PRESS RELEASE

29 July 2013

Early warning train fault detectors, dengue-testing prognosis kits among winners of NRF’s proof-of-concept awards

1 A university researcher has designed a sophisticated early warning mechanism to detect potential faults in the rail system. The novel technology uses radio waves to monitor rail tracks and trains for defects. Currently, train inspections are carried out during off-service hours using a dedicated vehicle installed with sensors and instruments that is run on the railway tracks. Rail defects which may occur between scheduled inspections may not be detected. With the real-time monitoring system, any signs of faulty components associated with the electrical system can be detected instantly and repaired, thereby enhancing the reliability of train service and ensuring passengers’ safety.

2 Another new discovery is the world’s first dengue prognostic kit. This kit determines during early infection whether a person will develop life-threatening conditions such as dengue haemorrhagic fever and dengue shock syndrome. With this kit, hospitals are able to intelligently triage dengue patients during epidemics, improve overall clinical outcomes and, most importantly, save lives.

3 These proposals are among some of the 44 exciting and impactful research projects submitted by the institutes of higher learning (IHLs) under the 9th Proof-of-Concept (POC) Grant Call organised by the National Research Foundation (NRF), Prime Minister’s Office, Singapore.

4 Following evaluation by a 22-member panel of experts appointed by NRF, 17 finalists were shortlisted to present their ideas to the judges in May this year. Nine research projects were finally recommended to receive the POC awards this month. Four the nine awarded projects are in engineering/information and communication technology and five in medical device technology. Awardees will each receive up to $250,000 to demonstrate that their technologies or processes are feasible. They are given 12 months to commercialise their ideas.

5 The project proposals were assessed on a range of criteria such as project scope, innovativeness, technical soundness, market potential, manufacturability and scalability as well as the potential for spin-offs.

6 Professor Low Teck Seng, Chief Executive Officer of NRF said: “This current crop of projects is focused on addressing the practical concerns and needs of citizens. These proposals seek to improve operations, realise greater efficiency in
design, and push the boundaries of technology. We look forward to these ideas translating into real-life products and transforming how we do things.”

7 Dr Tan Sze Wee, chairman of the medical device technology evaluation panel on the submissions: “The awarded projects address important medical needs, and the researchers have the potential to develop new and innovative solutions to address these needs. The committee looks towards their successful outcomes and the future impact to the health of Singaporean patients.”

8 Commented Mr Frank H Levinson, chairman of the engineering and ICT evaluation panel on the submissions received for this grant call: “Whereas in the past more proposals focused on microelectronics and elements of computing, the submissions showed how Singapore is responding to the world's challenges for sustainability and efficiency. This has been a substantial and important change for Singapore's research community over the past few years.”

9 The 10th POC grant call is currently open.

Encls:

Annex A – NRF POC Grant Call Synopses
Annex B – NRF POC Grant Evaluation Panel
Annex C – NRF POC 1st-9th Grant Call Awarded Projects
Annex D – NRF POC Factsheet

The National Research Foundation (NRF)

The National Research Foundation (NRF), set up on 1 January 2006, is a department within the Prime Minister’s Office. The NRF helps set the national direction for research and development (R&D) by developing policies, plans and strategies for research, innovation and enterprise. It also funds strategic initiatives and builds up R&D capabilities and capacities by nurturing local and attracting foreign talent. The NRF aims to transform Singapore into a vibrant R&D hub that contributes towards a knowledge-intensive, innovative and entrepreneurial economy; and make Singapore a talent magnet for excellence in science and innovation. For more information, please visit www.nrf.gov.sg

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ANNEX A

NRF PROOF-OF-CONCEPT (POC) 9th GRANT CALL SYNOPSIS

Engineering/ICT Proposals

Development of an Energy Efficient Expander-compressor Unit for Refrigeration / Air-con Systems

The main objective of this project is to achieve energy savings on a global scale by significantly reducing the energy consumption of air-conditioning, refrigeration, as well as heating systems. To achieve this, the expansion valve and the compressor of the conventional systems will be replaced by a newly invented novel “cross-vane expander-compressor” mechanism or “CVEC”.

The CVEC is a single machine. Therefore, instead of two machines, one machine will be built. This significantly reduces manufacturing costs. Additionally, there is a significant improvement in the overall machine efficiency, as CVEC has mechanical losses which are contributed by only one machine instead of two machines. Hence, a significantly lower manufacturing cost and yet substantially higher machine efficiency is expected of CVEC as compared to systems utilising a combined compressor and an expander.

One of the main reasons that such a system is not commercially viable today is due to the cost factor. All existing research systems used an individual unit of an expander and a compressor and thus it is both bulky and costly.

Literature has shown that by replacing the expansion valve with an expander, it can improve the efficiency of the new environmentally friendly carbon dioxide (CO₂) refrigeration system by more than 40% and the conventional refrigeration systems by 20%.

This newly invented device uses a novel mechanism which simultaneously provides expansion and compression of the working fluid in a single unit. It recovers energy during the expansion process and feeds this recovered energy to assist the compressor during the compression process and hence it reduces the total electrical energy required to run the systems and thus significantly improves the energy efficiency while keeping the manufacturing cost down by having just a single unit which simultaneously provides expansion and compression as needed by the systems.

Apart from the above mentioned advantages, theoretical studies show that additional advantages of using CVEC are:
• Reduction in peak power requirement of the system thus a smaller electric motor is needed to run the system which leads to further cost reduction;
• A significant reduction in the number of parts to be fabricated and thus reduces the materials used and manufacturing cost, hence it is more environmentally friendly; and
• Reduction in physical size and makes it more compact and space saving and hence it is easier to be implemented.

Our first market is on automotive application, as the machine is compact, lighter and consumes lesser energy, which is crucial for automobiles applications. It also provides a higher COP on all types of refrigeration systems (especially CO₂ system) but requires a smaller space.

OOI Kim Tiow, Associate Professor,
School of Mechanical & Aerospace Engineering,
Nanyang Technological University, Singapore

Dr Ooi Kim Tiow is an Associate Professor in Thermal and Fluids Division, School of Mechanical & Aerospace Engineering, Nanyang Technological University, Singapore.

He came to Singapore after obtaining PhD in Mechanical Engineering from University of Strathclyde, Scotland, U.K. in 1990.

