THE AUSTRALIAN NATIONAL FABRICATION FACILITY

ANFF

ANFF CONNECTED 2023

ENABLED BY NCRIS National Research Infrastructure for Australia
An Australian Government Initiative

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ANFF IN 2022/23

Welcome to the readers of this 2023 Casebook with the theme of 'ANFF – Connected' that highlights our connections to various ecosystems in Australia and globally. I trust that you will be as excited reading it as we were creating it.

This year (2022-23) has been an exciting year now that the impact of Covid has diminished. NCRIS 2022 funding will provide nearly $83 million in support of our operations, network facilities and staff. We saw ANFF grow with the introduction of ANFF-C. The aim of ANFF-C is to directly support early-stage entities with pre-seed money to accelerate the rate of new-business creation. This resulted in 16 funded projects plus the successful launch of Trioda Wilingi, an Indigenous majority-owned company that was one of the first to spin out with ANFF-C support.

Our ANFF Enlightened learning management system continues to expand its offerings, currently with 19 courses on topics ranging from lithography to deposition to fabrication and more.

There have been several changes at ANFF-HQ. The ANFF Board and indeed the ANFF Team are delighted with Distinguished Prof Chennupati Jagadish's acceptance to join the ANFF Board of Directors. Respectfully known as Jagadish, he has over 40 years of research experience in compound semiconductor, optoelectronics, nanotechnology, photovoltaics, neuroscience and neurotechnology. Also, Dr Rowan Gilmore will now serve as Chair of the Audit and Risk Management Committee. Finally, I was honoured when the Board appointed me as Chair of ANFF.

Sadly, we have also experienced tragedy with the passing of Emeritus Prof Chris Fell in December 2022. His legacy leaves a strong and viable organisation that has blossomed from his vision of a strong research community, and I was privileged to serve under his leadership. Words cannot express the gratitude we owe him.

The Board continues to support the three pillars that underpin ANFF's strategy: Pillar 1 – Research Infrastructure Excellence, Pillar 2 – Capturing the Benefits and Pillar 3 – National Resilience.

Our entire staff looks forward to the ANFF Staff Forum 'Future Proofing ANFF' at the National Centre for Synchrotron Science, Melbourne, on 17–18 October 2023.

With the ANFF Network always evolving, our website has even more stories and connections than the Casebook could ever hope to cover.

Enjoy the Casebook.

Andrew Brawley
ANFF Chair

As I reflect on this year's theme, ANFF – Connected, I see so many places where our success is underpinned by connections - within our facility network, across other NCRIS projects, and through global partnerships. ANFF has, once again, provided significant impact across the areas where we put our efforts, and these outputs are supported by our interaction and leadership in various ecosystems.

Our primary focus of providing world-class expertise and facilities is continuing to bear fruit, with solid usage figures across our locations. These include increasing industry usage and more projects that are using multiple Hubs. Our success in raising awareness of how ANFF can solve real problems has contributed to ANFF taking a leadership role in strengthening industry engagement. We hope to see an uplift across the NCRIS portfolio through greater integration of our industry facing initiatives.

Our valuable outputs have led to a further 5 years of Commonwealth funding to ensure that ANFF can continue to provide services to our users across sectors as broad as MedTech, Space, Sensors and Textiles. This stability forms the solid foundation that ANFF uses to be a critical partner.

We can also look to ANFF-C and how its connection with the research translation landscape is flourishing. With 16 funded projects in the short time it has been operational, this nascent program has had significant impact with spin outs, partnerships and follow-on investment all being enabled through this platform.

ANFF is increasing its involvement with our international peers with trips to the US, Canada, UK, Taiwan and Europe. These interactions help us to benchmark ourselves with the world's best and bring opportunities for both staff and clients.

Our people are the foundation for ANFF's success. This year we have shone a spotlight on the immense value of research infrastructure specialists, however, our university HR systems are not well equipped to reward it. This position paper has stimulated discussion on how to address this critical problem and can be found on our website.

Currently, there are many opportunities in the research, development and translation sectors. ANFF, as a critical component of many of these ecosystems, stands ready to lead, partner and contribute to benefit us all.

Jane Fitzpatrick
CEO

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NCRIS National Research Infrastructure for Australia
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ANFF

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IN MEMORIAM

Late in 2022, the Australian National Fabrication Facility community was devastated by the loss of our beloved Board Chair, Emeritus Professor Chris Fell AO FTSE HonFIEAust CPEng.

Prof Fell was instrumental in the establishment of the ANFF organisation in 2007 as one of nine original research infrastructure facilities established under the Commonwealth's National Collaborative Research Infrastructure Strategy (NCRIS). He became the organisation's first director, and in 2011, he took over as Chair of the Board.

Chris was a true lynchpin in the nanotechnology research sector. He not only understood the importance of accessing micro- and nanofabrication equipment, but he also quickly realised that research infrastructure and the expertise to use it would become critical in supporting the future growth and development of Australia's scientific community.

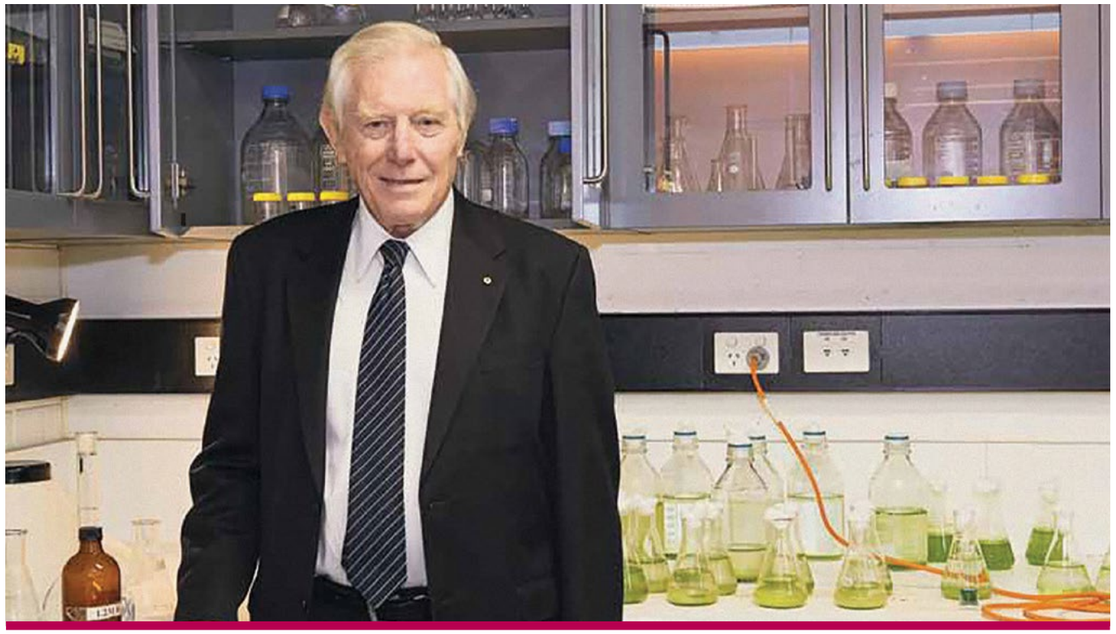
In 2021, Chris was appointed an Officer in the General Division of the Order of Australia (AO). He received this honour for distinguished service to science and engineering, particularly to nanotechnology research and fabrication and to professional networks.

