Physical Sciences Fund 2021

Fishburners, Sydney Startup Hub

15 December 2021

NSW GOVERNMENT


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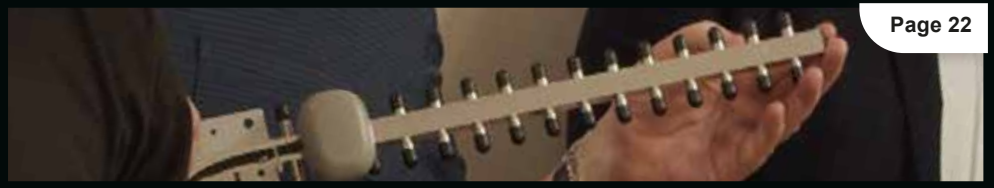
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Physical Sciences Fund 2021

Announcement Event

Fishburners, Sydney Startup Hub

15 December 2021

The NSW Chief Scientist & Engineer with Quasar Satellite Technologies, a funding recipient at the 2020 Physical Sciences Fund Announcement Event, Sydney Startup Hub, 9 February 2021.

Order of Proceedings

Introduction and Welcome to Country
Master of Ceremonies
Dr Dharmica Mistry, Head of Medtech and Biotech, Cicada Innovations

Keynote Address
The Hon. Gabrielle Upton MP
Parliamentary Secretary to the Premier

NSW Chief Scientist & Engineer Address
Professor Hugh Durrant-Whyte

Expert Panel Chair Address
Professor Annabelle Duncan

Physical Sciences Fund 2021 Video

Announcement of Successful 2021 Funding Recipients
Dr Dharmica Mistry, The Hon. Gabrielle Upton MP

Discussion with Recipient Panel

Message from the Parliamentary Secretary to the Premier

In a year when we have emerged from the most serious health crisis in a generation, NSW is relying more than ever on science, technology and innovation to guide us forward to a safer, better, more prosperous future.

The NSW Government is committed to supporting our world-class research sector to deliver the new ideas, products, services, industries and skills we need to respond to the pressing issues of our time: health, an ageing population, emissions reduction, energy transition and natural resources management. Our 2021 Accelerating Research and Development in NSW Action Plan will help deliver these outcomes.

Two recent examples are our $96 million Australian-first pilot RNA manufacturing facility to help fight pandemics, cancer and genetic diseases and our NSW Hydrogen Strategy to establish our state as a clean energy economic power leading the nation towards 50 per cent emissions reduction by 2030 and Net Zero by 2050.

Now in its third year, the NSW Physical Sciences Fund, like the Medical Devices Fund which inspired it, challenges our most exciting new researchers, innovators and entrepreneurs to turn ingenious ideas into devices and systems which solve real-world problems for NSW. With guidance and support, their innovations will build new businesses, create new jobs and develop new ecosystems.

I congratulate tonight's Physical Sciences Fund recipients and will watch with great interest as your inspirational ideas are translated into successful enterprises delivering impactful solutions of benefit to the people, environment and economy of NSW.

The Hon. Gabrielle Upton MP

Foreword from the NSW Chief Scientist & Engineer

NSW is known for producing world-leading research in our universities, institutes and tech businesses, developing innovative solutions to local and global issues. One of my priorities as the NSW Chief Scientist & Engineer is to translate these ideas into viable commercial products that can improve outcomes for the people of NSW, Australia and the world.

Much is being done to support innovation in NSW. To name a couple of recent NSW Government announcements, the NSW Hydrogen Strategy and mRNA Pilot Facility and BioScience Alliance are major commitments to ensure NSW's standing as a globally relevant R&D and innovation participant. This year also saw the launch of the Accelerating Research and Development in NSW Action Plan. Led by the Hon. Gabrielle Upton MP, who joins us this evening, the Action Plan focuses and coordinates the way we support innovative companies, build research capacity and skills, connect researchers to industry, and develop and scale critical new technologies such as advanced bushfire prediction and control, driving new industries in NSW.

The Physical Sciences Fund continues to champion the growth of innovative industries in NSW and this year's projects highlight the diverse range of expertise across our SME sector.

