



Faculty of  
Engineering

**ANNUAL REPORT 2013**

A large, abstract graphic dominates the center of the page. It consists of multiple overlapping, glowing lines in shades of blue, purple, orange, and red. These lines form a circular, somewhat irregular shape that resembles a stylized 'C' or a ring. Below this main shape, there is a series of glowing orange lines forming a diamond or zigzag pattern that tapers downwards. The background is dark with some faint, radiating lines.

**RESEARCH  
INNOVATION  
INSPIRATION**

# VISION

A LEADING ENGINEERING SCHOOL THAT  
INNOVATES FOR A BETTER FUTURE.

# MISSION

TO NURTURE ENGINEER-LEADERS AND  
TO ADDRESS GLOBAL CHALLENGES  
THROUGH RESEARCH, INNOVATION,  
INSPIRATION, AND INFLUENCE.

# CONTENTS

A WORD FROM THE DEAN **02**  
FACULTY BOARD **04**  
EDUCATION **08**  
RESEARCH & ENTERPRISE **18**  
OUR PEOPLE **28**  
FACTS & FIGURES **44**



**RESEARCH  
INNOVATION  
INSPIRATION**

**2013** has been an exciting year, with major initiatives put in place that will spell transformative changes in the years to come. It was indeed a memorable occasion for all of us when the Keppel-NUS Corporate Laboratory was launched at the Faculty of Engineering in November. This Lab is the first large scale research laboratory established by a local company jointly with a Singapore university. Launched as part of the National Research Foundation's Corp Lab @ University scheme, the \$75 million research laboratory will enhance our industry-university partnership with Keppel – a synergy which we have built up and shared over the past decade, since the launch of the Keppel Chair Professorship in 2002. We are extremely pleased that Keppel has chosen us in this effort to contribute towards the sustainability of Singapore's marine and offshore industry, a key economic pillar. This initiative is an affirmation of our capabilities in this field.



Sustainability is the operative word in a world of limited resources, and NUS Engineering has shown its mettle and capabilities in this area – coming up with out-of-the box solutions. I recall with much pride how our team of multi-disciplinary experts returned triumphant from the *Next Generation Container Port Challenge 2013* organised by the Singapore Maritime Institute and Maritime and Port Authority of Singapore. Joining forces with Shanghai Maritime University and Shanghai Zhenhua Heavy Industries Company Limited, the team took home the top prize of US\$1 million for their concept of a double-storey container terminal design, which achieves a quantum leap in performance, productivity and sustainability.

The Year-in-review also saw collaboration with other industries that are cornerstones of Singapore's development. For example, the Tunnelling and Underground Construction Society, Singapore (TUCSS) continues to provide support and encouragement for

NUS Engineering students in the field of geotechnical engineering – in the form of the TUCSS Master of Science (Geotec) Scholarship. In 2013, they pumped a further \$150,000 into the continuation of the scholarship, which was established with the Department of Civil & Environmental Engineering in 2006.

Tunnelling activity in Singapore has increased significantly. There has been rapid expansion of many such projects, in the form of underground rail and road systems, as well as deep sewers and buried utility tunnels. The most notable example is the recent opening of the Marina Coastal Expressway – an undersea tunnel that is 420 metres long – the first of its kind in Singapore. I am extremely pleased that TUCSS has chosen NUS Engineering as its partner to nurture the right students up to postgraduate level – and ensure that they stay in the profession to help develop Singapore in addressing the challenge of land scarcity.

The aerospace industry has also been identified as an exciting and promising new growth area for the nation. In addressing challenges arising from this field, NUS Engineering has established the Centre for Aerospace Engineering (CAE) with much support from industry, namely, DSO National Laboratories, SIA Engineering and ST Aerospace. CAE will conduct aerospace-focused research and education – and also outreach activities to attract more talent into this field of Engineering. The Department of Mechanical Engineering hopes to double its current intake of undergraduate students to its Aeronautical Engineering specialisation.

NUS Engineering is also excited to play a role in Singapore's satellite-related investments. The Department of Electrical & Computer Engineering has inked a Memorandum of Understanding with ST Electronics at the Global, Space & Technology Convention 2013 to undertake research in and develop a low cost hyper-spectra payload for earth observation. Such images are very useful for anomaly detection, identification and analysis – widely used in applications for agriculture, mineralogy, physics and surveillance.

I am glad to report that our research front has been vibrant and robust – garnering more than \$147 million in research funding for the period Jan to Dec 2013. Our researchers' hard work is evident and has received recognition both locally and overseas. We have a number of projects which made headlines not only in the academic circle but also in the general media (both local and international) because of the uniqueness and strong potential of their research. One example is a record-breaking piece of muscle engineered in our lab – superhuman in strength and yet extremely human-like in behaviour. The team, led by Dr Adrian Koh, has achieved a world record – their novel polymer muscle can carry a weight 80 times its own, while extending to five times its original length. So far, artificial muscles have been known to extend only to three times its original length when similarly stressed. This discovery will have significant implications in robotics. Dr Koh was awarded the Promising International Researcher Award at the *3rd International Conference on Electromechanically-Active Polymer Transducers and Artificial Muscles* in June, held in Zürich, Switzerland.

I would also like to congratulate one of our young researchers, Dr Qiu Cheng Wei, who won the Young Scientist Award 2013. His passion in the field of electromagnetic systems and light-matter interactions has led to several breakthroughs.

His paper, published in *Advanced Functional Materials*, reported for the first time, the creation of ghost illusions through optic scattering and metamaterials. He and his team will be developing this technique to make larger microwave devices to achieve radar "ghosts" and aircraft camouflage suitable for defence purposes.

My congratulations too, to Associate Professor Liu Bin who was conferred the NUS Young Researcher Award 2013. Among other breakthroughs, Assoc Prof Liu has developed a new category of organic light-emitting molecules which are water soluble. Being organic, this means they are of low cytotoxicity and can be used for better bio-imaging to detect or monitor diseases such as cancer.