His distinguished career started in chemical engineering with a degree in 1965 and spanned over 55 years and many sectors. A world-renowned expert in separation technology, water treatment and the handling of chemicals, Chris held various positions during his 30 years at the University of New South Wales, including Deputy Vice-Chancellor (Research and International) for 10 years.

'The ANFF community has lost a great leader. Chris Fell has been a constant guiding hand for us for the entire history of this organisation after his passion and energy helped create it. Australia will forever be indebted to this great man, who spent his whole life providing benefits to others. We will miss his wisdom and his wit and his love for sharing a good story,' said ANFF CEO Jane Fitzpatrick.

Under his leadership, ANFF has grown over the last 16 years to represent a highly impressive network providing relevant expertise and tools that is the envy of our peers internationally. ANFF is now proud to include 21 Hubs under our banner, supporting thousands of researchers from the public and private sectors across Australia every year.

The ANFF Board of Directors stated that Prof Fell maintained his role as the Chair of the ANFF Board for many years because he was the best person for the job. ANFF is immensely grateful for his many years of significant service. His presence and enthusiasm for nanotechnology will be sorely missed, and the ANFF Board members feel privileged to have worked with Chris.



UNSW Sydney

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RESEARCH THEMES

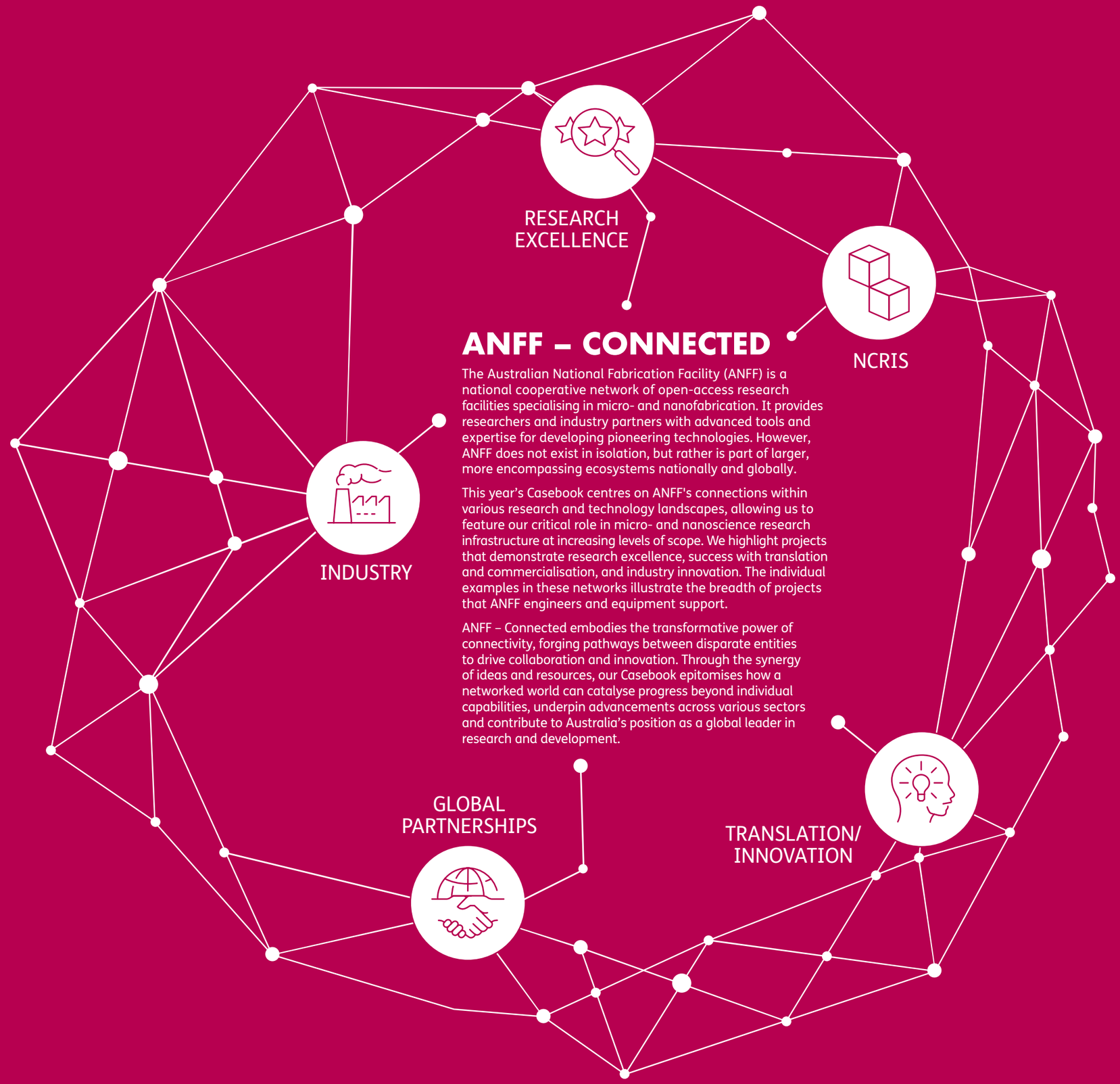
FRONTIER TECHNOLOGIES AND MODERN MANUFACTURING

HEALTH AND MED TECH

RECYCLING AND CLEAN ENERGY

SPACE

ENVIRONMENT AND CLIMATE



ANFF – CONNECTED

The Australian National Fabrication Facility (ANFF) is a national cooperative network of open-access research facilities specialising in micro- and nanofabrication. It provides researchers and industry partners with advanced tools and expertise for developing pioneering technologies. However, ANFF does not exist in isolation, but rather is part of larger, more encompassing ecosystems nationally and globally.