I congratulate tonight's winners and thank you for the work you are doing for the benefit of NSW. I look forward to following your journeys along the commercialisation pathway.

I also thank the Physical Sciences Fund Expert Panel and Expert Sub-Committee for their efforts. This year we say goodbye to Professor Rose Amal – thank you for your significant contributions since the Fund's beginning.

As a final note I want to highlight the special connection between the Physical Sciences Fund and the recently crowned 2021 NSW Scientist of the Year, Professor Jim Patrick AO, one of the original engineers at Cochlear. The success of Cochlear inspired the development of the Medical Devices Fund, which in turn inspired the Physical Sciences Fund. Jim is a testament to the high calibre of innovation in NSW that the Physical Sciences Fund aims to support.

Professor Hugh Durrant-Whyte

Foreword from the Chair of the NSW Physical Sciences Fund Expert Panel

Once again it has been a pleasure to lead the Physical Sciences Fund Expert Panel in the third year of this exciting program. We continue to be impressed by the quality of applications and range of innovative technologies – and in 2021 have awarded more grants than ever.

This year's winners include a groundbreaking method to make green hydrogen production more viable, a robot that safely cleans high rise buildings, another autonomous system that performs underwater hull cleaning and a long-range WiFi system for mines. There are also several agricultural innovations, including a greenhouse film that boosts crop growth, a unit that optimises seed placement and a device which uses microwave energy to control weeds and disease. Each project has major implications for their respective industries, and many have scope to benefit other sectors.

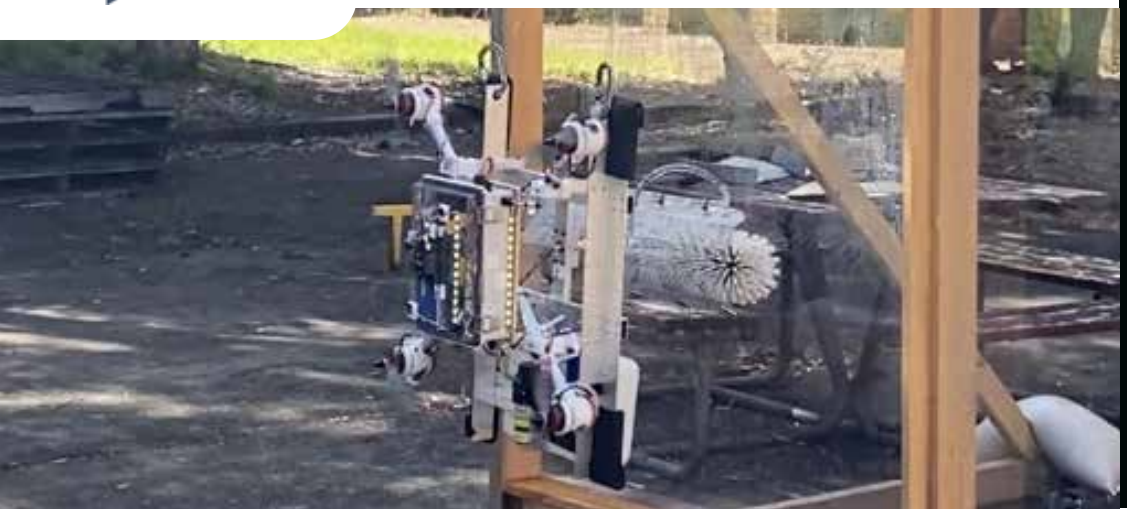
Thank you to my fellow Expert Panel members: Professor Rose Amal AC, Martin Duursma, Dr Simon Poole AO and Professor Tony Weiss AM. Once again it has been a privilege to work with such a wise and experienced team. This year was Professor Rose Amal's final year on the Panel. Rose, your contribution over the past three years has been highly valued and you will be missed. Thanks must also go to the Physical Sciences Fund Sub-Committee, who helped us to assess applications and refine our review – work which helps us immensely.