Our students continue to do well both locally and overseas. For example, a team of three Design-Centric Programme (DCP) students was awarded First Prize (Biotechnology Category) at the 2013 GlobalTIC Talentpreneur Award & Forum in Taiwan. They also won Best Exhibition title for their prototype, which is a smart watch that measures vital signs such as heart rate and body temperature. It can potentially detect blood glucose levels without the need for pin-pricks. Not stopping at that, they also managed to win the Best Team of Young Entrepreneurs award at the Intel Global Challenge at UC Berkeley.

Another team of students also did extremely well in the area of robotics and artificial intelligence. In 2013, having been awarded Second Prize in the Singapore Autonomous Underwater Vehicle (AUV) Challenge, they became the first Singapore team to participate in the "Super Bowl" of AUV challenges – the AUVSI Robosub – an international competition held annually in San Diego. They made it to the top 10 and returned with the Best Entry title.

I am also very proud of three teams which took three top prizes out of four in the Singapore Space Challenge 2013. The teams, from different departments, took the First Prize in the Autonomous Systems Category, the Mini Satellites Category, as well as the Aviation and Aerospace Category.

NUS Engineering looks forward to more achievements from our staff and students – not just because of the glory they bring to the University – but also because of the difference their efforts make to society and the world at large.

**Professor Chan Eng Soon**  
DEAN



**PROF CHAN ENG SOON**  
Dean

**OUR  
VICE DEANS  
AND  
ASSOCIATE  
DEAN**



**ASSOC PROF ANG KOK KENG**  
Vice Dean, *Student Life*



**PROF ASHRAF KASSIM**  
Vice Dean, *Undergraduate Studies*



**PROF QUEK SER TONG**  
Vice Dean, *Graduate Studies*  
Director, *Global Engineering Programme (TILL AUGUST 2013)*



**PROF VICTOR SHIM**  
Vice Dean, *External Relations*



**PROF TEO KIE LEONG**  
Vice Dean, *Research*



**DR YAP CHEE MENG**  
Associate Dean



**PROF LIM SEH CHUN**  
Deputy Dean

**OUR  
HEADS OF  
DEPARTMENTS,  
DIVISION AND  
PROGRAMMES**



**ASSOC PROF CHAU FOOK SIONG**  
Director, Bachelor of Technology Programme *(FROM AUGUST 2013)*



**PROF CHEONG HIN FATT**  
Head, Department of Civil & Environmental Engineering *(TILL MAY 2013)*



**PROF CHUA KEE CHAING**  
Head, Department of Electrical & Computer Engineering



**PROF JAMES GOH**  
Head, Department of Biomedical Engineering



**PROF HANG CHANG CHIEH**  
Head, Division of Engineering & Technology Management



**PROF LEE JIM YANG**  
Head, Department of Chemical & Biomolecular Engineering



**PROF LOH HAN TONG**  
Director, Bachelor of Technology Programme *(TILL AUGUST 2013)*



**PROF PHOON KOK KWANG**  
Head, Department of Civil & Environmental Engineering *(FROM MAY 2013)*



**PROF TANG LOON CHING**  
Head, Department of Industrial & Systems Engineering



**PROF TAY TONG EARN**  
Head, Department of Mechanical Engineering



**PROF WANG CHIEN MING**  
Director, Engineering Science Programme  
Director, Global Engineering Programme *(FROM AUGUST 2013)*



**PROF JOHN WANG**  
Ag Head, Department of Materials Science & Engineering



**EDUCATION**



## NUS ENGINEERING NOW 7TH IN THE WORLD

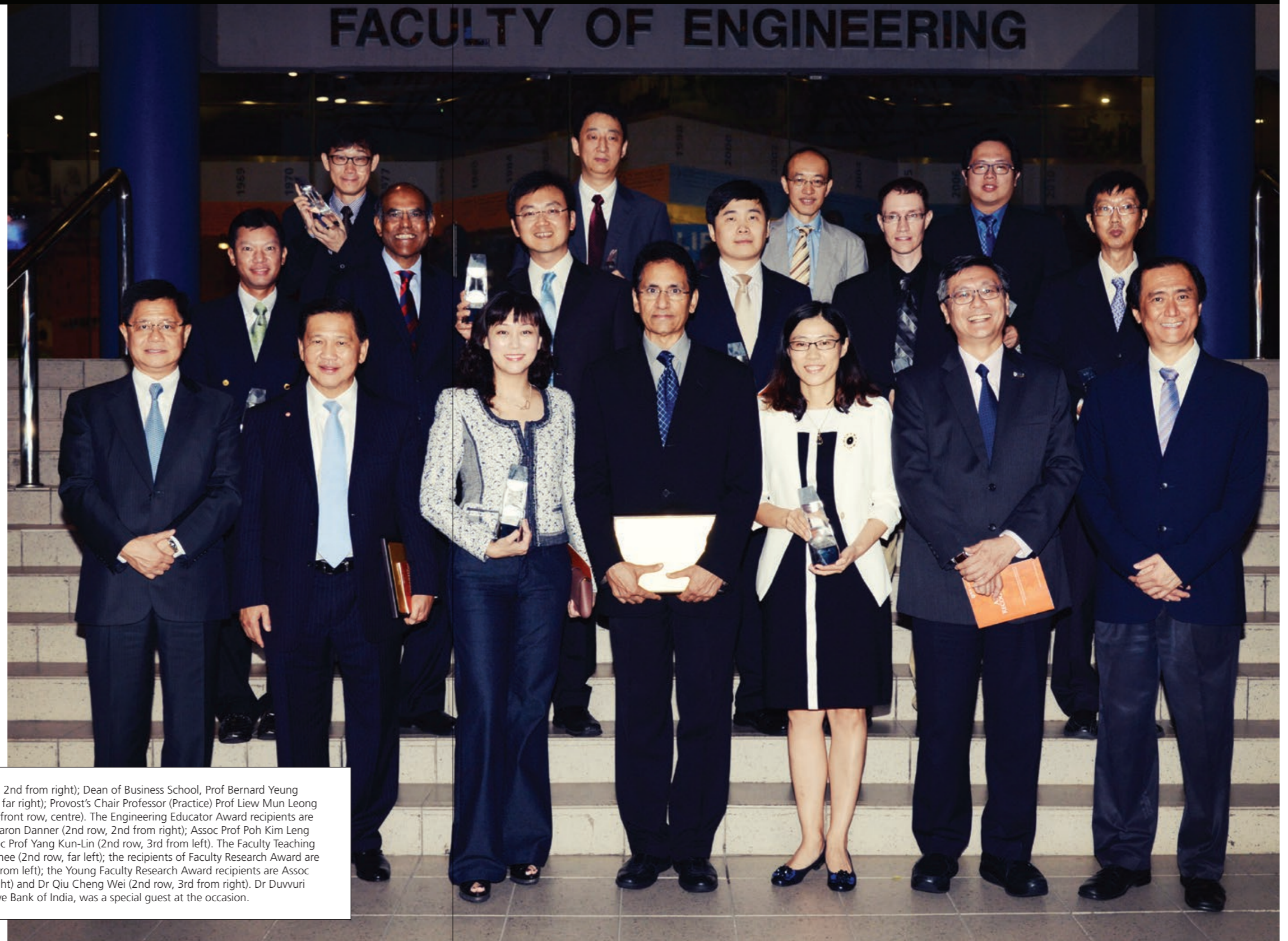
NUS Faculty of Engineering has leapt forward in the QS World University Rankings. With regard to its international stature, the Faculty has risen from 9th to 7th place.