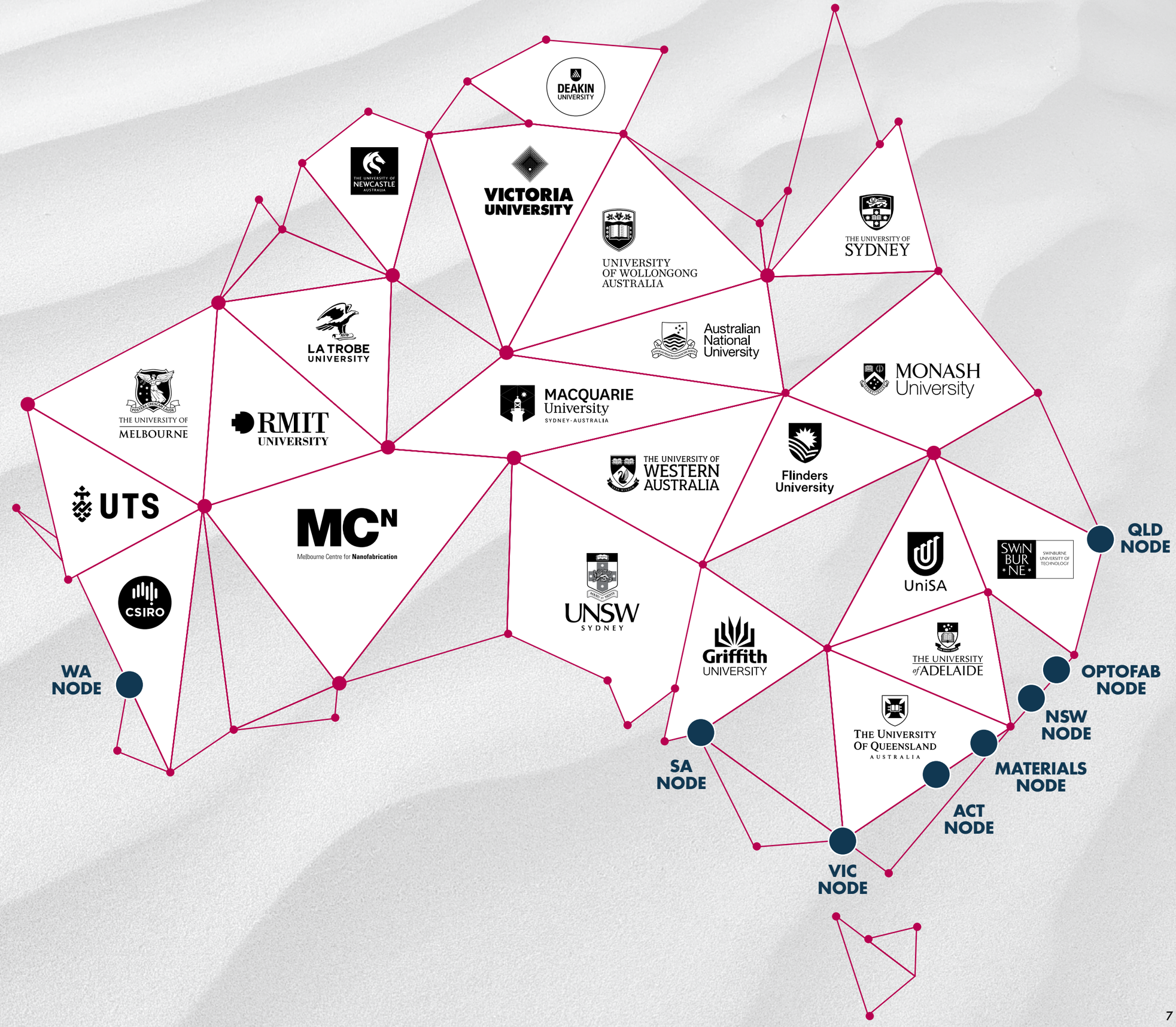
This year's Casebook centres on ANFF's connections within various research and technology landscapes, allowing us to feature our critical role in micro- and nanoscience research infrastructure at increasing levels of scope. We highlight projects that demonstrate research excellence, success with translation and commercialisation, and industry innovation. The individual examples in these networks illustrate the breadth of projects that ANFF engineers and equipment support.

ANFF – Connected embodies the transformative power of connectivity, forging pathways between disparate entities to drive collaboration and innovation. Through the synergy of ideas and resources, our Casebook epitomises how a networked world can catalyse progress beyond individual capabilities, underpin advancements across various sectors and contribute to Australia's position as a global leader in research and development.

ANFF

ANFF offers affordable solutions to reduce barriers in undertaking R&D and Commercialisation by providing open access to research infrastructure for micro- and nanofabrication. ANFF owns and provides access to capabilities that support innovative research, the development of new products and improvements to current production methods. Distributed across 21 institutional Hubs organised into eight Nodes, more than 500 tools are available across our network, with each Hub offering complementary specialised manufacturing facilities supported by our exceptional staff.

Following extensive consultation with clients and other providers over many years, ANFF identified and integrated into its facilities the critical infrastructure required to work at the forefront of science and accelerate the commercialisation of novel technology. These capabilities, including initial prototyping tools and complete, industry-relevant, process trains within the National Research Infrastructure landscape, provide extensive value across the innovation ecosystem.



ANFF IN NUMBERS

THE YEAR 2022-2023 WAS YET ANOTHER STRONG YEAR, WITH THE ANFF NETWORK ACHIEVING THE FOLLOWING FANTASTIC OUTCOMES:

16.5%

24+ yrs

215,965 hours of tool usage recorded

15%

3,162

clients helped

20,620

supplies manufactured

35%

3,569

instances of process training

630

publications that acknowledge ANFF in the calendar year 2022*

62%

involved international researchers from 60+ institutions

172

experts on hand to assist clients

*number of publications published in 2022 that acknowledged using ANFF facilities

ANFF'S STRATEGIC MISSION

Providing services for Australia's R&D & Commercialisation Ecosystems

An essential part of the research capability of Australia, ANFF continues to build on our current micro- and nanofabrication research infrastructure, positioning the organisation to embrace a rebirth of Australian manufacturing and stimulate economic outcomes. Our long-term organisational goals and decision-making processes are guided by three foundational pillars.

THE STRATEGY CENTRES ON THREE PILLARS:

1

Infrastructure Excellence
Maintaining world-class fabrication research infrastructure

2

Capturing the Benefits
Working with industry to facilitate innovation, development and commercialisation

3

National Resilience
Supporting sovereign manufacturing capability in Australia

IMPACT AGAINST STRATEGY

These pillars reflect our remit from the Commonwealth Department of Education through the NCRIS program and also the needs of the community that we serve.

Infrastructure Excellence: The first pillar is the core of what we do, continuing to support and maintain our world-class fabrication infrastructure. Providing tools and expertise across the country arranged in curated process trains ensures that we can serve the largest range of clients from both academia and industry. These equipment sets have been designed to be industry-relevant to shorten the time frame for translating breakthroughs from the ANFF labs to large-scale manufacturing processes.

Capturing the Benefits: ANFF has evolved and now has dedicated resources to walk the translation pathway side-by-side with our clients. Too little of the IP generated and proven in our facilities makes it to real-world use where it can have real impact. The ANFF-C platform supports these projects early in their development with key, out-of-the-lab support. This support can help prove a market exists, check freedom to operate or develop manufacturing feasibility, among other things. It is designed to be nimble, fit for purpose and remove one more barrier on the way to real world impact.

National Resilience: Our final pillar focuses on ANFF's investment in Australia's connected manufacturing infrastructure. ANFF plays a significant role in the development of strategic and flexible sovereign manufacturing capability. In providing a unique resource for Australia, ANFF wants to ensure that innovative micro- and nanofabrication capabilities are retained in the system or brought into the open- access ethos that signifies the entire NCRIS ecosystem. These investments will vary and to date have included a world-beating Fibre Braggs grating system, precision optics and large-scale fibre tools.

RESEARCH EXCELLENCE

SYNERGY WITH DSTG

ANFF and the Defence Science and Technology Group are transforming advanced manufacturing, precision optics and micro/nanoengineering through exchange of expertise, workshops on areas of communal expertise, and development of projects that utilise both sets of capabilities. Together we support the development of novel technologies to help researchers, academics and industry.

10

Australian Research Council Centres of Excellence are supported by access to ANFF capabilities.

ANFF's comprehensive network of interconnected resources, processes and equipment collectively fosters Australia's ecosystem of researchers and engineers to stay at the forefront of global R&D and scientific trends. Co-location with universities throughout the country provides convenient, open access to our world-class micro and nanofabrication capabilities, ensuring that businesses and universities can innovate at the cutting edge.

Our network provides more than just fabrication facilities by forming close working relationships within the academic ecosystem to watch for trends and plan for emerging needs. ANFF's expert staff also provide specialist training and support for Australia's research students and entrepreneurs as part of our mandate to support leading-edge research. These clients are generating a high volume of valuable outputs, including highly skilled graduates trained in nanofabrication techniques, fundamental research published in high-impact journals, and collaborative academic/industry research in sectors such as automotive, food, clean energy, and defence.

60.1%

of ANFF-supported publications are in the top 10% journal tier.

These publications have received

79,160

citations.