The Physical Sciences Fund would not be the success it is today if not for the passion and advocacy of the NSW Chief Scientist & Engineer, Professor Hugh Durrant-Whyte, and the support provided by his team at the Office of the NSW Chief Scientist & Engineer.

I would also like to thank all this year's applicants for their innovative ideas. And lastly, sincere congratulations to tonight's winners. Your projects represent the best of innovation in NSW. I am excited to play a part in supporting your ideas and will be keenly following you as you take them to market.

Professor Annabelle Duncan

The BEAR
(Building Envelope Access Robot)



"The BEAR allows safe access to commercial buildings for smart autonomous façade inspections and window cleaning. This will protect human lives and transform the nature of the work to be faster, cheaper and more comprehensive."

– Dr Abbie Widin

GLOBALLY, BUILDINGS ARE getting taller, making access to their exterior more dangerous, difficult and costly. Defy-Hi Robotics has developed the BEAR robotic system to do the dangerous, dull and dirty work of cleaning and inspecting high-rise buildings.

The robotic system includes a mounting system, a carriage and functional platform, and window cleaning and façade inspection attachments.

The funding will be used for making the BEAR autonomous, as well as incorporating artificial intelligence into key functional operations, such as window cleaning and façade inspection.

In window-cleaning mode, the BEAR smart cleans the windows and façades. Funding will be used to incorporate artificial intelligence to check cleaning quality.

In façade-inspection mode, the BEAR uses sensors to provide a visual data stream of the entire building. Funding will be used to expand sensors to include a high-resolution camera (visual defects), thermal camera (heat/cool leaks) and hyperspectral camera (material changes such as rust) and artificial intelligence to analyse data for building defects including concrete cancer and cracks. A smart report detailing new defects, along with longitudinal changes in known defects, will then be provided to the client.

High-rise cleaning and inspection ensure building integrity is maintained for longer, attracting higher-quality tenants, reducing costs, and increasing and protecting capital values. The BEAR allows these services to be undertaken with less risk to human safety, as well as more quickly, cheaply and with better quality.

Defy-Hi Robotics hope to export the BEAR world-wide, improving interaction with high-rise buildings globally and bringing export revenue and STEM jobs to NSW.

Defy-Hi Robotics

Stage/Category:

Early stage/Robot development and manufacture

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Co-Founder

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www.defyhi.com

Growave Series Wave One

"Growave is electrifying how farmers control weeds and disease, enhancing sustainable food production."

– Liam Hescock

COMPETITION BETWEEN WEEDS and crops is rising due to herbicide-resistant weeds, regulation that limits access to traditional controls and consumer demand for more sustainable food. To address this issue, Growave is pioneering the use of highly efficient microwave energy to remove weeds and seedbanks, and control disease.

Growave's sustainable, chemical-free approach is a real alternative to chemical herbicides. It is also more effective, penetrating the target and permanently destroying the cell structure from the inside.

Growave will use funding to expand and improve its current Alpha unit, which has demonstrated successful results in recent on-farm trials in NSW. The project will ultimately design and manufacture Growave's first commercial unit – the Wave One. Using microwave generators that either attach behind a tractor or bolt on to autonomous platforms, Wave One will be field-tested on strawberry pathogen control and on chemical-resistant weeds. Commercial treatments will begin in the 2022 financial year.

Growave will expand its team over the next 15 months, including in the key areas of electrical engineering, agricultural sciences and commercialisation. This team will focus on energy efficiency, farm integration and scaling of the technology.

Growave Pty Ltd

Stage/Category:
Early stage/Product development

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The Hullbot One System

"Hullbot's mission is Robots for Healthy Oceans. The Hullbot One System is an underwater drone platform deployed from a pod that leverages computer vision, advanced sensors, artificial intelligence, and machine learning to inspect, map and interact without human supervision."

– Tom Loefler

THE HULLBOT ONE System is highly capable of performing a diverse range of tasks including daily grooming of hulls, 4D inspections (time series-defined 3D data) and surveys of underwater structures and environmental management. The robot can navigate and localise itself underwater without human input and is deployed and retracted autonomously from an above-surface pod.