His research area is related to refrigeration systems and components, in particular the refrigeration compressor. He is widely consulted by engineering companies both locally and internationally.
Development of Anti-coking Catalysts for CO2 Reforming of CH4 for Syngas Production: From Lab to Commercialization

The aim of this project is to develop an anti-coking and active functionalised-material promoted Ni/SiO$_2$ catalyst that is stable at a high DRM$^1$ reaction temperature.

Due to adverse global warming effect caused by escalating emissions of CO$_2$ and liquefied natural gas (CH$_4$), it is increasingly important to find ways to utilize CO$_2$ and CH$_4$ efficiently. Despite Singapore’s land scarcity, it is one of the world largest oil refining and petrochemical hubs. Furthermore, Singapore is slated to be the hub for CH$_4$ processing in the near future due to recent technology advancement for extracting large amount of shale gas (natural gas) in US.

A preferred and promising approach is via DRM to produce syngas (H$_2$+CO) which can be easily converted to chemicals and fuels (via Fisher-Tropsch synthesis) and for hydrogen production. However, the main drawback for DRM which hinders its industrialisation is severe carbon deposition on cheap nickel-based catalysts causing rapid catalyst deactivation.

Its low cost, high catalytic activity and anti-coking property makes this catalyst particularly attractive and commercially viable, which leads to effective CO$_2$ utilisation and conversion to highly valuable chemicals in the end-process.

The main beneficiaries of this process include power plants, oleochemical, petrochemical and fertilizer companies which generate large amount of CO$_2$ leading to escalating global warming phenomena and carbon tax penalties upon emission to air.

Sibudjing KAWI, Associate Professor,
Department of Chemical and Biomolecular Engineering,
National University of Singapore, Singapore

Associate Professor Sibudjing Kawi is currently with the Department of Chemical and Biomolecular Engineering, National University of Singapore.

He received MSc (Chem. Eng.) from Illinois in 1988 and BSc (Chem. Eng) from Texas in 1985. He obtained PhD in Chemical Engineering from Delaware in 1992.

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$^1$ Refers to CO$_2$ (dry) reforming of CH$_4$
His research interests include studies on next generation catalyst that will provide a knowledge base for novel synthesis techniques and molecular engineering of highly active and selective catalysts, as well as the design and growth of novel inorganic membranes preferred by industries.
Next Generation High Performance Uncooled Infrared Image Sensors Based on AlGaAs/InGaAs Heterostructure Thermopiles Technology

The objective of this project is to develop and commercialize high performance yet cost effective “Infrared Image Sensors”, required for applications such as night vision vehicle driving assistance systems, vehicle detection systems, rescue robot-eye applications, thermal imaging in biology and medical industry, remote sensing in security systems, and THz electronics applications.

Recently, the team has demonstrated a AlGaAs/InGaAs Heterostructure Thermopiles technology for uncooled IR image sensing.

The next phase of development in the POC will focus on optimizing next-level performance in key parameters such as responsivity and response time on a larger pixel size. By implementing the key technical disclosures related to the fabrication process know-how of AlGaAs/InGaAs heterostructure thermopiles developed by the NTU team with collaboration with key industry players, a new uncooled infrared focal plane array (FPA) with improved performance and low cost will be ready for commercialization.

Dr WANG Hong, Associate Professor, School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore

Dr Wang Hong is an Associate Professor in School of Electrical and Electronic Engineering, Nanyang Technological University (NTU), and the Director of Nanyang NanoFabrication Centre (N2FC).

Dr Wang obtained his B.Eng. degree from Zhejiang University and PhD from NTU in 2001. He is the recipient of the Royal Research Fellowship, United Kingdom (1994-1995) and co-recipient of the 2007 Defence Technology Prize, Ministry of Defence, Singapore.

His current research interests include III-V electronic and photonic devices, micro- and nano-fabrication, RFSi MOS devices and technologies.
Real-Time Monitoring and Fault Detection of Train’s Electrification System

This project involves the development of a novel inspection method based on patented radio frequency (RF) inductive coupling technology in response to current constraints in railway inspection methods.

Existing railway inspection methods based on ultrasonic, pulsed eddy current and machine vision technologies require the sensors and instruments be installed on a dedicated vehicle. For this reason, the inspection can only be carried out during the train off-service hours and therefore any railway defects occurred between scheduled inspections will not be detected.

The electrification system of an electric train consists of third rail, collector shoe, electrical drive, axle wheel and railway track. The electric motor that moves the train receives its power supply through the third rail and railway track. Any defects associated with the electrification system can lead to train service interruptions.

The expected inspection system resulted from the proposed technology can be easily installed on any in-service electric train to monitor the condition of the electrification system. With the installed system, each passing train in every few minutes doubles up as an inspection vehicle, making real-time monitoring possible. The RF inductive coupling eliminates direct electrical connection to the high voltage electrification system, making it very safe to use without affecting the train’s normal operation.

With the proposed real-time monitoring system, any early signs of faulty components associated with the electrification system can be detected timely for immediate remedial actions; this will enhance the train service reliability as well as commuter’s safety.

SEE Kye Yak, Associate Professor, School of Electrical & Electronic Engineering, Nanyang Technological University, Singapore

Associate Professor See Kye Yak is currently with the School of Electrical & Electronic Engineering, Nanyang Technological University, Singapore.
He received the B.Eng. degree with 1st class honours from the National University of Singapore, Singapore, in 1986, and the Ph.D. degree from Imperial College London, United Kingdom, in 1997.

Between 1986 and 1993, he was with industries holding senior engineering positions in Singapore, Hong Kong and United Kingdom. He currently also holds concurrent appointments as the Head of the Division of Circuits and Systems and the Director of Electromagnetic Effects Research Laboratory (EMERL).

He served as the Organizing Committee Chair for the inaugural 2008 Asia Pacific EMC Symposium in Singapore. He was invited twice as the speaker for the 2007 and 2008 IEEE Global EMC University, held concurrently with IEEE International Symposium in USA. He has been appointed as the Technical Editor of the IEEE EMC Magazine since January 2012.