2022 AIP CONGRESS PHOTONICS WORKSHOP

Prior to the American Institute of Physics 2022 Congress, ANFF-Optofab and ANFF-SA co-sponsored a 'Fabricating photonic & optical components' workshop featuring a world-class line-up of experts. By utilising ANFF's equipment, facilities and expertise, these researchers are developing disruptive technologies in telecoms, biotechnology, medicine, microelectronics, optical sensing, astronomy, industrial processing, defence and security.

ANFF-SA Microengineering Winter School 10 YEAR ANNIVERSARY

Are you studying engineering or the sciences and interested in designing and fabricating microscopic devices used in the world's newest technologies? Prepare to be mind-blown!

Piloted in 2014, ANFF-SA's four-day, hands-on, intensive Microengineering Winter School inspires the next generation of microengineers in advanced manufacturing.

'The vision was for students from all over Australia to experience our world-class technology first-hand, be equipped with knowledge that would seed ideas, opportunities and innovations of their own, and be inspired by real success stories of leading Australian technologies and careers,' explained Prof Craig Priest, ANFF-SA Director.

Winter School is delivered onsite at the University of South Australia's Future Industries Institute in Mawson Lakes, along with online participation options. The program includes lectures, presentations, and practicals delivered by industry leaders and technical experts who introduce design, fabrication and testing processes – including photolithography, etching, PDMS devices, CAD design, microelectrodes, characterisation techniques, electrical integration and 3D printing.

Onsite participants can enjoy hands-on practicals using state-of-the-art equipment housed in world-class cleanroom facilities, while lectures and insight sessions by industry and academic leaders provide opportunities for all attendees to engage with industry leaders for useful career insights.

Winter School students are a mix of bachelor, master and PhD students, university researchers and industry innovators. The Winter School attracts students from universities across Australia and, in some cases, students have joined the school from overseas.

To date, about 800 people have attended the school. Past Winter School students are now using the facility for their own research or encouraging their own students or colleagues to complete the four-day course.

'It's an amazing opportunity to see what's available and what can be done in this field.'
Dr Damien Chong, DSTG

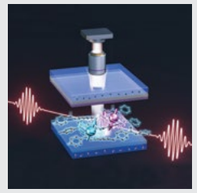
'The ANFF-SA team managed to demonstrate how effective, high quality microfabrication can be used to enhance the tools and devices used in both industry and academia.'
Dr Ivan Maguire, Dublin City University, Ireland

The school has always been free for attendees as an ANFF-SA gift to South Australia. In addition, the school has been made possible by the generosity of industry sponsors, volunteers and over 41 organisations who share a commitment to the next generation of microengineering experts. Many prepare practicals, presentations, and travel from afar. One key supporter is Australia's Defence Science and Technology Group (DSTG), which has from the very beginning understood the purpose of the Winter School and shared ANFF-SA's vision for knowledge transfer to support Australia's next generation of microengineers.

ANFF CEO Jane Fitzpatrick said, 'The ANFF-SA Winter School is a shining beacon of how ANFF connects people from all realms of the ecosystem. From those bringing the expertise to those broadening their mind on the possibilities, it provides the proverbial melting pot for generating real impact.'

Ten years ago, ANFF-SA's steadfast commitment to problem solving led to the idea of skilling-up the next generation of microengineers, securing its role as an industry resource going forward and forging lifelong ties with the State's most promising graduates. The continuing commitment from ANFF, valued sponsors, UniSA, State Government and Commonwealth Government will see our Winter School flourish for many anniversaries to come.

VISUALISING THE MAGNETIC WORLD



Quantum research could turn smartphones into portable magnetic field sensors thanks to the UNSW Sydney team at the ARC Centre of Excellence in Exciton Science, supported by ANFF-NSW. Integration of an OLED with a microwave resonator creates a tiny oscillating magnetic field across the device, allowing each individual pixel of the screen to respond to external magnetic fields. This innovative OLED magnetic field sensor can function at microchip scale and doesn't require input from high-powered lasers like existing imaging equipment, showing great potential for use in scientific research, industry and medicine.

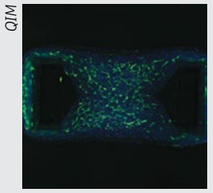
Rugang Geng: r.geng@unsw.edu.au

NANO CLIMATE CONTROL

Imagine a world where home heating and cooling is controlled by coatings on the building itself. At the University of Melbourne, a transformative breakthrough emerges: buildings that intuitively manage temperature. Pioneering scientists have unveiled phase-change nanoparticle inks, modulating radiation for enhanced passive temperature regulation and marked energy savings. This adaptability, while innovative, poses characterisation challenges. Leveraging ANFF-VIC's premier spectroscopy tools within the University's Materials Characterisation and Fabrication Platform, real-time phase shifts are meticulously tracked, affirming successful synthesis and functionality of these revolutionary materials.

Mohammad Taha: mohammad.taha@unimelb.edu.au

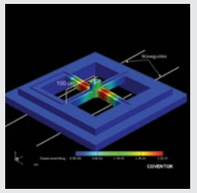
FINE TUNING CARDIAC RESEARCH



Researchers at QIMR Berghofer use cardiac organoids to study cardiac biology and test drugs to improve heart function. The team grows human cardiac tissue, derived from pluripotent stem cells, in a highly controlled and precise manner in 96-well plates. When their novel screening platform technology needed a better plate to improve imaging during screening, they turned to ANFF-SA's experts and micromachining capabilities. Creating a smooth finish on the culture plate base to contrast with the rough pillar tops provided the improvements needed for the automated inspection equipment to work efficiently.

James Hudson: James.Hudson@qimrberghofer.edu.au

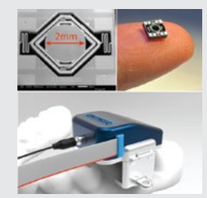
A HIGH-SENSITIVITY MEMS-BASED MAGNETOMETER



Drawbacks to modern magnetometers include the need for cryogenic cooling, large size and power draw, and narrow dynamic ranges that limit high-sensitivity measurements within the earth's background field. University of Western Australia researchers have created a Lorentz-force, MEMS-based sensor that allows them to sidestep many of these limitations. Combining a suspended MEMS-beam supporting a current-carrying conductor and a method to sense the MEMS-beam deflection, their prototype is in development with support by ANFF-WA's capabilities and expertise in magnetic materials and phenomena and funding from the WA Defence Science Centre.

Dilusha Silva: dilusha.silva@uwa.edu.au

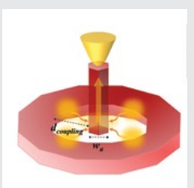
NO NEED TO FEAR THE DENTIST



Griffith University researchers have partnered with Dentroid Technologies, Australian National University and University of Sydney to make significant progress in developing micro-electro-mechanical systems (MEMS) mirrors for controlling high-power lasers. All fabrication steps were conducted at ANFF-QLD facilities. Their miniature MEMS mirror, coupled with a femtosecond laser, is being integrated into an intraoral robotic device, aimed at delivering ultra-precise and pain-free dental procedures using a laser instead of a drill. This innovative dental device provides practical solutions to dentistry's enduring issues by allowing more precise, efficient and predictable treatment.

Dzung Dao: d.dao@griffith.edu.au

POINTING IN THE RIGHT DIRECTION



A major obstacle to miniaturising light sources is how to direct them. ANFF-ACT is empowering Australian National University researchers to take a novel approach in overcoming this obstacle. The researchers have demonstrated directional lasing in an all-dielectric, bottom-up grown material system by coupling the laser emission from an InP micro-ring cavity into a vertical nanowire at the ring centre, which function as the photon source and directional antenna in the system, respectively. Their micro-ring/nanowire system is paving the way for low power consumption, on-chip microlasers with tunable emission directionality.