In terms of specific disciplines, a number of its programmes have made it to the top 10 globally. Mechanical Engineering is ranked 6th, a tie with Harvard University; Chemical Engineering and Materials Science are also ranked 6th while Electrical Engineering is regarded as 10th.

Civil Engineering fares relatively well – at 11th position, it is way up in the top 20.

### Flying the NUS Engineering flag high

THEY have done well contributing to the Faculty's good standing in the world ranking. Each year, the Faculty recognises those who have contributed significantly to nurturing future engineer leaders as well as attaining greater heights in research. This year, two newly-appointed Provost's Chair Professors – Professor Liew Mun Leong and Professor T Venkatesan as well as 11 others were honoured at the annual Faculty Award Ceremony.



The Faculty Award winners with NUS Provost, Prof Tan Eng Chye (front row, 2nd from right); Dean of Business School, Prof Bernard Yeung (front row, far left); NUS Engineering Dean, Prof Chan Eng Soon (front row, far right); Provost's Chair Professor (Practice) Prof Liew Mun Leong (front row, 2nd from left); and Provost's Chair Professor, Prof T Venkatesan (front row, centre). The Engineering Educator Award recipients are Distinguished Professor Phoon Kok Kwang (back row, far left); Assoc Prof Aaron Danner (2nd row, 2nd from right); Assoc Prof Poh Kim Leng (2nd row, far right); Assoc Prof Christina Lim (front row, 3rd from left); Assoc Prof Yang Kun-Lin (2nd row, 3rd from left). The Faculty Teaching Award (Engineering Educator Honour Roll) recipient is Assoc Prof Loh Kai Chee (2nd row, far left); the recipients of Faculty Research Award are Prof Ding Jun (back row, 2nd from right); Prof Zhang Yong (back row, 2nd from left); the Young Faculty Research Award recipients are Assoc Prof Qiu Anqi (front row, 3rd from right); Dr Lee Poh Seng (back row, far right) and Dr Qiu Cheng Wei (2nd row, 3rd from right). Dr Duvvuri Subba Rao (2nd row, 2nd from left), former Governor General of the Reserve Bank of India, was a special guest at the occasion.

## LEARNING TO BE ENGINEER-LEADERS THROUGH VALUE CREATION

VALUE creation drove much of the Institute for Engineering Leadership (IEL)'s directions and actions in 2013. Simply defined, it is the increase in worth of a good, a service or even an organisation through actions taken. Thus, leaders create value through their ability to organise and motivate resources around them to bring about the desired change. It was with this underlying principle that IEL had set about exploring ways to embed value creation in programmes and initiatives for students, staff and industry.

One of the more visible and tangible result of this intent was the inaugural InnoVenture 2013. First conceived by the Enterprise Development Lab (EDL), student leaders came together to develop and launch the flagship technopreneurship learning platform and competition. To be organised annually, InnoVenture 2013 featured real industry problems identified by Dow-Corning, HDB, JTC Corp., Nestle and NUH. Student teams went through intensive technopreneurship workshops and prototyping bootcamps, guided by industry experts and mentors.

The student leaders set for themselves and their peers an admirable and lofty aim – to tackle real problems and create real scalable impact on society. Although only the top teams were selected to receive grants to develop their ideas further, through experiencing the value creation process, all the students who had participated came away with much more. Students gained a healthy

recognition and respect of complexities in dealing with real problems and real people, and an understanding of the skills they need to handle complexities and lead change towards value creation.

One of these skills is emotional intelligence – the ability to perceive, control and evaluate emotions and relationships. Leaders know that in order to drive change and create value, they need to be able to effectively read people and situations, and connect with others emotionally. Through observation of team dynamics in experiential programmes, IEL recognised that students needed to be provided with additional guidance to develop their emotional intelligence or “soft” skills.

IEL conducted the inaugural EQ Bootcamp in 2013 as a first step to validate the relevance of emotional intelligence to developing engineering leadership competencies in students. IEL intends to work towards entrenching emotional intelligence awareness and development guidance in programmes throughout the Faculty.

Through such experiential and innovative initiatives, IEL aims to help the Faculty draw in and develop individuals who are strategic systems thinkers and value creators able to identify market and technology opportunities and engage people around them to deliver profitable growth with social impact.



Students venturing into value creation at InnoVenture 2013.