His research interests include electromagnetic compatibility (EMC), signal integrity, filter design, and railway fault detection.
Medical Device Technology

Measurement And Insertion Device (MAID) for In-office Unsedated Tracheoesophageal Puncture

The team developed a medical device innovation known as the TEP Measurement And Insertion Device (MAID) for secondary Tracheo-Esophageal Puncture (TEP) to restore voice in post-laryngectomy patients. The main objective of this project is to develop multiple-use and single-use MAID device for first-in-humans trial.

Total laryngectomy is often used as surgical treatment for locally advanced laryngeal and pharyngeal cancer, in which the larynx is detached from the trachea and excised. The loss of voice accompanying the procedure often results in disabling psychosocial and economic consequences for the patient. While there are a number of options available for voice restoration, tracheo-esophageal speech provides the best recovery of voice and is the gold standard for voice rehabilitation.

In order to achieve tracheo-esophageal speech, a passage has to be surgical created between the posterior tracheal wall and anterior esophageal wall. Voice prosthesis is then implanted within this passage in order to allow air to be diverted from the lungs and trachea, through the esophagus and exiting the mouth. Creation of the aforementioned passage is achieved by means of a TEP. The TEP is an expensive surgical procedure that is traditionally performed in an operating theatre with rigid esophagoscopy and under general anesthesia.

The team’s hypothesis was that a surgical device could be developed and used for TEP creation, as well as sizing and insertion of the voice prosthesis in a single-stage procedure suitable for office-based use. The MAID with its measurement system, serial design and cylindrical tubular shape, specially designed plunger, light-weight handle and integration enables immediate prosthesis insertion at the time of fistula tract creation.

It has been designed, manufactured, and tested successfully on three live pigs. Ease of use and time savings have been confirmed with our device during the animal experiments. Instead of waiting for at least two weeks for voice restoration, a patient can speak again almost immediately. The ease of use will enable the clinicians to safely perform TEP procedures on more patients.

The team is also developing new voice prosthesis that is patient specific and made of nanocomposite materials for good sound quality. The team hopes that TEP MAID will eventually bring immediate voice restoration for the masses.
The engineering team of Dr Chui Chee Kong in Department of Mechanical Engineering, National University of Singapore has been in close collaboration with Dr David Lau, who is an ENT surgeon in Raffles Hospital, on development of new devices to treat conditions of the ears, nose, throat, head and neck.

Dr CHUI Chee Kong, Assistant Professor,
Department of Mechanical Engineering,
National University of Singapore, Singapore

Dr Chui Chee Kong has been with the Department of Mechanical Engineering, National University of Singapore as an Assistant Professor from July 2007. Since then, he has successfully built a research programme on medical devices, robotics, imaging and simulation in the department with more than 15 graduate research students.

Dr Chui obtained his Ph.D. from Biomedical Precision Engineering Laboratory, The University of Tokyo in 2004.

He was the principal investigator of the Biomedical Simulation & Device Design Project at an A*STAR research institution. He received several international research awards from his work on medical engineering including RSNA InfoRAD and ECR CompuRAD.

Dr Chui is lead inventor of two patented human-computer interfacing apparatus and system, and is co-lead inventor of a patented medical device design methodology, and has several patents pending.

His research interests include research and development of engineering systems and science for medical and surgical applications. As much as he likes to see the successful application of these medical systems/devices on patients, he wishes to teach the engineering and science of these systems and devices. Dr Chui has written and contributed over 80 articles in journals and conferences in his 20 years of research and development on engineering in medicine.
Multiplex Oligonucleotide-linked Signal Amplification Technology (MOST) and its Application to the Investigation of Encephalitis of Unknown Etiology

Molecular interactions such as antibody-antigen interactions represent the most complex, but critical processes in any biological system. Their detection can provide important information of diagnostic, prognostic, therapeutic or commercial value. However, except for interactions involving nucleic acids, there is currently no effective methodology for the amplification of molecular interaction signal in a biological system. The project had recently invented a new platform, Multiplex Oligonucleotide-linked Signal-Amplification Technology (MOST), which overcomes all major problems of other existing methods.

MOST is ideal for high-throughput multiplex detection of pathogen-specific antibodies for diagnosis and surveillance of major infectious diseases. They will focus on encephalitis, or inflammation of the brain, which is a life-threatening condition especially prevalent in children. Several hundred cases of encephalitis are reported in Singapore each year. Although infection is thought to be an important cause, a diagnosis of the etiological agent is not made in up to 70% of cases. All current antibody tests are based on one-test-for-one-pathogen and it is prohibitively expensive and time-consuming. In this project, they aim to develop a one-for-all serological assay using MOST to fill this critical technological gap.

The methodology developed will be applicable to a large number of other applications, including investigation of autoimmune diseases and potential infectious atiology of various cancers.

WANG Linfa, Professor
Programme in Emerging Infectious Diseases,
Duke-NUS Graduate Medical School, Singapore

Professor Wang Linfa is the Director of the Programme in Emerging Infectious Diseases at Duke-NUS Graduate Medical School, Singapore.

Professor Wang holds a PhD in Biochemistry and Molecular Biology from the University of California (Davis).

He is an international expert in infectious disease research with special focus on bat-borne zoonotic viruses. He is a member of the WHO SARS Scientific Research
Advisory Committee, and played a key role in identification of bats as the natural host of SARS-like viruses.

He is an elected Fellow of the Australian Academy of Technological Sciences and Engineering and Editor-in-Chief of Virology Journal.

Prof Wang also has a strong interest in developing novel serological test platforms to diagnose infections by different families of viruses. He has over 300 publications with a current $h$-index of 41.
The World’s First Prognostic Kit for Dengue

Dengue is declared by the World Health Organization (WHO) as “the most rapidly spreading mosquito-borne viral disease in the world,” because of its magnitude and continued geographic expansion.

Currently, physicians indiscriminately hospitalize all dengue patients based on platelet count in case potentially lethal DHF/DSS later develops. This leads to an unnecessary shortage of hospital beds and significantly burdens hospital resources, especially during major epidemics.

Making advancement in dengue prognostic technology, this project develops the world’s first dengue prognostic kit. This kit determines during early infection whether one who has been infected by dengue will develop life-threatening dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS), thus effectively distinguishing them from those with non-severe dengue fever (DF).

The microbiology laboratory of NUS, with more than 25 years of dengue research experience, has recently discovered three biomarkers that can identify dengue patients who will develop DHF/DSS before symptoms arise (patent pending).