Proactive maintenance of boats increases hydrodynamic efficiency, reduces CO_2 emissions and reduces maintenance costs, while ending the reliance on toxic and expensive antifouling paints that pollute waterways and require annual reapplication.

The Hullbot One system can undertake daily grooming of yacht hulls using self-deploying robots that gently remove early-stage biofouling with rotating brushes. In this way, the Hullbot One System replaces both diver cleaning and antifouling paint, representing a transformative global technology with no direct competitors.

The Hullbot One System has a versatile foundation that can be used across a diverse array of other industries and applications including asset and risk management and mitigation, environmental management, conservation and marine species monitoring.

Hullbot Pty Ltd

Stage/Category:

Early growth/Device development and manufacture

Contact:

Tom Loefler
CEO

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Phone: 0402 810 667

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‘Next-Generation’ Water Electrolyser

“Electrolysers are the key technology for producing green hydrogen, which will be a major energy source in a Net Zero economy, of similar scale to today’s natural gas industry. Hysata’s electrolyser is by a considerable margin the most efficient globally, meaning it will deliver the cheapest green hydrogen, accelerating decarbonisation and positioning Hysata at the front in a major new trillion-dollar industry.”

– Dr Gerry Swiegers

IT IS ESTIMATED that 15-25 per cent of energy in a Net Zero emissions global economy will come from ‘green hydrogen’ – hydrogen produced by splitting water using renewable energy. This will decarbonise sectors that cannot use renewable electricity directly, including heavy transport, chemicals and steel. However, the water electrolysers currently used to produce hydrogen are relatively inefficient, complex, costly and difficult to scale.

Hysata is developing a new type of electrolyser that promises to overcome the limitations of existing electrolysers and deliver the world’s lowest cost green hydrogen. Critically, Hysata’s electrolyser directly converts water into hydrogen and oxygen gas without the intermediate step of forming gas bubbles, which are a key cause of energy inefficiency.

Removing bubbles also removes the need for many of the systems used in current electrolysers. This results in extremely efficient hydrogen production and a simple design that makes it cheap to manufacture and easy to ramp up to the massive scales needed to decarbonise the energy sector.

This technology has the potential to give Australia world-beating capacity in hydrogen production technology, with direct and indirect employment and major export potential.

Hysata Pty Ltd

Stage/Category:

Early stage/Device development and manufacture

Contact:

Dr Gerry Swiegers
Chief Technical Officer

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LLEAF Technology

"LLEAF (luminescent light emitting agricultural film) improves crop productivity by up to 25 per cent through optimisation of natural sunlight. It is a sustainable way to improve world food security in an environmentally friendly manner in the current climate change crisis."

– Alexander H. Soeriyadi

TO FEED A growing population sustainably and securely, global food production must increase by 70 per cent. To address this need, LLEAF is developing new agricultural film that optimises the use of one of our biggest natural resources – sunlight.

LLEAF's patented technology, developed in collaboration with UNSW Sydney, uses material with different dyes to shift non-optimal wavelengths of sunlight to wavelengths that enhance plant growth. The film can be retrofitted in greenhouses and has been shown to improve crop growth by up to 25 per cent. LLEAF's other benefits include faster growth and the ability to induce or inhibit fruiting cycles. NSW is the ideal place to develop LLEAF technology with the unique combination of its pool of expertise in material engineering, abundance of sunlight and being the centre of greenhouse cropping in Australia.

LLEAF's work is aligned with UN sustainable development goals especially SDG 2 (Zero Hunger) and SDG 13 (Climate Action). LLEAF is currently in the final stages of a field pilot, partnering with the Future Food Systems CRC. Funding will be used to launch LLEAF's first product – LLEAF-Red – to the market.