## ENGINEERING EDUCATION GETS BIG BOOSTS FROM INDUSTRY

THE industry plays no minor role in boosting the quality of engineering education. The Tunnelling and Underground Construction Society, Singapore (TUCSS) for example, continues to offer significant support and encouragement for NUS Engineering students in the field of geotechnical engineering. In 2013, the Department of Civil & Environmental Engineering received \$150,000 from the Society towards the TUCSS M Sc (Geotec) Scholarship.

TUCSS, established in 1998, currently has close to 800 individual members and more than 76 corporation members. TUCSS is affiliated to the International Tunnelling Association (ITA), and has close links with other tunnelling and geo-engineering societies of countries around the world.

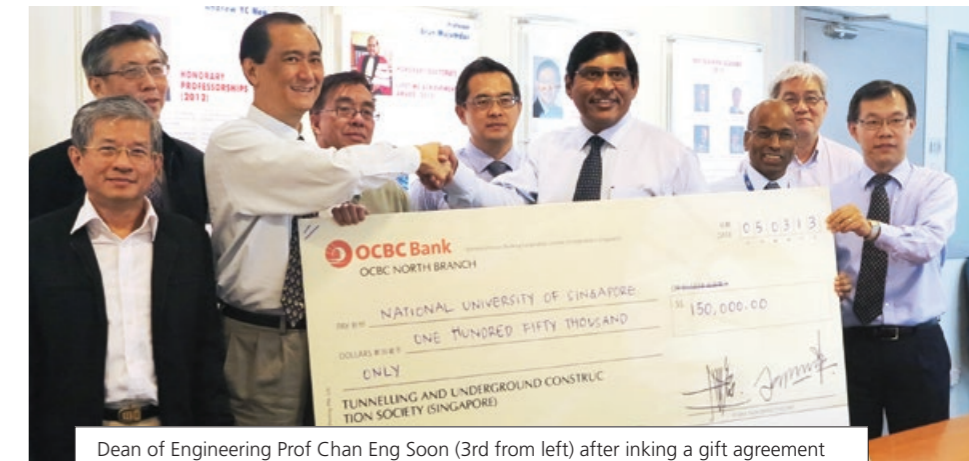
Tunnelling volume in Singapore has increased significantly since the early 80s and 90s which saw the initial phases of the mass rapid transit system that included some 20km of tunnels. Since the completion of these phases, there has been rapid expansion of many more tunnelling projects such as underground rail and road systems as well as deep sewers and buried utility tunnels. The Downtown Line, for example, is expected to be completed in 2017. The recently-opened Marina Coastal Expressway which allows motorists to bypass the crowded CBD, has a 420m undersea tunnel, the first of its kind in Singapore.

Singapore urgently needs engineers in this field of underground space technology. The challenge lies in nurturing the right students up to postgraduate level – and ensuring that they stay in the profession. The Faculty of Engineering hopes to work hand in hand with TUCSS to address this challenge.

### OFFSHORE ENGINEERING

ABS, the leading provider of classification services to the global offshore industry, has also increased its support through a new ABS Scholarship which will provide financial support for five years to Civil or Mechanical Engineering students majoring in an offshore engineering or offshore oil and gas discipline.

As part of its initiative to address Singapore's growth in the global marine and offshore sectors, ABS recently inaugurated its Singapore Innovation and Research Centre. The new facility is collaborating with academic institutions including NUS in new areas of marine and offshore research.



Dean of Engineering Prof Chan Eng Soon (3rd from left) after inking a gift agreement on 11 April with Mr Kulaindran Ariaratnam, President of TUCSS (4th from right).

### CHEMICAL ENGINEERING

ABB, a leading power and automation technology group, has also presented US\$80,000 to two faculty members at the Department of Chemical & Biomolecular Engineering to develop a new project with industrial applications in the power and automation area. Associate Professor Rajagopalan Srinivasan and Professor Iftekhar A Karimi will develop a test-bed to capture the dynamics of a multi-product specialty chemical enterprise over a long time horizon.

Their project is one of 40 research projects selected for funding by ABB globally, after academic and research institutes around the world were invited to submit proposals for grants that will shape the future of power and automation.

Said Mr Haider Rashid, Head of ABB in South East Asia and Oceania, “Our aim is to establish a truly collaborative innovation environment with world-class institutes such as NUS. In particular we were looking for projects that support our strategy, which is to develop power and automation technologies that save energy and improve people's lives.”

## CENTRE FOR AEROSPACE ENGINEERING TAKES OFF AT NUS ENGINEERING

THE Centre for Aerospace Engineering (CAE), established at the NUS Department of Mechanical Engineering, will collaborate with DSO National Laboratories, SIA Engineering and ST Aerospace to conduct aerospace-focused research, education and outreach activities.

Experts from the three industry partners will deliver guest lectures at the NUS Engineering Faculty. They will also offer internships, design projects as well as final-year projects for NUS Engineering students. Such projects include Wing-in-Ground (WIG) craft, aerial flapping wing craft as well as unmanned aerial vehicles.

The Department's aeronautical engineering specialisation will be doubling its current intake of undergraduate students, admitting about 50 students per year – either through direct entry from Year 1 or from Year 3. Some 20 NUS researchers will be leading and participating in various studies, for example, on drag reduction with investigations spanning both low and high subsonic speed regimes, strength of composite materials and structures, as well as the

evaluation, prediction and detection of damage and repairs relevant to the aircraft industry.

The scientific and technical knowledge arising from these studies will have benefits beyond the aerospace industry to other major sectors such as energy, transportation and marine, said Professor Tay Tong Earn, the Centre's Director and Head, Department of Mechanical Engineering.

"We have experienced a considerable surge in aerospace activities in Asia, and at NUS, we have been in the forefront of such innovative research. We hope to make strong contributions to the industry and the Singapore economy," said Prof Tay.

Minister of State for Finance and Transport, Mrs Josephine Teo, guest-of-honour at the launch, noted that the local aerospace sector is a key pillar of Singapore's economy, providing close to 20,000 jobs. The new Centre will help to nurture young talent and to ensure that they join the aerospace workforce upon graduation.