This kit is based on the common enzyme-linked immunosorbent assay (ELISA) platform in accordance with US FDA design control guidance. The 96-well ELISA plate is coated with biomarker-specific antibodies. The team validated these biomarkers against 224 serum samples from Tan Tock Seng Hospital and achieved sensitivity and specificity above 90%.

This new technology allows hospitals to intelligently triage dengue patients during epidemics, improve the overall clinical outcome and, most importantly, save lives. It will also save patients, insurance companies and government programs unwarranted hospitalization costs.

The public health implications and associated market value of this technology is significant, since over half of the world’s population (3.6 billion) is at risk from dengue. The estimated 390 million clinical dengue fever cases that occur annually will be a directly addressable market.
Professor Mary NG Mah Lee
Department of Microbiology
National University of Singapore, Singapore

Professor Mary Ng is currently the Acting Head, Department of Microbiology, Yong Loo Lin School of Medicine, National University of Singapore (NUS), and Director, Electron Microscopy Unit, Yong Loo Lin School of Medicine, NUS.

She received her Doctor of Philosophy from Monash University, Australia in 1978 and Bachelor of Science (Honours) from Monash University, Australia in 1975.

Professor Mary Ng has more than 30 years of experience in Flavivirology research.

Her primary research interest is to understand virus-host interaction in flavivirus disease pathogenesis, and to identify and develop novel vaccines and antiviral strategies for the prevention and/or treatment of flavivirus infections.

Her other area of research interests:
- Discovered a novel cell penetrating peptide from Dengue virus that efficiently delivers siRNA and proteins into primary and immortalised cell lines, is non-cytotoxic and has intrinsic antiviral properties towards flaviviruses.
- Co-developed a VLP-display technology as a new vaccine platform against flaviviruses.
- Developing a novel broad-spectrum anti-flaviviral strategy through modulation of the immune response of infected host cells.
- Developing a novel broad-spectrum antiviral strategy that specifically targets virus genome synthesis.
- Understanding the biological basis underlying dengue haemorrhagic fever and dengue shock syndrome and the roles of our identified biomarkers in severe disease, through collaboration with clinicians.
Method and Apparatus for Enhancing Sensitivity of Optical Coherence Tomography

The objective of this project is to develop a sensitivity-enhanced Spectral-domain Optical coherence tomography (SD-OCT) technology, demonstrate advantages of the proposed technology over the best existing SD-OCT technology in penetration depth and motion artifact suppression.

This technology can be used to enhance SD-OCT sensitivity by more than one order of magnitude. This advance in sensitivity can either produce ~10-20% increased penetration depth, or 10-20 times faster imaging acquisition.

SD-OCT is an established clinical imaging tool for diagnosis of eye diseases. Sensitivity of the current SD-OCT technology is not able to provide enough penetration depth, so that many tissue structures associated with glaucoma, myopia and other diseases cannot be clearly visualized. The current OCT sensitivity also limits the imaging speed, so that the image quality is often degraded by artifacts caused by eye motion.

Successful application of the proposed technology will enable visualization of important tissue structures associated with above mentioned diseases which cannot be visualized clearly using the current technology at higher speed. In addition, the proposed technology can be incorporated into all the current clinical devices without significant cost increase and modification of the hardware.

Dr LIU Linbo, Assistant Professor,
Division of Control & Instrument, School of Electrical & Electronics Engineering, and Division of Bioengineering, School of Chemical & Biomedical Engineering, Nanyang Technological University, Singapore

Dr Liu Linbo is an Assistant Professor with School of Electrical and Electronic Engineering and School of Chemical and Biomedical Engineering, Nanyang Technological University, Singapore, since 3 September 2012.

He received B.Eng. in Precision Instrument in 2001, and M. Eng. in Optical Engineering in 2004, from Tianjin University, China. He received PhD in Bioengineering in 2008 from National University of Singapore. From 2008 to 2011, Dr Liu received his postdoctoral training in Wellman Center in Photomedicine, Harvard Medical School and Massachusetts General Hospital, where he invented a new generation of optical coherence tomography (OCT) technology, termed Micro-OCT. He was promoted as an Instructor in Dermatology at Harvard Medical School.
His current research interests are mainly focused on development and validation of non-invasive, cellular and sub-cellular resolution imaging methods for disease diagnosis and life science research. Dr Liu’s current projects include development of subcellular resolution endomicroscopic technologies for early cancer detection, development of high performance ophthalmic OCT for cellular resolution and deep tissue imaging, and submicron OCT for visualizing ciliary motion in 4D.
Blood Perfusion Monitoring Device for Application in Ischemic Foot

This project will develop the world’s first real-time perfusion monitor for use during limb salvage procedures. The global diabetes pandemic (affecting 350 million people worldwide) has resulted in a rising incidence of peripheral vascular disease where blood vessels in the legs become blocked over time.

Such a condition is most prevalent in the elderly and the diabetic, and if left untreated, often leads to critical limb ischemia (CLI) in which compromised blood flow to the feet presents in the form of blackened toes, diabetic foot ulcers and/or gangrene tissue which requires amputation. Balloon angioplasty is the primary method used to re-open blood vessels in CLI but to date, doctors lack a real-time perfusion monitor to guide them during the angioplasty procedure. This results in current reliance on subjective physician judgment instead of objective quantitative perfusion readout.

The proposed device will change the standard of care in lower limb reperfusion procedures, and in the process create an estimated US$1B worldwide market.

LEE Kijoon, Assistant Professor,
Division of Bioengineering,
School of Chemical and Biomedical Engineering,
College of Engineering,
Nanyang Technological University, Singapore

Assistant Professor Lee Kijoon is a faculty member in the School of Chemical and Biomedical Engineering at the Nanyang Technological University.

He is a graduate of Seoul National University, Korea (BS, MS, Physics) and Brown University, US (PhD, Physics).

Assistant Professor Lee has broad expertise in biomedical optics, including diffuse optical imaging, optical coherence tomography, and near-infrared spectroscopy.