LLEAF Pty Ltd

Stage/Category:

Early stage/Agriculture Technology (Agtech)

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CEO/Co-Founder

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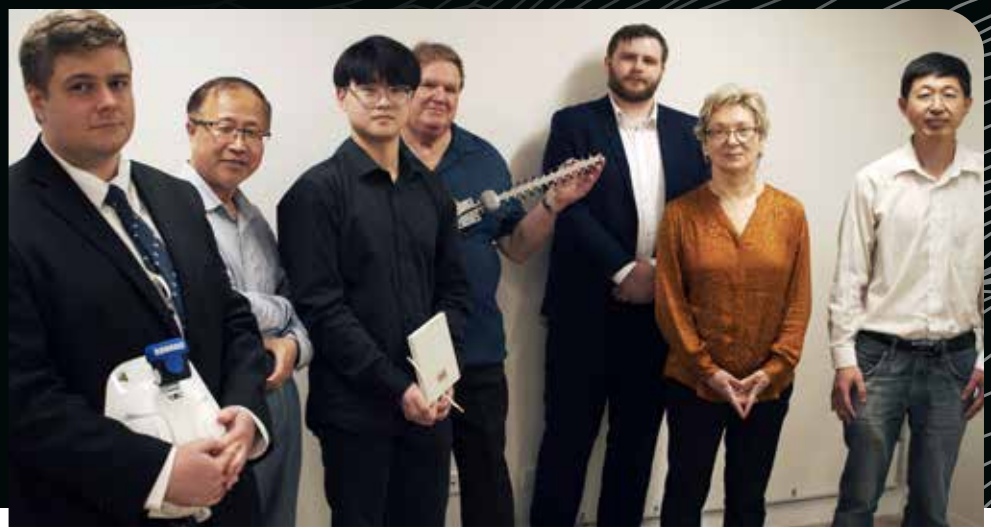
ROOBUCK

Long-Range High-Rate Wi-Fi System



"The long-range WiFi system significantly increases the WiFi range from less than 100 metres to more than 1,000 metres. It maintains high data rates, low latencies and is compatible with the existing WiFi systems. The long-range capability reduces the need for WiFi equipment such as access points, dramatically reducing communications costs in underground mines."

– David Forshaw,
Business Development Manager

ROOBUCK AND THE University of Sydney are collaborating to commercialise the world's first long-range high-rate WiFi system compatible with conventional WiFi devices. Developed by university researchers, the novel long-range WiFi system (LRWiFi) will significantly expand broadband coverage in underground mines, increasing both productivity and safety.

The short transmission range of current WiFi technology makes it expensive to use where WiFi is needed over a wide area. Coverage is typically achieved by mesh networks relying on a high number of nodes and relay hops, resulting in severe latencies and congestions.

The LRWiFi system developed by the university researchers is low-cost and scalable. Modelling indicates the system could significantly reduce the number of access points and reduce costs by more than 80 per cent.

Products resulting from this Roobuck and University of Sydney collaboration could be transferred to other sectors such as the petrochemical, agriculture, construction, and logistics industries.

Roobuck Pty Ltd

Stage/Category:
Consolidation/Products/System development and manufacture

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CEO/Co-Founder

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www.roobuck.com.au

MPT AgTech ‘Smart Seeder’

“In a modern no-till cropping operation, the only time farmland soil is ever opened up is during the seeding process. MPT is working to maximise this opportunity by mapping soil moisture and soil carbon using sensors embedded within the seeder and utilising this collected data in real time to increase crop yields and decrease fuel burn.”

– David Finlay

SOIL MOISTURE IS critical to achieve optimal seed emergence. Large paddocks can have highly variable soil moisture and farmers face increasing challenges establishing crops in marginal moisture conditions, with climate change exacerbating risks.

The MPT AgTech ‘Smart Seeder’ integrates soil moisture sensing technology into a self-adjusting seeder to accurately manage seed placement. Typically, farmers must rely on data collected from static probes to identify a single seed depth for the whole paddock – a limited approach that only provides a ‘best guess’. The Smart Seeder captures live data using smart sensing tines and analyses this data with an on-board processor that feeds information to an electronically controlled smart row unit that uses an algorithm to vary the depth of seed placement constantly and automatically.

Planting seeds to suit moisture conditions at individual locations maximises crop uniformity, resulting in higher yields and increased productive seasons. The system also increases machine efficiency, reducing fuel use and general wear and tear.

