establish collaborative partnerships.

Cementing international partnerships

In 2026, the Centre is welcoming two MIT professors of nuclear science and engineering, Professor Jacopo Buongiorno and Professor Koroush Shirvan. From January to May, Professor Shirvan will deliver advanced nuclear science lectures, focusing on nuclear energy and the innovation environment in the United States supporting new reactor technologies.

Professor Buongiorno will visit in the second half of the year, supporting the curriculum and teaching Nuclear Thermal Hydraulics.

In June, the Centre will also welcome Professor Piero Martin, a professor at the Physics and Astronomy Department of the University of Padova in Italy. He will be teaching Fusion Energy: History, Physics, and Engineering Challenges.

Expanding our team

To align with our vision of scaling research, the Centre's team is expanding. In October, two post-doctoral fellows, Bronwyn Thomas and Kay Song, joined. An additional two post-doctoral fellows will be welcomed in early 2026. One of these positions is a partnership between the UNSW Law Faculty and the UNSW Nuclear Innovation Centre, supported by the Sir William Tyree Foundation. Art Cotterell will assume this role in February, seeking to bridge the gap between nuclear law and nuclear energy.

Future Steps

Appendix

Publications

Abraham JL, Dayal P, Farzana R, Bahmanrokh G, Sorrell GC, Koshy P and Gregg DJ (2026), 'Optimising glass-ceramic compositions for zirconolite-based actinide immobilisation', *Journal of Nuclear Materials*, 621:156399, <https://doi.org/10.1016/j.jnucmat.2025.156399>.

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Media features

A selection of media features and appearances showcasing the activities of the Centre in 2025.

ABC News article on renewables and the role of nuclear energy (April)

<https://www.abc.net.au/news/2025-04-10/act-solar-and-nuclear-experts/105155684>

ABC Lab Notes (April)

<https://www.abc.net.au/listen/programs/lab-notes/nuclear-power-plant-reactor-decommissioning-radioactive-fuel/105138792>

The Australian article on the Nuclear Futures conference and the undergraduate degree launch (August)

<https://www.theaustralian.com.au/breaking-news/leading-british-nuclear-scientist-sir-robin-grimes-says-australia-will-face-consequences-if-it-rejects-nuclear-energy/news-story/b885c59d4f763ad0999c0a73213e8f48>

Sky News TV appearance with Edward Obbard and Jonathan Fisher about Australia in the global 'nuclear renaissance' (August)

<https://www.youtube.com/watch?v=1aY4JnUak1I>

Sky News TV appearance with Patrick Burr and Edward Obbard at the Nuclear Futures conference (August)

<https://www.skynews.com.au/business/energy/uns-w-launches-nations-first-ever-nuclear-engineering-degree-to-meet-ai-generated-demand-for-20000-skilled-workers-in-the-sector/news-story/339cc9a3936fbb3f33071844fb1b6ed>

NT News on the space race to a nuclear reactor on the moon, with Edward Obbard (September)

<https://www.ntnews.com.au/technology/science/if-you-lead-in-space-you-lead-on-earth-space-race-heats-up-as-us-fast-tracks-plans-for-nuclear-reactor-on-moon/news-story/04e5aa05785c88c5cd6556fdb12d64b7>

The Guardian article featuring Edward Obbard on the AUKUS workforce requirements (October)

<https://www.theguardian.com/australia-news/2025/oct/20/aukus-submarine-workforce-nuclear-powered-boats-australia>

Funding

From	Amount	To	For
Sir William Tyree Foundation*	\$750,000	UNSW Nuclear Innovation Centre	To support scholarships, fellowships, and the Tyree Nuclear Fellow position, facilitating progression from lecturer to professor in nuclear engineering.
AINSE ECR Grant	\$10,000	Vladimir Pan	Advanced radiation sensors for space weather characterisation and radiation protection.
ANSTO Accelerator beam time (in-kind): two successful proposals	Eight days accelerator access	Linh Tran	Characterisation of new batch of SOI microdosimeters and its electronics for particle therapy and space application.
ANSTO Accelerator beam time (in-kind): two successful proposals	Six days accelerator access	Vladimir Pan	Advanced radiation sensors for space weather characterisation and radiation protection.
Department of Defence	Confidential	Associate Professor Edward Obbard, Associate Professor Patrick Burr	UNSW Graduate Certificate Programs for Department of Defence nuclear engineers.
Eden Foundation	\$200,000	Associate Professor Patrick Burr	To support equipment for UNSW AtomCraft in 2025. In line with the intended purpose, the funds may be used for equipment needs for UNSW AtomCraft.
UNSW Canberra	Confidential	UNSW Nuclear Innovation Centre	Co-funding the Centre's Program Manager role.
UNSW Engineering	Confidential	UNSW Nuclear Innovation Centre	<ul style="list-style-type: none"> Senior Lecturer role Co-funding the Centre's Program Manager role Funding the Centre's Senior Administrative Officer role.
Australian Research Council, HB11 Energy	\$1,283,367 (\$724,349 from HB11 Energy, including \$235,500 in-kind)	Professor Francois Ladouceur	Linkage project for the research: 'Towards non-thermal hydrogen-boron fusion.'
Australian Institute of Nuclear Science and Engineering	\$9000	Harvey Ling, Dr Jennifer Stansby, Associate Professor Edward Obbard, Dr Benedicta Arhatari, Dr Joseph Bevitt	AINSE Postgraduate Research Award.
ANSTO	\$65,568 (in-kind)	Harvey Ling, Dr Jennifer Stansby, Associate Professor Edward Obbard, Dr Benedicta Arhatari, Dr Joseph Bevitt	Micro-Computed Tomography Beamtime at the Australian Synchrotron.
ANSTO	\$65,568 (in-kind)	Harvey Ling, Dr Jennifer Stansby, Associate Professor Edward Obbard, Dr Joseph Bevitt	Imaging and Medical Beamtime at the Australian Synchrotron.
ARC, Tokamak Energy, ANSTO*	\$367,869.67	Associate Professor Patrick Burr	Linkage Project for the research: 'Advanced shield materials for compact fusion energy'.
Australian Research Council, HB11 Energy*	\$105,361.75 (\$23,520.50 from HB11 Energy)	Associate Professor Patrick Burr	Australian Research Council/Industry Fellowship – Mid Career for the research: 'Life prediction and optimisation of advanced first-wall fusion materials'.

* Note: This is the allocated funds for 2025 and does not represent the total funds granted. Previous reports may have reported total funds granted.



Thank you for your support

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