Minister of State for Finance and Transport, Mrs Josephine Teo (centre) at the launch of the Centre. With her on the stage are (from left) Prof Tay Tong Earn (CAE Director), Ms Glory Wee (Head, Aerospace, EDB), Prof Chan Eng Soon (Dean of Engineering), Ms Milly Tay (VP Engineering & Development Centre, ST Aerospace), Mr Cheong Chee Hoo (Director, Networks, DSO); and Mr Chew Siong Hee (VP Engineering, SIA Engineering).

## FUTURE PORT DESIGN WINS TOP PRIZE OF US\$1 MILLION



The moment of triumph. From left: Mr Lucien Wong, Chairman, Maritime & Port Authority of Singapore, Mr Lui Tuck Yew, Minister for Transport, Assoc Prof Lee Loo Hay, Assoc Prof Chew Ek Peng and Mr Teo Siong Seng, Chairman, Singapore Maritime Foundation.

RADICAL thinking by a multidisciplinary NUS-Shanghai team has led to winning the top prize of US\$1 million at the Next Generation Container Port Challenge launched by Singapore Maritime Institute and Maritime and Port Authority of Singapore.

The team led by NUS comprised academics from Industrial & Systems Engineering, Civil & Environmental Engineering, Electrical & Computer Engineering and Centre for Maritime Studies. Combining forces with Shanghai Maritime University and Shanghai Zhenhua Heavy Industries Company Limited, they have come up with a revolutionary double storey container terminal design as an answer to a container port that could achieve a quantum leap in port performance, productivity and sustainability.

The Challenge required participants to solve the problem of how a limited land area of 2.5 square kilometers

could still be highly productive and handle 20 million twenty-foot equivalent units (TEUs) a year, of which 80 per cent are transshipment cargo.

Their concept, named SingaPORT (Sustainable Integrated Next Generation Advanced Port) sports a double-storey design with multiple access points for quay cranes. This concept results in high land productivity – creating additional spaces to ease traffic congestion as well as allowing an integrated logistics centre to be housed within the port premises.

Their design also took Singapore's hot weather into consideration. The 2nd storey acting as a shelter for the first storey port area would lead to less energy consumption especially by refrigerated containers. Equipment and vehicles would also be protected from harmful UV light resulting in longer life spans.

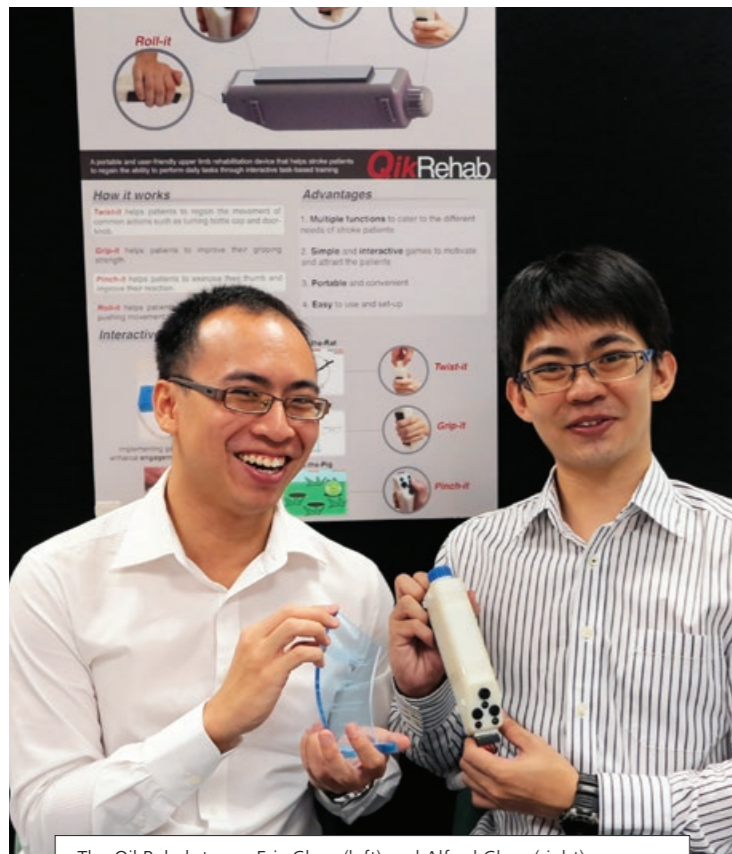


## EDIC MARKS THE YEAR WITH OUTSTANDING ACHIEVEMENTS

THE year in review has been an exciting one for Engineering Design and Innovation Centre (EDIC). The Centre's inaugural cohort of Design-Centric Programme (DCP) students has graduated and left behind legacies – award-winning solutions for better living.

Graduating DCP teams garnered top prizes at the National Climate Change Competition (NCCC) Technology Project Challenge themed "Singapore: A Climate Change Resilient City" which challenged youths to utilise technology and innovation to reduce carbon emissions and mitigate climate change. Team *Greenerds* took home the first prize in the tertiary category with their entry, "Energy Efficient Humidity-Controlled Cooling System" – while another team *Utopia Sustainis* took the 2nd prize in the same category with their prototype, an integrated system that encourages food stall owners to recycle food waste.

The graduating cohort has also proven their enterprising prowess. Team "QikRehab" took their design, a portable device to help stroke patients at home, to the National Assistive & Rehabilitation Technology Students Challenge 2013. They returned with the Award of Excellence (Design). Their concept also garnered the top prize of \$15,000 at Start-Up@Singapore 2013.



The QikRehab team: Eric Chan (left) and Alfred Chua (right).

## FSAE CAR UPS RANKING

EDIC's Formula SAE car roared the NUS spirit at the international FSAE challenge at Michigan, upping its previous 29th overall position to 19th.

Said team leader Thomas Oh Sien Jun before the competition, "We have a very fulfilling time working on the car. We worked on it from design to finish. We tackled many issues. But I think the greatest challenge of all was adapting it last minute to accommodate the new FSAE competition ruling of having a minimum length for the leg compartment. But we managed to adjust. The new rule was added at the 11th hour because the judges wanted to see how we solve problems and think out of the box."