The data generated from seeding can also be exported to compare with field maps and contribute to the farmer’s overall knowledge for future management.

Sensortine Pty Ltd trading as MPT AgTech

Stage/Category:

Early stage/Manufacturing, agricultural

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CEO/Founder

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Physical Sciences Fund Expert Panel

The Expert Panel to oversee and assess the Physical Sciences Fund applications is composed of distinguished experts who collectively have skills, experience and expertise in science and engineering, devices and systems commercialisation, venture capital, financial management and consumer advocacy. The Panel composition reflects a strong focus on end-user needs.

The following people were approved by the then-Minister for Trade & Industry, the Hon. Niall Blair MLC, to be members of the Physical Sciences Fund Expert Panel:

Professor Annabelle Duncan PSM
Chair

Current Chair of the Sydney School of Entrepreneurship's Board of Directors, Annabelle was formerly the Vice-Chancellor and CEO of the University of New England (UNE). Prior to joining UNE Annabelle spent 16 years at CSIRO, including six as Chief of the Division of Molecular Science.

She has acted as an advisor to the Department of Foreign Affairs and Trade on biological weapons control, representing Australia at international arms control meetings and acting as a biological weapons inspector with the United Nations in Iraq.

Professor Rose Amal AC

Rose is a chemical engineer, the leader of the Particles and Catalysis Research Group and Co-Director of the ARC Training Centre for the Global Hydrogen Economy. A pioneer in fine particle technology, photo-catalysis and functional nanomaterials, her current research is on solar and chemical energy conversion nanomaterials and engineering solutions for solar-induced processes.

Rose has attracted over $25 million to UNSW in ARC and industry funding.

Rose was recognised as NSW Scientist of the Year at the 2019 NSW Premier's Prizes for Science & Engineering, and was awarded the 2021 Chemeca Medal for her research into catalysts for efficient energy conversion.

Mr Martin Duursma

Martin is a partner at Main Sequence Ventures (CSIRO Innovation Fund) and has over 25 years' experience as a technologist, business founder, angel investor and mentor in Australia and the US.

A senior executive at Citrix, where he built their research arm Citrix Labs, Martin started the Citrix Accelerator and led investment in over 30 new companies. As VP and head of the Global Technology Office, he led due diligence in over 60 transactions totalling $2.5 billion.

Dr Simon Poole AO

Director and VP Business Development at Cylite Pty Ltd, Simon is an engineer with 40 years' experience in photonics in research, academia and industry.

A leading technologist and entrepreneur in optical communications, he is highly experienced in startups and is renowned for both his contribution to the technology of photonics and the companies he founded (Indx, Engana, Cylite), which have generated over $1.25 billion in revenues to date.

Professor Tony Weiss AM

McCaughey Chair, Professor and NHMRC Leadership Fellow at The University of Sydney, Tony's research is on tropoelastin and elastin, the biological ingredients that give human tissue its elasticity. He is an inventor on 167 granted patents in 22 families and is commercialising treatments that decrease scarring and accelerate the repair of wounds.

Tony was awarded the Prime Minister's Prize, NSW Premier's Prize, Eureka Prize and Australian Academy of Technology & Engineering's Clunies Ross Medal in recognition of his translational science, including the founding of Elastagen, which three years ago was acquired for the sum of $340 million by Allergan, with the products rapidly moving to market.

Tony was one of the first recipients of a grant through the NSW Medical Devices Fund.

Physical Sciences Fund Sub-Committee

Erik W Aslaksen Independent Researcher

Erik has over 50 years' industrial experience covering fields as diverse as microwave components, power electronics, quantum electronics and communications, ranging from basic research to corporate management. Erik has been at the forefront of developing the system approach to engineering, with an emphasis on life-cycle costing and a design optimisation process based on a holistic definition of cost-effectiveness; more recently he has been applying the system approach to society as a complex system.