He is a member of OSA, APS, SPIE, and IEEE Photonics Society. He is serving as treasurer of Singapore Chapter of OSA, committee member of Singapore chapter of IEEE PS. He is also serving as a reviewer for various scientific journals on optics, physics, and biomedical engineering. He is an associate editor of Journal of Medical Imaging and Health Informatics.
His research interest is over a broad area of interaction of light with human tissue, with the application in medical imaging in mind. He is experienced in both instrumentation and numerical image reconstruction, and is actively performing research on finding photonics-based solutions for breast cancer screening, brain activity monitoring, and blood perfusion monitoring in lower limb; and has worked with collaborators at the National Cancer Center, Tan Tock Seng Hospital, and A*STAR.

Assistant Professor Lee’s prior research focuses on the field of spectroscopy and includes a new generation breast imaging optical device at the University of Pennsylvania.
# NRF PROOF-OF-CONCEPT (POC) GRANT EVALUATION PANEL

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<tr>
<td>1</td>
<td>Mr Tan Peng Yam</td>
<td>Chief Executive, Defence Science &amp; Technology Agency (DSTA)</td>
<td>Engineering and ICT/EEE/ECE</td>
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<td>2</td>
<td>Mr Fong Saik Hay</td>
<td>Chief Technology Officer, ST Engineering</td>
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<td>3</td>
<td>Dr Lerwen Liu</td>
<td>Founder and Managing Director, NanoGlobe Pte Ltd</td>
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<td>4</td>
<td>Dr Sze Tiam Lin</td>
<td>Director, IPI Limited</td>
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<td>5</td>
<td>Ms Yong Soo Ping</td>
<td>Vice President, Software &amp; IT Services, Walden International</td>
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<td>6</td>
<td>Dr Frank Levinson</td>
<td>Managing Director, Small World Group</td>
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<td>Dr Andreas Hauser</td>
<td>Head, Water Service, TÜV SÜD Asia Pacific Pte Ltd</td>
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<td>8</td>
<td>Mr Chua Joo Hock</td>
<td>Managing Director, Vertex Venture Management</td>
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<td>Mr Pierre Hennes</td>
<td>Managing Partner, Extreme Ventures Pte Ltd</td>
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<td>10</td>
<td>Mr Chow Yen-Lu</td>
<td>Managing Director, WholeTree Technologies</td>
<td>ICT/EEE/ECE</td>
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<td>11</td>
<td>Mr Rahul Harkawat</td>
<td>Consultant, Mobitila Pte Ltd</td>
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<td>12</td>
<td>Mr Scott Anthony</td>
<td>Managing Director, Innosight</td>
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<td>13</td>
<td>Dr Lai Kok Fung</td>
<td>CEO, Buzz City</td>
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<td>14</td>
<td>Mr Johnson Chen</td>
<td>Managing Partner, ClearBridge Partners</td>
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<td>15</td>
<td>Dr Lionel Lee</td>
<td>Executive Vice Dean, Lee Kong Chian School of Medicine, NTU</td>
<td>Medical Device Technology and Pharmaceuticals/Biotechnology</td>
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<td>16</td>
<td>Mr Damien Lim</td>
<td>General Partner, BioVeda Capital</td>
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<td>Dr Casey Chan</td>
<td>Partner, Venture MD</td>
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<td>18</td>
<td>Dr Howard Califano</td>
<td>Director, Innovation Centre, Singapore-MIT Alliance for Research and Technology (SMART)</td>
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<td>19</td>
<td>Dr Tan Sze Wee</td>
<td>Deputy Executive Director, A*Star</td>
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<td>20</td>
<td>Dr Steve Myint</td>
<td>Founding Partner, Innovatum Partners</td>
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<td>21</td>
<td>Mr Eitan Konstantino</td>
<td>Co Founder, TriRememe Medical</td>
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<td>22</td>
<td>Ms Fiona Loke</td>
<td>Manager, SGH Device Development Office</td>
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**ANNEX C**

**NRF POC 1ST-9TH GRANT CALL AWARDED PROJECTS**

1st Call

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<th>S/N</th>
<th>Project Title</th>
<th>Principal Investigator</th>
<th>Host Institution</th>
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<td>1</td>
<td>A Hand-Held Digital Lensless Microscope System for MEMS and Micro-Device Inspection and Characterisation</td>
<td>Prof Anand Asundi</td>
<td>NTU</td>
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<td>2</td>
<td>Flexible Pressure Sensors Using Area-Array Nanocomposites</td>
<td>Dr Zuruzi Abu Samah</td>
<td>NYP</td>
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<td>3</td>
<td>Redesign of SEMs for Parallel Energy Detection</td>
<td>Prof Anjam Khursheed</td>
<td>NUS</td>
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<td>4</td>
<td>DISH: Enabling Cooperative Multi-Channel Communication for Wireless Ad Hoc Networks</td>
<td>Prof Mehul Motani</td>
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<td>5</td>
<td>Creating, Viewing, Publishing, and Sharing Stereoscopic Images/Videos at Anytime Anywhere</td>
<td>Dr Steven ZHOU</td>
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<td>6</td>
<td>An Ultra Low-Power RF Transceiver Chip Towards a New Paradigm of Life Quality</td>
<td>Prof YEO Kiat Seng</td>
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<td>7</td>
<td>Ultra-Low Cost Bead-Based Microarrays for Biomolecular Diagnostics</td>
<td>Prof Dieter Trau</td>
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<td>8</td>
<td>Novel, Less Invasive Mitral Valve Implantation Method Involving a Bayonet Insertion and Release Mechanism</td>
<td>Prof Theodoros Kofidis</td>
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<td>9</td>
<td>Multi-Layered Surgical Prosthesis with Drug-Releasing Biodegradable Coating for Hernia Repair</td>
<td>Prof Freddy BOEY</td>
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# 2nd Call