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NCRIS

NCRIS
National Research Infrastructure for Australia
An Australian Government Initiative

Founded in 2007, ANFF was one of nine projects established under the Commonwealth's National Collaborative Research Infrastructure Strategy (NCRIS).

At present, 24 interconnected projects encompass a wide range of scientific and research capabilities, including equipment, laboratories, data repositories and services across various disciplines. This ecosystem plays a pivotal role in advancing Australia's research landscape and driving innovation by enabling researchers and institutions to address complex questions in fields such as health, environmental science, technology and more.

In 2022, ANFF collaborated with the NCRIS Directors to release a Research Infrastructure Specialist position paper outlining the issues around the recognition and reward of the staff who are vital to research infrastructure operations.

Currently, we are leading efforts to create an NCRIS-wide, seamless portal for industry to find the appropriate NCRIS solution provider. This NCRIS concierge service would provide potential clients with effective navigation of the immense breadth and depth of capabilities available through NCRIS.

TRANSLATION & INNOVATION

DEFENCE TRAILBLAZER

Trailblazers were created by the Department of Education to drive translation and commercialisation. ANFF is now a member of the 'Defence Trailblazer for Concept to Sovereign Capability', a collaboration between Uni of Adelaide, UNSW, DSTG, CSIRO and >30 industry partners, which aims to strengthen Australian defence with cutting-edge technologies and solutions.

When you want to turn an idea into a fabricated product, ANFF, the micro- and nanofabrication sandpit, is the place to which innovators turn.

ANFF facilities provide the critical infrastructure required to accelerate and de-risk technology development, such as ANFF-NSW's Advanced Fibre Bragg Grating capabilities, ANFF-SA's Precision Engineering Centre and ANFF-QLD's UQ expanded cleanroom facility. The availability of these experts and capabilities, including tools for initial prototyping and complete, industry-relevant process trains, adds immense value to early innovations.

Entrepreneurs and early-stage entities must be equipped with the skills to take new ideas to market. ANFF fosters entrepreneurship by training researchers in the micro- and nanofabrication skills necessary to make materials, devices and systems. By enabling researchers to develop new ideas that have long-term implications and supporting them with critical funding for the translation pathway, ANFF and ANFF-C can help turn these devices and prototypes into societal benefits.

LAB TO LABEL

Deakin University's new Future Fibres Facility, housing fibre-production and yarn-processing equipment along with specialised knitting and weaving machines, will enable researchers to take ideas from the drawing board through prototyping and production. The facility will foster innovation to strengthen Australia's circular economy by developing fibres from sustainable sources.

5x

ANFF-C Gate 2 projects ($500k)

11x

ANFF-C Gate 1 projects ($220k)

MEDICAL DEVICE PROTOTYPING FACILITY

In partnership with South Australia's Medical Device Partnering Program (MDPP), the ANFF-SA Flinders Hub works with inventors and early-stage entities in the MedTech sector. Its facility has engineers, designers and technology that can help turn a eureka moment into a real, in-your-hand prototype that is ready to go.

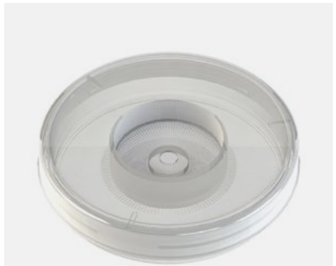
ANFF-C CONNECTS

ANFF technology platforms support research outcomes that frequently have the potential to become commercial products but have not been developed beyond the point of solving an interesting research problem.

ANFF-C was created to see more of Australia's world-class basic research become successful commercial products and services. We support early-stage ventures by providing pre-seed capital to overcome some of the hurdles of development, maximising the potential for successful outcomes.

ANFF-C funding is available through two investment stages. Gate 1 supports very early-stage projects that have demonstrated product feasibility, with support up to $20,000. At this stage, funding is generally used for market and technical validation. Gate 2 supports early-stage projects with funding up to $100,000. This money has been used for developing regulatory strategies and manufacturing plans or supporting studies to demonstrate the equivalency of the new technology with existing ones.

Our most valuable aid often comes in the form of our networks and understanding of sector-specific ecosystems. We aim to provide seamless integration of financial support and advice to accelerate a start-up team's vision. ANFF-C's broad range of capabilities on offer ensures that a client's exciting, innovative R&D can be supported as they look towards leaving the laboratory nest, headed for the roller coaster of commercialisation. ANFF-C is ready to help your great ideas get to market.



NEOGENIX

Gate 2 recipient NeoGenix's focus is to achieve better outcomes for IVF cycles by improving the reliability and efficiency of sperm isolation and selection, processes often overlooked in management of IVF technologies.

Their microfluidic-enabled selection device, shown above, mimics elements of the female reproductive tract to select the best sperm with minimal damage. This breakthrough device is designed to slot into existing IVF protocols, is much gentler on the sperm and produces more than enough material for a standard IVF cycle. NeoGenix's technology has the potential to reduce time and error rates during sperm analysis and selection and to passively select sperm that are immediately ready for IVF.

Steve Vasilescu
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TRIODA WILINGI

Majority owned by Indigenous Australians, Trioda Wilingi is developing innovative medical gels from cellulose nanofibres extracted from spinifex grass harvested in north-west Queensland. The technology originated from a long-term research partnership between the University of Queensland (UQ) and Bulugudu Ltd. In February 2023, Uniseed and Bulugudu (owned by the Indjalandji-Dhidhanu people) agreed to invest $2.6 million in Trioda.

Trioda was spun out of UQ with the support of ANFF-C. The late Dr Ian Griffiths, the previous ANFF CEO, recognised the potential of the fibres in medical gels and started the commercialisation negotiations that led to the establishment of Trioda Wilingi.

Tim Case
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SEVREN

Gate 1 recipient Sevren is developing light-based sensors that can measure neural activity. Combining liquid crystal transducers and integrated optic technologies, their multiple 'optrode' array (MOA) can register nerve impulses in a living animal body, creating an all-optical, passive, neural interface. Sevren's innovative sensors may provide a path towards implantable, conformable, high-density neural interfaces.

In the short term, the MOA device would be used in scientific instrumentation for neuroscience in-vitro experiments and electrophysiological studies. Long-term goals for the technology include the development of an implantable brain-machine interface which could enhance human sensory or motor abilities, control prosthesis, restore movement and sensation, and combat neural degeneration.

Francois Ladouceur
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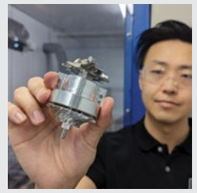
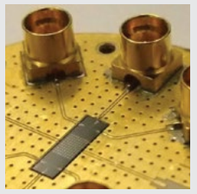
MINI MOTORS THAT PACK A PUNCH



ecoJet Engineering's all-in-one power generation, storage and distribution system is targeted for residential, commercial, deployable/mobile and rural applications, including combined heating and power. Their modular microturbine inverter genset (MTIG) offers clean onsite power because it can run on most liquid and gaseous fuels, including hydrogen and biofuels, and can be integrated with renewables, such as solar and wind, to reduce fuel consumption. MTIGs will be exceptionally compact, quiet and lightweight generators. ANFF-Optofab Adelaide is a key partner in exploring the advanced materials and manufacturing routes used to develop ecoJet Engineering's prototypes.