Ellen Gorissen Consultant, Commercialisation Expert, Tech Investor

Ellen has more than 25 years' experience in strategy, business development, technology commercialisation and venture capital. She started her career as a chemical engineer in the resources sector before moving into investment banking, venture capital and technology commercialisation. Her passion is bringing new technologies to market and working with startups and new ventures. Until striking out on her own, Ellen was Investment Director at IP Group Australia, the Australian subsidiary of IP Group plc, a global technology investment and commercialisation company listed on the London Stock Exchange. In this role she led investments into IP-based startups, often originating from universities or research institutions. Prior to joining IP Group, Ellen led the Commercialisation Function at CSIRO and was responsible for complex licensing, spinouts and the equity portfolio across all technology areas. Before CSIRO, Ellen was Chief Operating Officer at CeramiSphere, a spinout from the Australian Nuclear Science and Technology Organisation.

Associate Professor Maryanne Large Innovation & Commercialisation, The University of Sydney

Maryanne is a physicist, working in optics and materials science. She has research experience in both academia and industry (Canon and her own startups). Since 2013 she has been based at The University of Sydney, where a large part of her role is helping postgraduate students develop the skills for research translation. Her "Inventing the Future" program has resulted in students developing a number of highly successful startup companies, including Flurosat and Earth AI.

Leong Mar Commercial, CSIRO

At CSIRO, Leong manages the commercial engagements and commercialisation of technologies developed by a number of the business units and strategic initiatives like the Missions Program. He is also the CSIRO representative on the Investment Committee of Uniseed Investments. Previously, Leong spent 10 years with DuPont where he held several roles including Manager of the ANZ Technology Centre and leading Corporate Business Growth and Innovation. During this time, he led the development of multi-award-winning product and service solutions for the mining industry. Leong has also worked in a number of technology startups.

Alexandra Meldrum Vice President Learned Society, Institution of Chemical Engineers

Alexandra is a professional engineer, economist and non-executive director. She leads the international technical strategy and policy for IChemE. Alexandra has 25 years' management experience in government, industry, academia, the not-for-profit sector and has worked in the international food, manufacturing and energy industries. She consults and teaches strategy, economics, change management and sustainability at university business schools. Alexandra was Principal Advisor, Productivity Commission at NSW Treasury and Manager, Strategic Projects at NSW Department of Industry. She has led strategy development, managed operations, created processes for delivering innovative new services and products and led transformational change of strategy, governance, structure and culture. Her expertise is in strategy, transformation and education.

Bernard A Pailthorpe Applied and Computational Physicist

Bernard has built his career on theoretical and computational modelling of materials. Currently he is an Honorary Professor of Physics at The University of Sydney. He has held numerous research grants in Australia and the US, and served on grant review panels in both countries. He has contributed to advanced computing research infrastructure over two decades and has held two CEO-level positions, in Sydney and Brisbane.

Natasha Rawlings Investment Manager, Uniseed

Natasha is a tech entrepreneur who has led, founded and mentored early and mid-stage tech startups, with a particular focus on creating revenue through sales, marketing and product development. Prior to this, Natasha had a successful career in marketing and product development, holding top management positions in Australian and UK companies. Natasha's previous roles include CEO and Founder of StreetHawk, a mobile relationship management platform and along with being an investment manager at Uniseed she is now a director of three startups - Forcite Helmets, Wildlife Drones and Cardihab.

Ben Wright Manager of Nanosonics Investments, the strategic investment vehicle for Nanosonics Ltd, a global leader in infection prevention and control

Ben has over 20 years' experience in R&D, clinical trials, operations, financial management and commercialisation within both private and ASX-listed technology businesses. Ben is the Managing Director of Ballistic Ventures, a medtech venture studio building the next generation of clinician-led innovation and is the former Director for the NSW Medical Device Commercialisation Training Program, an initiative of NSW Health and the Office for Health and Medical Research.

Physical Sciences Fund Announcement Event, Sydney Startup Hub, 9 February 2021 (L to R):
the Hon. Gabrielle Upton MP, MicroTau CEO Henry Bilinsky, BioScout CEO Dr Lewis Collins, Professor Hugh Durrant-Whyte, Quasar Satellite Technologies Acting CEO Dr Ilana Feain, Zetifi CEO Dan Winson and the Hon. Rob Stokes MP.


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