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<tr>
<td>1</td>
<td>A Human Monoclonal Biotherapeutic to Target the Dengue NS3 Protein</td>
<td>Prof Subhash Vasudevan</td>
<td>DUKE-NUS GMS</td>
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<td>2</td>
<td>A Semantics-based and Service-oriented Framework for the Virtualization of Sensor Networks</td>
<td>Dr LIM Hock Beng</td>
<td>NTU</td>
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<td>3</td>
<td>Low Cost High Performance Anti-Reflective Coating based on Si Nanocrystals Embedded in SiO₂ Film</td>
<td>Ms Eunice GOH Shing Mei</td>
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<td>4</td>
<td>New Grid Array Antennas and their Integration Method for an Innovative Solution to 60-GHz Radio Devices</td>
<td>Dr ZHANG Yue Ping</td>
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<td>5</td>
<td>Development and Demonstration of Silicon Carbide (SiC) Based Power Electric Converter for Motor-Generator Control in Hybrid Electric Vehicles</td>
<td>Dr TSENG King Jet</td>
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<td>6</td>
<td>High Efficiency Electrogenerated Chemiluminescence with Colloidal Quantum Dot Emitter in Ultrathin Cells for Display Applications</td>
<td>Dr SUN Xiaowei</td>
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<td>7</td>
<td>Photonic MEMS (Microelectromechanical Systems) Tunable Laser</td>
<td>A/Prof LIU Ai Qun</td>
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<td>8</td>
<td>Spin Wave Based Non-destructive Semiconductor Testing Tools</td>
<td>Dr YANG Hyunso</td>
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<td>9</td>
<td>Single-coil Superconducting Miniundulator – The Next Step Towards High-Brilliance Synchrotron Radiation</td>
<td>Dr DIAO Caozheng (Previously Prof Herbert O. Moser)</td>
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<td>10</td>
<td>New Compact, Fast, Parallel-processing Fourier-transform Interferometer (FPP FTIR) Enabling Short-pulse Spectroscopy</td>
<td>Prof Mark B. H. Breese (Previously Prof Herbert O. Moser)</td>
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<td>11</td>
<td>Development of a New and Precise Alignment System for Micromanipulation</td>
<td>A/Prof TAN Kok Kiong</td>
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<td>12</td>
<td>A New Endoluminal Device for Duodenal Exclusion in Treatment of Type 2 Diabetes Mellitus and Obesity</td>
<td>Dr Jimmy SO Bok-Yan</td>
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<td>13</td>
<td>Anti-inflammatory Peptide Loaded Micro Emulsion Gel Formulation as Potential Therapeutic for Post-operative Adhesion</td>
<td>Prof Gopalakrishnakone Ponnampalam</td>
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<td>14</td>
<td>Processing Full Range of Waste Grease into</td>
<td>Ms SONG Sin</td>
<td>RP</td>
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<td>Renewable Energy</td>
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<td>Hedge Funds and Structured Products Advisors (HedgeSPA.com)</td>
<td>Dr Bernard LEE</td>
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<td>16</td>
<td>Development of a Hand-held Solid Dispenser Using a Motor-Driven Auger</td>
<td>Dr Ken LEE</td>
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<td>3-Dimensional Micro/Nano-Structures for Energy Harvesting</td>
<td>Dr Hannah Gardner</td>
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<td>2</td>
<td>Creating a Comprehensive Lexical Index of Documents from the World Wide Web (WWW)</td>
<td>A/Prof Datta Anindya</td>
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<td>3</td>
<td>Partial Breast Reconstruction using a Nanofibrous Scaffold following Breast-Conserving Surgery</td>
<td>Dr CHAN Ching Wan</td>
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<td>4</td>
<td>Development of Efficient Methods for the Production of Biodiesel from Grease</td>
<td>A/Prof LI Zhi</td>
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<td>5</td>
<td>Improvement in Yield of Haemotopoietic Stem Cells (HSCs) via Automation and Optimization of the Umbilical Cord Blood (UCB) Collection Process with Further Stem Cells' Characterization</td>
<td>A/Prof TAN Kok Kiong</td>
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<td>6</td>
<td>Development of a Highly Energy-Efficient Revolving Vane Expander</td>
<td>A/Prof OOI Kim Tiow</td>
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<td>CDH17 Marker as a Novel Target for Liver and Stomach Cancer Therapies</td>
<td>A/Prof John LUK</td>
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<td>8</td>
<td>Fluorescent Tagged Antimalarials as Commercial Molecular Probes to Diagnose Drug Resistance and to Study Diseases</td>
<td>Dr Kevin TAN and Dr Martin Lear</td>
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<td>Development of a Novel Bioabsorbable Drug-Eluting Ventilation Tube for Chronic Middle Ear Infection</td>
<td>A/Prof Lynne LIM</td>
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<td>10</td>
<td>High Frequency Graphene Transistors</td>
<td>Dr YANG Hyunsoo</td>
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# 4th Call

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<tr>
<td>1</td>
<td>An Adaptive Ultra-Secure User-Controllable Routing Algorithm for Next-Generation Mobile Ad-hoc Network</td>
<td>Mr KAN Siew Leong</td>
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<td>2</td>
<td>Rapid Design Verification Platform for Analog/RF Circuits Beyond the Scale of 65nm and 60GHz</td>
<td>Dr YU Hao</td>
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<td>3</td>
<td>Automated Neuro-Motor Stroke Rehabilitation Device - A Platform for Functional Recovery of Paralyzed Hand after Stroke</td>
<td>Dr John HENG</td>
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<td>4</td>
<td>Sol-Gel-Derived Environmentally Stable Nanostructured Single Defogging Layer with Persistent Superhydrophilicity</td>
<td>Ms WU Xinghua</td>
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<td>5</td>
<td>Scalable Production of Ultrahigh Purity Single-Walled Carbon Nanotubes</td>
<td>A/Prof CHEN Yuan</td>
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<td>Network Animation Factory (NAF)</td>
<td>Prof SEAH Hock Soon</td>
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<td>7</td>
<td>Immersive 3D Audio System for 3D Media</td>
<td>Mr TAN Ee Leng</td>
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<td>A New Glaucoma Drainage Device with Sustained Drug Elution</td>
<td>Prof Venkatraman Subramanian</td>
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<td>9</td>
<td>Ballast Water Treatment using Ozone Microparticles</td>
<td>Prof NG Kim Choon</td>
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<td>10</td>
<td>Fabrication of High Performance Li Rechargeable Batteries with Superfast Charge Rate and Ultra-high Power Density for Green-Powered City</td>
<td>Prof LU Li</td>
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<td>11</td>
<td>Line-scan Focal Modulation Microscope</td>
<td>Dr CHEN Nanguang</td>
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<td>12</td>
<td>Nanoparticle Factories in Flowing Foams: Scalable Continuous Sub-Micron Size Material Synthesis in Multi-Phase Microreactors</td>
<td>Dr Khan Saif</td>
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<td>13</td>
<td>A Turn-Key Machine For Graphene Production</td>
<td>A/Prof LOH Kian Ping</td>
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<td>14</td>
<td>Conjugated Polymer-Biomolecule Conjugate as Next Generation Fluorescent Probes for In Vitro Diagnostics</td>
<td>A/Prof LIU Bin</td>
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<td>15</td>
<td>A Randomized, Double-Blind, and Placebo-Controlled Trial of an Anti-Malarial Drug Artesunate for Chronic Asthma</td>
<td>A/Prof WONG Wai Shiu Fred</td>
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<td>16</td>
<td>Development of Novel Mesoporous TiO₂ Anode Based Li-ion Battery for Electric Vehicle</td>
<td>Dr Palani Balaya</td>
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<td>Application</td>
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<tr>
<td>1</td>
<td>An Interactive Web-Based Game for Helping Angry Children and Youth</td>
<td>Dr Daniel FUNG</td>
<td>IMH</td>
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<td>2</td>
<td>A Novel Cryo-Preparation Technique for Near-Instantaneous Vitrification of Biological Samples</td>
<td>Dr Daniel PICKARD</td>
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<td>3</td>
<td>A Body Vein Pattern Verification System for Criminal Investigation</td>
<td>Dr Adams KONG Wai-kin</td>
<td>NTU</td>
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<td>4</td>
<td>Low-Cost Antenna-in-Package for Single-Chip Tri-Band Radio Devices</td>
<td>A/Prof ZHANG Yue Ping</td>
<td>NTU</td>
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#### Engineering Proposals