James Kim: jameskim@ecojetengineering.com.au

SHRINKING ANOTHER PART OF THE QUANTUM COMPUTER



Analog Quantum Circuits is using ANFF-QLD fabrication tools to develop tiny superconducting microwave circulators, which help direct microwave signals in electric circuits operating in the extremely low temperature environments needed for solid-state quantum computers. While current microwave circulators are too big and costly to fit onto a computer chip, AQC's prototype is just a few tens of micrometres in size, allowing thousands of circulators to be placed on the same chip. By scaling circulators down in size, AQC's innovation will enable the scale up of superconducting quantum computers.

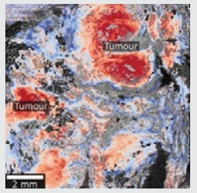
Arkady Fedorov: arkady@aqcircuits.com

SEAWEED STYLE

Australian start-up ULUU is producing a novel, ocean-derived, bioplastic material, called PHA, that is climate positive and home compostable. The biopolymer is made via a unique process that uses seawater, seaweed and 'salt-loving' microbes to produce pellets tailored for different applications. PHA textiles could soon be used to replace unsustainable petrochemical-based textiles such as polyester. ANFF-VIC Deakin assisted ULUU to produce the first polymer pellet and create the first continuous yarn from it. ULUU prototype yarn is currently being spun using the melt-spinning capability at IFMs Future Fibres Facility.

Dylan Hegh: dylan.hegh@deakin.edu.au

FEELING WITH LIGHT



OncoRes Medical provides surgeons with the ability to 'see' residual cancer tissue remaining during breast cancer surgery. Their novel imaging tool measures the mechanical properties of tissue at the microscale level to facilitate real-time assessment, converting the surgeon's sense of touch into a viewable image. Their device will improve the accuracy of breast-conserving surgery and reduce complication rates and the need for repeat surgeries. ANFF-WA worked with OncoRes to produce the first clinically viable pre-production prototypes of the disposable, patient-contacting sensor that forms an integral part of the device.

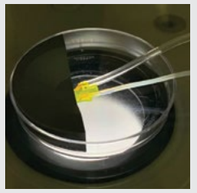
James Anstie: james.anstie@oncoresmedical.com

FROM PAPER TO POWER, A PRINTING REVOLUTION

Charge Around Australia (CAA) sent a Tesla electric vehicle around Australia, charged with a new type of printed solar cell developed using the roll-to-roll (R2R) print facility at the ANFF-Materials Newcastle Hub. This technology has continued to evolve since the CAA tour wrapped up, with advancements in several key areas stemming directly from this real-world testing. Kardinia Energy and the Trailblazer for Recycling and Clean Energy (TRaCE) are partnering to commercialise these solar cells. With support from ANFF-Materials, Kardinia will build Australia's first printed solar manufacturing facility in the Hunter Valley region.

Ben Vaughan: ben.vaughan@newcastle.edu.au

PROTECTIVE CRADLES FOR THE START OF LIFE



Fertilis is pioneering micro-medical technology that automates the way embryos are incubated. By placing each embryo into a patented 3D-printed cradle smaller than a pinhead in size, they have created a microfluidic system that monitors embryo growth while being cultured under dynamic flow conditions, reducing the need for technicians to handle embryos and removing the need to change the medium formulation directly, thereby reducing variability. Through a partnership with ANFF-SA, Fertilis can manufacture these micro-devices in minutes with access to the 2PP (two-photon polymerization) 3D printer located at our new Precision Engineering Centre at UniSA.

Marty Gauvin: marty@fertil.is

INDUSTRY

WORKFORCE DEVELOPMENT

In micro- and nanofabrication facilities, a trained workforce is needed to manage stringent cleanrooms and run tools that require specialist training. As a first step in developing this workforce, ANFF is partnering with TAFE SA to explore the requirements for a nanofabrication technician and how well that maps onto currently available training.

MCN PRIVATE INDUSTRY LAB

Alongside its industry residency program, the Melbourne Centre for Nanofabrication (MCN) offers a leasing option for a small (approx. 30 sqm) private laboratory, an initiative aimed at hosting translational activities leveraging a broad spectrum of MCN capabilities. ProtonIntel, MCN's current tenant, is developing the first real-time, on-demand wearable for potassium monitoring.

46,915

hours of engagement

CONCIERGE SERVICE

Our Client Engagement Facilitators are the primary contacts for industry clients whose needs transcend a single ANFF Node or who require assistance finding the best way that ANFF can support their project. By taking ownership of the client's problem, they engage the ANFF network to find the best possible solution.

ANFF once again leads the way in engagement with, and providing value to, industry. Access to ANFF gives industry the space and freedom to test ideas and innovate without interfering with day-to-day operations.

Our network operates in an IP-neutral environment, which means that all IP stays with the client. As a not-for-profit, ANFF offers services at low cost to make development affordable and faster and regularly plays matchmaker between clients that can provide solutions to each other's R&D challenges.

ANFF's network also supports manufacturing scale-up efforts by early-stage entities. For example, ANFF-VIC has facilitated scaling up of the NanoMSlide platform using a unique Talbot lithography instrument from Eulitha. ANFF-Materials supports a commercial-scale facility at the University of Newcastle to produce GBS Inc.'s needle-free diabetes test. Access to these same capabilities provide existing companies the ability to test ideas for efficiency and other benefits.

348

direct industry users

AUSTRALIAN RESEARCH COUNCIL FELLOWSHIP AWARDEES

ARC Early Career Industry Fellowships support academic researchers in establishing careers in industry and building research collaboration, translation and commercialisation skills. ARC Industry Laureate Fellowships support researchers with an exemplary record of research translation who aim to build and transform an emerging industry.

ARC EARLY CAREER INDUSTRY FELLOWSHIPS

NANOSTRUCTURED SILICON CHIPS LEVERAGE LASERS FOR DRUG SCREENING

DRUGSENS

Monash University's Dr David Rudd was awarded an ARC Early Career Industry Fellowship to prototype a new drug screening system utilising nanomaterials and mass spectrometry to improve the speed, cost and accuracy of current drug testing programs, while minimising the distress for users. The project is in partnership with Corrective Services New South Wales, with additional support from the newly formed DrugSens (Supported by Aditi Dhawan, Program Director at Innovyz) and Monash Innovation.

INDUSTRY LAUREATE FELLOWSHIPS

BREAKING THROUGH THE MANUFACTURING 'GLASS CEILING' FOR ZBLAN GLASS FIBRES

FLAWLESS PHOTONICS

ZBLAN glass fibres can potentially transport light over much longer distances than the best currently available optical fibres, a key to meeting the increasing demand for faster internet and global connectivity. However, current ZBLAN fibres have impurities limiting their full potential. University of Adelaide Prof Heike Ebendorff-Heidepriem will work with Flawless Photonics to not only tackle that issue by developing efficient purification methods but also to automate the fibre manufacture. These ZBLAN fibres will be rolled out across sectors such as defence, mining, medical devices and data communications.

UNLEASHING THE COMBINED POWER OF ELECTRONS AND HOLES FOR QUANTUM COMPUTING

diraq

Quantum computers require millions of high-speed quantum components, the development of advanced materials and new technical approaches. UNSW Scientia Prof Alexander Hamilton plans to develop groundbreaking silicon quantum computer technology that will create new quantum components operating thousands of times faster than current approaches. With his key industry partner Diraq, an Australian company and world-leader in silicon quantum dot computing, these new technologies will be brought to market for end users in industries with complex simulation and optimisation needs, such as BioTech, aeronautics, automotive and finance.