Professor Seah Kar Heng, the Faculty FSAE advisor, commented: "We were placed 10th in the Engineering Design category out of the 120 teams. This is the third time the NUS team has entered the top 10 positions; the last two times being 9th in 2006 and 10th in 2008. This is the most significant category as we are competing with teams from engineering schools around the world, and this is primarily an engineering design competition."

As the best team from Asia yet again, they were also runner up in the 2013 FSAE Chief Design Judge Award (2nd prize in Engineering Design Drawing).

The NUS FSAE team has also enjoyed the privilege interacting with well known Formula One (F1) experts. Recent visits have included one of the most renowned technicians in F1, Mike Gascoyne, the CTO of Caterham Group – and Infiniti Red Bull racer, Mark Webber.

NUS Engineering's track record of producing successful Engineer-Leaders in the area of motor performance has also led to Infiniti, the luxury high performance vehicle division of Nissan Motor, to launch their Performance Engineering Academy at the Faculty.



NUS FSAE team 2013 in great spirit with NUS FSAE guru, Prof Seah Kar Heng (seated).

## ENGAGING MINDS ON AGEING SOLUTIONS

They came from all over the world to brainstorm at the Design Summer Programme (DSP) on solutions for issues faced by the aged. Themed "Designing for Active Ageing: An Engineering perspective", DSP2013 was organised by EDIC and supported by the Lee Foundation.

Chair of the Organising Committee, Dr Kevin Kuang who is also Autodesk Professor at EDIC, said: "Active ageing, besides leading a physically active

life also means choosing to remain engaged in social, economic, cultural, spiritual and civic affairs. Even older folks who retire from work and living with disabilities, or are ill, can continue to contribute to their families, peers and communities. At DSP2013, we would like to explore how engineers can support and contribute to promoting this concept of active ageing in view of the variety of challenges and unique needs facing this segment of society."

\* More EDIC stories in "Research & Enterprise" and "People" chapters.



Participants hail from universities all over world such as Massachusetts Institute of Technology, Cambridge, Carnegie Mellon, Sungkyunkwan, Zhejiang, Tohoku, Institute Technology of Brunei, De La Salle and Hamburg. The Summer Programme was joined by the Faculty's own Design-Centric Programme students.



# RESEARCH & ENTERPRISE

## KEPPEL-NUS CORPORATE LABORATORY LAUNCHED AT NUS ENGINEERING

ADVANCING offshore technology will take off in a big way at NUS Engineering. The Keppel-NUS Corporation Laboratory launched at the NUS Faculty of Engineering in November, will pursue three main research thrusts – Future Systems, Future Yards and Future Resources to meet challenges of the marine and offshore industry.

Officiated by the Deputy Prime Minister of Singapore, Mr Teo Chee Hean who is also Chairman of the National Research Foundation (NRF), the \$75 million Corporate Laboratory is the first of this scale to be established by a local company with a Singapore university. The Corporate Laboratory is the second to be established under the NRF's Corp Lab @ University scheme to support Singapore's autonomous universities in their conduct of industry-relevant research with companies as partners.

Keppel-NUS Corporate Laboratory has set its vision as a global technology centre of excellence in the pursuit of resources in a safe and responsible manner from harsh environments and ocean beds, preserving and sustaining our environment. Its mission is to undertake R&D through Keppel's core competencies and NUS' research expertise for solutions to Deepwater, Arctic and other fields.

Speaking at the launch, NUS President Professor Tan Chorh Chuan said that each of these thrusts leverages on different strengths of NUS' R&D capabilities: "For Future Systems, NUS' world-class expertise in both numerical and physical modelling will enable novel insights into the complexities of harsh environments and extreme weather conditions. For Future Yards, NUS advanced capabilities in automation and robotics will be focused on creating yards of the future which are safer, more productive and more technology-intensive. For Future Resources, NUS will work with Keppel on developing economically-feasible and environmentally-sensitive solutions to explore and collect rich polymetallic nodules on the deep ocean floor."

NUS Dean of Engineering, Professor Chan Eng Soon who is also the Co-Chairman of the new Corporate Lab said that the Lab will provide a unique platform to build synergy between industry and academia.

"It will certainly create a culture for thinking out of the box in addressing real world problems. As it is imperative that we leapfrog ahead in innovation and technology towards expanding Singapore's investment in the offshore industry, we need to nurture engineer leaders and experts capable of going beyond frontiers in coming out with holistic solutions for complex challenges," he said.



DPM Teo Chee Hean (3rd from right) with NUS President, Prof Tan Chorh Chuan (far right) at the exhibition featuring capabilities of the Keppel-NUS Corporate Laboratory's three research thrusts: Future Yards, Future Systems and Future Resources. With DPM Teo (from left) are NUS Engineering Dean, Prof Chan Eng Soon who is the Lab's Co-Chairman, Mr Chow Yew Yuen, COO of Keppel Offshore & Marine; and Prof Andrew Palmer, NUS Department of Civil & Environmental Engineering.

## HERE COMES ROBOCARP, FIRST ROBOT FISH WITH AUTONOMOUS 3D MOVEMENTS IN ASIA

ELECTRICAL & Computer Engineering team led by Professor Xu Jianxin has developed a robot fish that mimics the movements of a carp. This robot can be programmed to perform specific functions, for example, exploring nooks and corners of wreckages or sunken cities – places difficult for divers or traditional autonomous underwater vehicles (AUVs) to reach. Other applications include military activities, pipeline leakage detection, and the laying of communication cable.

Mr Fan Lupeng who graduated in 2013 from the Department worked with Dr Ren Qinyuan, Research Fellow, on the project for his final year which won the High Achievement Award at the Faculty's 27th Innovation and Research Award.

Said Prof Xu, "Currently, robot fish capable of 2D movements are common. But these are not able to dive into the water. But our model is capable of 3D movements, meaning it can dive and float, using its fins like a real fish. Compared to traditional AUVs, they are certainly more mobile and able to manoeuvre with greater ease. And if used for military purpose, fish robots would definitely be more difficult to detect by the enemy."