| 5   | Ultrafast-Charging and High-Power Lithium Ion Batteries with Novel Two-Dimension Electrode Materials | Dr LIU Jiehua          | NTU              |
| 6   | Electrochromic Photonic Crystal Smart-Window Technology                       | Dr Alfred TOK          | NTU              |
| 7   | Beyond Lithium Ion Batteries: Novel Fluoride Ion Batteries                     | Dr Madhavi SRINIVASAN  | NTU              |
| 8   | Handheld Ultrasonic Bath Analyzer                                             | Dr Claus-dieter OHL    | NTU              |
| 9   | A Supercapacitive Energy Storage Device Based on Proprietary Nanomaterials     | Dr XIE Xian Ning       | NUS              |
| 10  | Large-Scale Transparent Graphene-Ferroelectric Devices for Touch Screen Applications | Dr Barbaros ÖZYILMAZ   | NUS              |
| 11  | An Advanced Adsorption Cycle for Desalination: the AD+MED or ADMED Cycle       | Prof NG Kim Choon      | NUS              |

#### Medical Device Technology Proposals

| 12  | Drug-Loaded Microparticles Encapsulated into Bioadhesive Films, Locally Delivered by Angioplasty Balloons | Dr Terry STEELE        | NTU              |
# 6th Call

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<td>Perspective Audio: Creating 3D Sound Ready for Prime Time</td>
<td>Prof GAN Woon Seng</td>
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<td>2</td>
<td>A Scalable Technology for Transparent Conducting Oxide Thin Films on Flexible Substrates</td>
<td>Dr CHENG Hansong</td>
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<td>3</td>
<td>Application of nano-sized adsorbent for arsenic contaminated water treatment</td>
<td>Prof CHEN Jiaping</td>
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<td>4</td>
<td>SMART Active Nanopores Membrane; integrated Catalytic Disinfectant and Sensory for Air/Water</td>
<td>Dr HO Ghim Wei</td>
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<td>5</td>
<td>Non-substrate transfer process to prepare large-area graphene films for ITO replacement</td>
<td>Dr YIN Zongyou</td>
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<td>6</td>
<td>Energy efficient hydrogen production via a hybrid photocatalysis/electrolysis prototype</td>
<td>Dr CHUA Ernest Kian Jon</td>
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<td>7</td>
<td>Low-Cost High-Performance Catalyst for Hydrogen Generation</td>
<td>Prof CHAN Siew Hwa</td>
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<td>Ready to use semiconducting single walled carbon nanotubes powder and film for a new generation of high performance printed electronics</td>
<td>Prof CHAN Bee Eng Mary</td>
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<td>Development of a ‘wound dressing patch’ made up of an aloe-vera-nanomesh impregnated with human umbilical cord Wharton’s jelly stem cells or its extracts and wound healing</td>
<td>Dr FONG Chui Yee</td>
<td>NUS</td>
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<td>10</td>
<td>Diagnosis of Myocardial Ischemia-producing Coronary Stenosis via Curvedness and Curvedness Rate Obtained from Stress Cardiac Magnetic Resonance Imaging Materials</td>
<td>Dr TAN Ru San</td>
<td>NHCS</td>
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<td>11</td>
<td>A novel multiple-zone soft contact lens to slow myopia progression</td>
<td>Prof SAW Seang-Mei</td>
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<td>12</td>
<td>Microfluidics Biochip for Cancer Diagnosis</td>
<td>Prof LIM Chwee Teck</td>
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<td>1</td>
<td>Next generation low-cost touch interface for large-sized surfaces</td>
<td>Prof KHONG Andy</td>
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<td>2</td>
<td>Next generation contact-free optical motion sensor</td>
<td>Prof KAKARALA Ramakrishna</td>
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<td>3</td>
<td>Development of Integrated Li-ion Battery for Portable Electronic Devices</td>
<td>Dr BALAYA Palan</td>
<td>NUS</td>
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<td>Self-healing anticorrosion coatings via microencapsulated HDI</td>
<td>Prof YANG Jinglei</td>
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<td>5</td>
<td>Light-Emitting Diode with High Luminous Efficacy and Color Tunability by Self-Assembled Hemispherical Microstructures</td>
<td>Dr CHEN Rui</td>
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<td>6</td>
<td>Multi-layer polymer capacitors using grafted fluoropolymer for applications in mobile phone cameras</td>
<td>Dr LEE Pooi See</td>
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<td>7</td>
<td>Development of Li rechargeable batteries with fast charge rate and high energy storage capacity</td>
<td>Prof LU Li</td>
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<td>8</td>
<td>Ion Camera&quot;: a real-time high-sensitivity and high-resolution ISFET-based ion detection system for food and drug safety</td>
<td>Dr YAN Mei</td>
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<td>Versatile core-shell-shell fluorescent upconversion nanoparticles for light based detection and disease diagnostics</td>
<td>Prof ZHANG Yong</td>
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<td>11</td>
<td>Development of Master And Slave Transluminal Endoscopic Robot (MASTER): a paradigm shift in endoscopy and surgery</td>
<td>Prof PHEE Louis</td>
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<td>All Solid Flexible Micro Super-Capacitors: Next Generation Energy Storage Device</td>
<td>Dr YANG Hui Ying</td>
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<td>2</td>
<td>Development of Novel Polymer Electrolytes for Applications in Proton Exchange Membrane Fuel Cells</td>
<td>A/Prof CHENG Hansong</td>
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<td>3</td>
<td>Ceramic Pore-Channels with Induced Carbon-Nanotube Fence for Removing Oil from Water</td>
<td>A/Prof HONG Liang and Dr CHEN Xinwei</td>
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<td>4</td>