ACCELERATING GREEN HYDROGEN PRODUCTION WITH HIGH EFFICIENCY ELECTROLYSERS

Hysata

Green hydrogen is an energy-dense renewable fuel that will be essential to achieve the planet's net-zero electrical generation goal. University of Wollongong Senior Prof Gerhard Swiegers and co-inventers have developed a new type of electrolyser to split water into hydrogen and oxygen that is being commercialised by Hysata. This electrolyser produces hydrogen efficiently, consuming about 20% less energy with higher hydrogen yields. This efficiency will make green hydrogen cost-competitive with fossil fuels. Together, these partners will help develop sovereign Australian hydrogen manufacturing.

SAFER ROADS THROUGH A NEW LENS

Seeing Machines' metalens provides a groundbreaking solution for the growing problem of driver distraction and drowsiness. Regulation demands integrated driver monitoring systems. These systems are camera-based and need high-performance optics but also must be small. By harnessing the power of TMOS meta (or flat) optics, the company created an extremely compact and robust lens that simplifies the integration process. Metalens fabrication was carried out using electron beam lithography (EBL) at the Melbourne Centre for Nanofabrication. Seeing Machines has opened new possibilities for advancements in automotive optics, paving the way for enhanced driver safety.

Litty Thekkekara: littyvarghese.thekkekara@rmit.edu.au

UNSWAYED BY SOLAR WINDS

Airbus has teamed up with University of New South Wales researchers to develop high-efficiency solar cells for space. Pushing photovoltaic solar cell technology to its limits, their satellite solar arrays will capture a broader range of the energy spectrum. With servicing impossible, these solar panels need to be highly reliable and able to withstand the hail of high energy particles delivered by the solar wind. ANFF-NSW is a key partner in their R&D ecosystem, taking the concepts and computer modelling from the team and fabricating the prototypes to test this innovation.

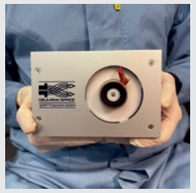
Ned Ekins-Daukes: nekins@unsw.edu.au

HEALING EYES THE WRITE WAY

iFix Medical, a NSW consortium of researchers, surgeons and industry, has developed a novel medical treatment technology incorporating 3D printing for corneal diseases and injuries. The two-component system – iFixInk™ and iFix Pen® – can be used to deliver a 3D-printed structure directly onto the eye to treat defects. The system involves the printing of a transparent structure that seals the wound and prevents pathogen infiltration. It relieves pain, accelerates healing and is biodegradable. ANFF-Materials engineers helped design and build the iFix pen and evaluate the biocompatibility of the GMP manufactured bioink.

Jingjing You: jing.you@sydney.edu.au

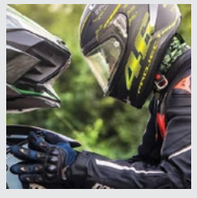
THRUSTING SATELLITES IN ORBIT



Manufacturing propulsions systems for satellites and spacecraft, Neumann Space delivers superior in-space mobility. An emerging global technology leader of in-space electric propulsion systems, the company has patented the Neumann Drive®, which employs a thruster unit using solid metal propellants for a safer, more efficient and simpler to operate propulsion system. Neumann Space utilised ANFF-SA's cleanroom facilities to assemble their propulsion systems. The Neumann Drive® flexed its muscle by heading into space for the first time on 13 June 2023, integrated into a Skykraft satellite, lifting off from California on board a SpaceX Falcon 9 rocket (Transporter 8).

Herve Astier: herve.astier@neumannspace.com

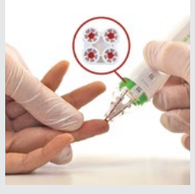
THE LOW DOWN ON PROTECTIVE GEAR



MotoCAP's motorcycle clothing assessment program measures the protection and breathability of off-the-shelf motorcycle gear, utilising ANFF-VIC characterisation equipment housed in a NATA-accredited testing facility at Deakin's Institute for Frontier Materials. MotoCAP goes into stores in New Zealand and Australia and buys the gear for testing, the results of which appear on the website to inform rider safety. Funded by government groups like the Accident Compensation Commission and their Australian equivalents, MotoCAP is independent of manufacturers and ensures that motorcycle rider safety continues to improve into the future.

Dylan Hegh: dylan.hegh@deakin.edu.au

EASY BLOOD SAMPLING BY ANYONE, ANYTIME



Blood tests are powerful healthcare diagnostic tools, but blood draws usually require technical expertise. Trajan Scientific and Medical's hemaPEN® portable device enables minimally invasive and convenient blood microsampling that can be performed by anyone, anywhere. hemaPEN® draws four identical blood samples from a single finger-stick, transfers them to filter paper within the device and stores those dried blood spot (DBS) samples inside the 'pen' until lab tested. With recent NATA accreditation for their Trajan Analytical Services Laboratory, the company is poised to develop and offer medical testing and analytical services and products.