Their "fish" can dive suddenly and to the precise depth intended. About one and half metres in length and weighing 10kg, it can dive to a depth of 1.8 metres. Challenges encountered for the team included

waterproofing the fish body, the motor and the control box. The fins and tails also need to be flexible and the team decided to use very fine (1mm) acrylic board for these. Buoyancy and balance for the robot is maintained by using plastic foams attached to both sides. For the diving mechanism, their robot fish is equipped with an internal ballast system to change density.



Robots that swim like carps. The team (from left): Mr Zhang Hengwei, Dr Ren Qinyuan and Mr Fan Lupeng.

Said Mr Fan who studied the movements of real life carps for three months, "We chose to study carps because most fish swim like them. There is no literature at all on designing a mathematical model on the locomotion of fish and so we had to start from scratch. We used a camera to capture all the possible movements of a carp and then converted the data mathematically so that we could transfer the locomotion of real carp to our robot using different actuators."

### Their underwater robot is Best New Entry at International RoboSub Competition, San Diego

UNDERWATER robot team, *Bumblebee*, kept their promise – to be among the world's top 10. Led by Ong Tian Chang (Mechanical Engineering student), the team which won the 2nd prize at the Singapore Autonomous Underwater Vehicle (AUV) Challenge 2013 emerged 7th at the AUVSI RoboSub Competition in San Diego (22-28 July). The team was joined by Goh Eng Wei (Computer Engineering), leader of *Coconut Pi* which took 3rd prize at the Singapore competition.

They were the first Singapore team to take part in this 16-year-old international competition which challenges new generation of engineers to perform realistic missions in an underwater environment. The competition is organised annually by the AUVSI foundation, co-sponsored by the US Office of Naval Research.



*Bumblebee* with their robot at San Diego.



## CREATING POWERFUL HUMAN-LIKE ROBOTIC MUSCLES

TEAM led by Dr Arian Koh has achieved a world record. They have designed an artificial muscle which could carry a weight 80 times its own while extending to five times its original length. The team's invention will pave the way for life-like robots with superhuman strength and ability.

Artificial muscles have been known to extend to only three times its original length when similarly stressed. The muscle's degree of extensibility is a significant factor contributing to the muscle's efficiency as it means that it could perform a wider range of operations while carrying heavy loads. Robots, no matter how intelligent, are restricted by their muscles which are able to lift loads only half its own weight – about equivalent to an average human's strength (though some humans could lift loads up to three times their weight).

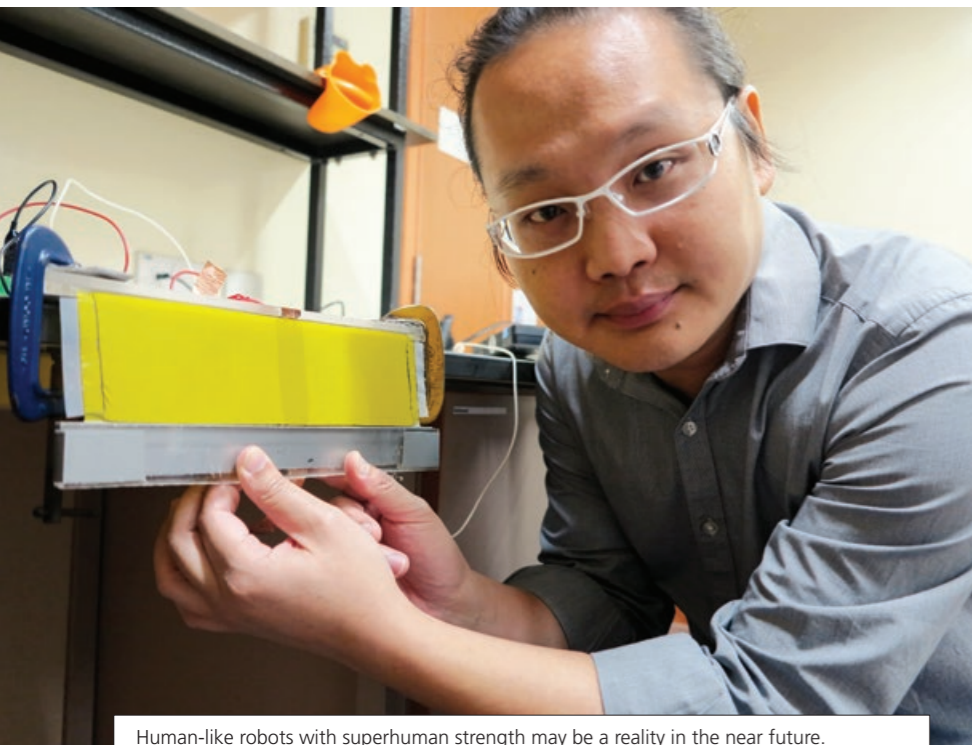
Dr Koh who is with Engineering Science Programme and the Department of Civil & Environmental Engineering, used polymers which could be stretched over 10 times their original length. A good understanding of the fundamentals was largely the cause of their success, said Dr Koh.

"We put theory to good use. Last year, we calculated theoretically that polymer muscles driven by electrical impulse could potentially have a strain displacement of 1,000 per cent, lifting a load of up to 500 times its own weight. So I asked my students to strive towards this holy grail, no matter how impossible it sounded," he said.

Though they could only achieve a fraction of their target, it was a world record. For his contributions, Dr Koh was awarded the Promising International

Researcher Award at the *3rd International Conference on Electromechanically-Active Polymer Transducers and Artificial Muscles* in June 2013 held in Zürich, Switzerland. The Award recognises young researchers from outside Europe, who have made significant contributions in the field of electromechanically-active polymers, and display promise to successful career in the field.

"Our novel muscles are not just strong and responsive. Their movements produce a by-product – energy. As the muscles contract and expand, they are capable of converting mechanical energy into electrical energy. Due to the nature of this material, it is capable of packing a large amount of energy in a small package," Dr Koh said.