<td>Stabilized Two-Phase Cooling for Effective Thermal Management of Power Electronics</td>
<td>Asst Prof LEE Poh Seng</td>
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<td>5</td>
<td>Development of Advanced Nano-filtration Membranes for High Removing Rate of Dyes in Textile Wastewater</td>
<td>Dr SUN Shipeng</td>
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<td>Up-scaling a Novel Method of Microneedle Fabrication</td>
<td>Dr KANG Lifeng</td>
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<td>Biocompatible and Photo-stable Quantum-dot-sized Organic Nanoparticles for Non-Invasive Long-term Cell Tracing</td>
<td>Dr LIU Bin</td>
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<td>Rapid Near-infrared Spectroscopy (NIRS) System for Intraoperative Margin Assessment in Breast Conserving Surgery</td>
<td>Asst Prof LIU Quan</td>
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<tr>
<td>1</td>
<td>Development of an Energy Efficient Expander-compressor Unit for Refrigeration Air-con Systems</td>
<td>A/Prof OOI Kim Tiow</td>
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<td>Development of anti-coking catalysts for CO2 reforming of CH4 for syngas production from lab to commercialisation</td>
<td>A/Prof Sibudjing KAWI</td>
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<td>Next Generation High Performance Uncooled Infrared Image Sensors Based on AlGaAsInGaAs Heterostructure</td>
<td>A/Prof WANG Hong</td>
<td>NTU</td>
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<td>4</td>
<td>Real-Time Monitoring and Fault Detection of Train’s Electrification System</td>
<td>A/Prof SEE Kye Yak</td>
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<td>Measurement And Insertion Device (MAID) for in-office unsedated tracheoesophageal puncture</td>
<td>Asst Prof CHUI Chee Kong</td>
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<td>Multiplex Oligonucleotide-linked Signal Amplification Technology (MOST) and Its Application to the Investigation of unknown aetiology</td>
<td>Prof WANG Linfa</td>
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<td>7</td>
<td>The World’s First Prognostic Kit for Dengue</td>
<td>Prof NG Mah Lee, Mary</td>
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<td>8</td>
<td>Method and apparatus for enhancing sensitivity of optical coherence tomography</td>
<td>Asst Prof LIU Linbo</td>
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<td>Blood Perfusion Monitoring Device for Application in Ischemic Foot</td>
<td>Asst Prof LI Kijoon</td>
<td>NTU</td>
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ANNEX D

NRF PROOF-OF-CONCEPT GRANT SCHEME

The NRF POC scheme is funded by the National Research Foundation. The grant provides funding to researchers from the universities and polytechnics to enable them to carry out further research on their inventions or ideas, with the aim of coming out with products or commercial applications.

The resulting product or application could then be licensed to interested companies or be marketed by a new company. A successful proof of concept demonstrates not just technical viability but also a high degree of commercial readiness. It would give potential licensees of the technology confidence to take up licensing and encourage inventors to start-up a new company to commercialise the technology.

There are two parts to the POC scheme, both funded by the National Research Foundation (NRF). The NRF administers the POC grant for IHL-linked researchers while SPRING Singapore administers the POC grant for Singapore-based SMEs and individuals in the public sector research institutes under the Technology Enterprise Commercialization Scheme or TECS.

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<tr>
<td>Funding Quantum</td>
<td>Up to S$250,000 per project</td>
<td>Start-up companies incorporated and operating in Singapore</td>
</tr>
<tr>
<td>Eligibility for Application</td>
<td>• Staff, researchers and students linked to IHLs</td>
<td>• Researchers in public sector research institutions</td>
</tr>
<tr>
<td>Frequency of Calls</td>
<td>Half-yearly</td>
<td></td>
</tr>
<tr>
<td>Technology Areas</td>
<td>• All areas of science and technology</td>
<td>The following specific areas:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Electronics, Photonics &amp; Device Technologies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Chemicals, Advanced Materials &amp; Micro/Nanotechnology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Information and Communications Technology (excluding Interactive Digital Media)</td>
</tr>
<tr>
<td>Evaluation Process</td>
<td></td>
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<tr>
<td>-----------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>• Researchers submit proposals to the technology transfer offices of their IHLs, who will evaluate all proposals and submit their top 15 to NRF.</td>
<td>• Submitted proposals are evaluated by the respective technical panels for technical merit and feasibility.</td>
<td></td>
</tr>
<tr>
<td>• A POC Panel will review the proposals, listen to presentations of shortlisted proposals and recommend proposals for grant based on their potential or commercial viability.</td>
<td>• Proposals shortlisted by the technical panels will be evaluated for commercial merit and recommended for funding by a POC Grant Panel.</td>
<td></td>
</tr>
</tbody>
</table>

**National Framework for Innovation and Enterprise (NFIE)**

The POC scheme is part of the National Framework for Innovation and Enterprise (NFIE) announced by the Prime Minister at the 3rd Research, Innovation and Enterprise Council (RIEC) meeting in March 2008.

The NFIE is a national programme to grow innovation and entrepreneurship in Singapore, especially through the formation of start-up companies to commercialise cutting-edge technologies developed out of R&D laboratories. Academic entrepreneurship is broadly defined as the involvement of academics, scientists and researchers in innovative activities with economic or societal impact.