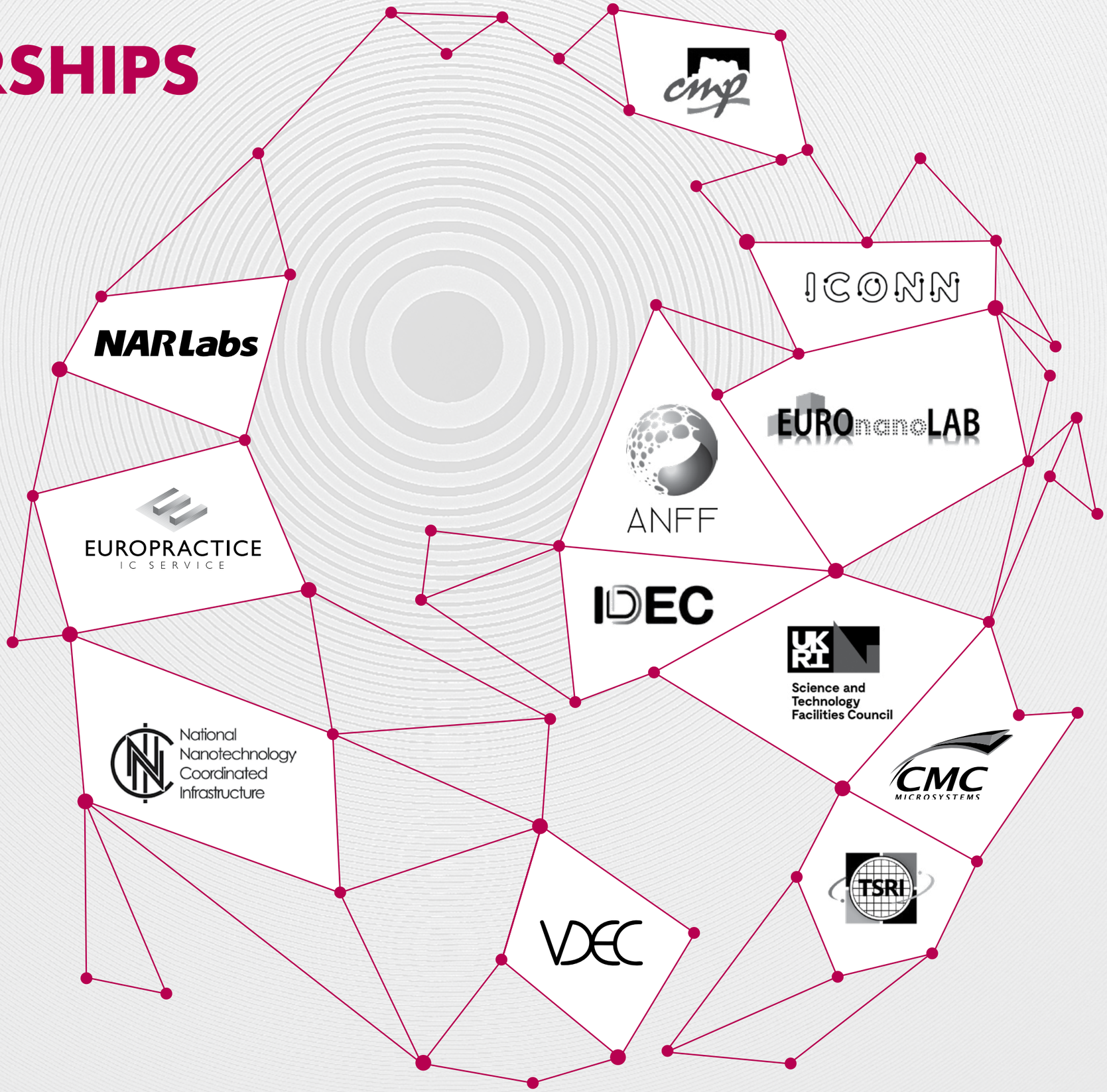
Amy Miller: amymi@we-worldwide.com

GLOBAL PARTNERSHIPS

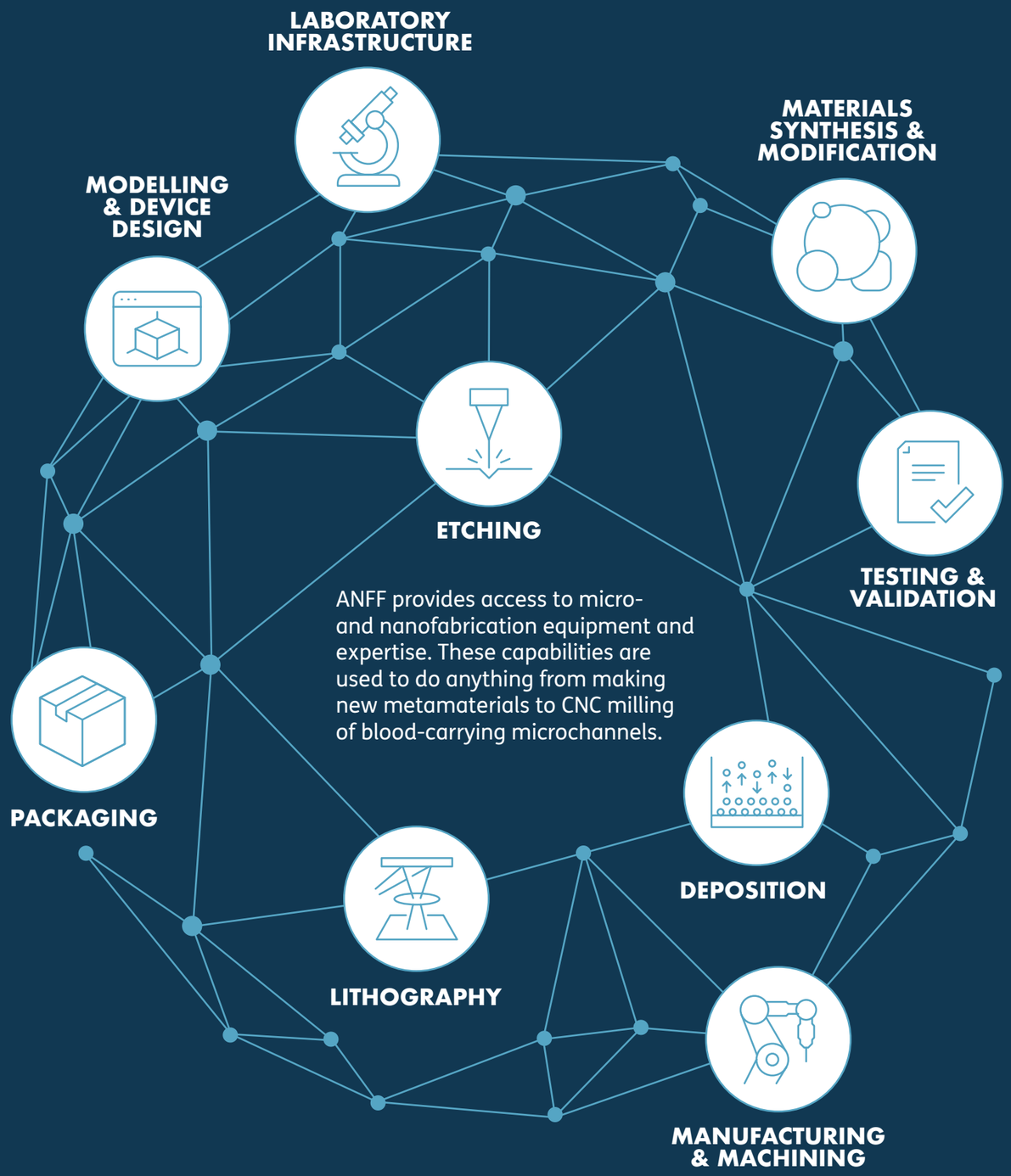
ANFF's global partnerships are crucial for fostering international collaboration, knowledge exchange and resource sharing in the fields of nanofabrication and research infrastructure, ensuring Australia's capabilities are at least on par with the rest of the world. The model that ANFF operates is also attractive to our international peers with invited presentations to our European (at ENRIS 2023) and US (NNCI Review) colleagues.

In late 2022, ANFF was one of the NCRIS groups representing Australia at the International Conference on Research Infrastructure (ICRI), a conference that deals with best practice in the development and sustainability of research infrastructure and how to maintain those capabilities into the future. We look forward to the end of 2024 when Australia hosts the next ICRI conference.

Planning is fully underway for the 8th International Conference of Nanoscience and Nanotechnology (ICONN 2024) in Melbourne, co-hosted by ANFF with the Australian Nanotechnology Network. ICONN 2024's focus on 'Innovate, Collaborate, Commercialise' will feature a diverse array of multidisciplinary talks connecting world leading scientists, students, engineers, industry participants and entrepreneurs working in nanoscience and nanotechnology to discuss new and exciting advances in the field.



ANFF EQUIPMENT



ACCESSING ANFF

ACCESS STEPS

ANFF is committed to exceeding the customer service expectations of our clients.

CONTACT US AT INFO@ANFF.ORG.AU → **DISCUSS PROJECT WITH ANFF AND ESTABLISH PATHWAY** → **ACHIEVE PROJECT OBJECTIVE**

RESEARCHERS

For researchers seeking to engage with ANFF, we invite you to contact your local Node who can have an initial discussion around how ANFF capabilities and expertise can align with your research needs.

INDUSTRY

The primary point of contact for industry is the ANFF Client Engagement Facilitator (CEF) team. They can help clients who require help in finding the best way ANFF can support their projects or for those whose needs transcend a single Node. The CEF can then take ownership of the client's problem and engage the ANFF Network to find the best possible solution.

ANFF-C

ANFF-C works with ANFF clients to identify and remove barriers on the translation pathway with dedicated funding for out-of-the-lab services.

Dr John Morrison, Director ANFF-C, would be delighted to discuss with you how the platform can be of assistance.

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NSW Node
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VISIT ANFF.ORG.AU

The ANFF team at the 2022 National Staff Forum in Canberra.