Human-like robots with superhuman strength may be a reality in the near future. Dr Adrian Koh demonstrating the strength and pliability of his artificial muscle.



## EDIC PROVIDES EXPERTISE IN 3D TECHNOLOGY FOR FACIAL RECONSTRUCTION SURGERY

COLLABORATION between a team at the Engineering Design & Innovation Centre (EDIC) led by Associate Professor Ian Gibson, and a surgical team at the National University Hospital (NUH) has helped patients with severe facial injuries and deformities to regain their looks more successfully – and in shorter time.

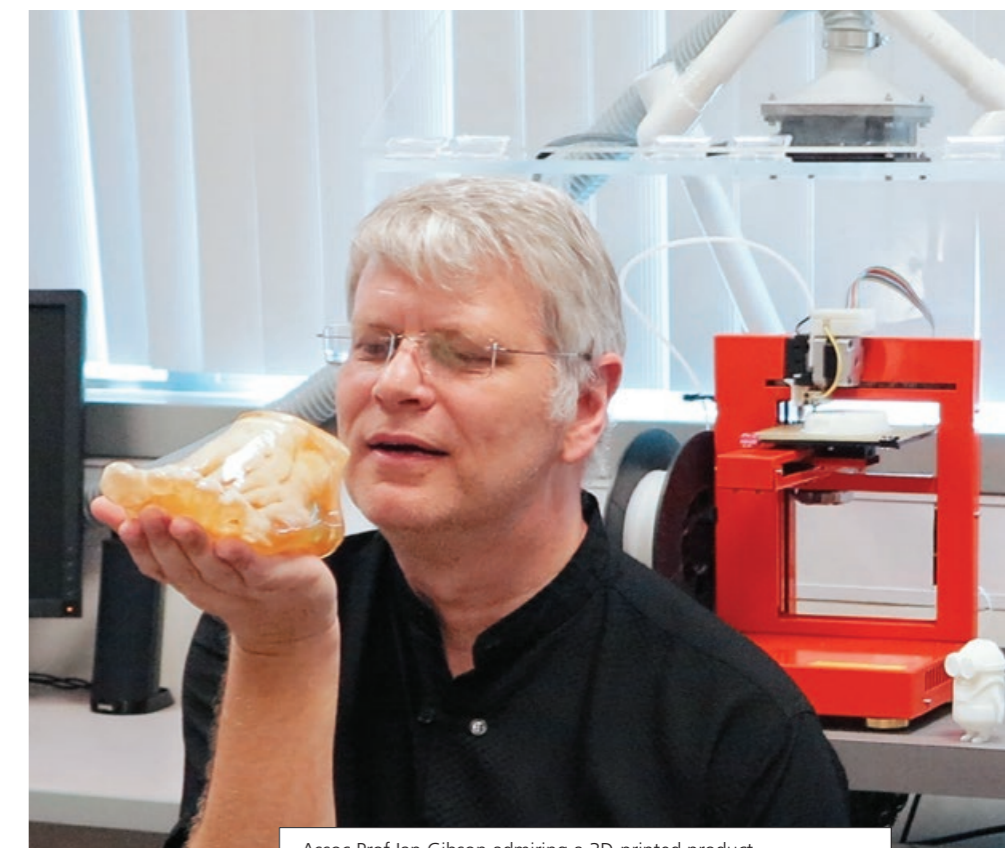
Since 2008, the Division of Plastic, Reconstructive and Aesthetic Surgery at NUH has been using 3D virtual models as operative guides before and during surgery to help surgeons plan, build and place implants (for reconstruction) with a high degree of accuracy. In January, a 3D prototyping printer has been added to the 3D technology platform – extending the capabilities by creating a physical 3D model that surgeons can hold and work on to further fine-tune accuracy.

Printing a 3D medical model is particularly beneficial for cases so severe that there are no bigger bone fragments left to form guide posts. With the printed model, surgeons can check the fit of the titanium implants on the physical plane, and adjust when necessary. The procedure becomes more precise with lower margins for error. Re-operations are also minimised with the use of 3D planning software, prototyping and computerised navigation.

Said Associate Professor Lim Thiam Chye, head and senior consultant with the Division, "With this 3D technology platform, we are now able to reconstruct the cranio-maxillofacial skeleton optimally with 99 per cent accuracy even with only half the facial skeleton intact. In addition to the 3D virtual guidance on screen, we can hold in our hands a 3D medical model, the exact replica of how the face should be.

This gives us the avenue to fit the implants onto the printed 3D model to bend and shape as accurately as possible, following the contours of the bone."

Said Assoc Prof Gibson, "This 3D technology platform represents a breakthrough in complex surgical treatment in the region. Whilst 3D printing has been around for many years, and surgical applications have been supported by this technology in the past, this is the first time we can say that it can be routinely included in surgical treatment.



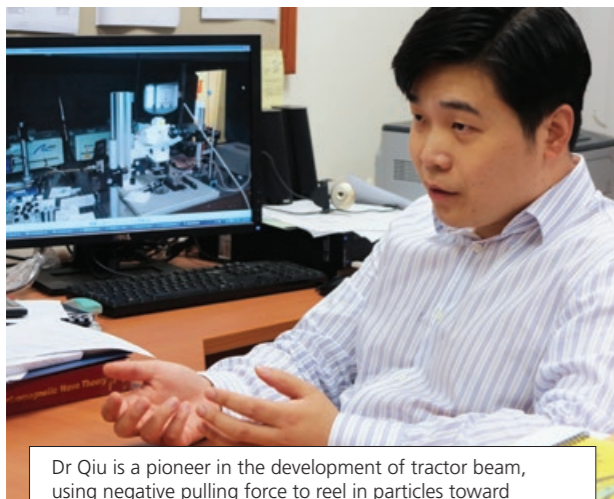
Assoc Prof Ian Gibson admiring a 3D-printed product.

Previously, facilities have normally been located in research labs that have only been able to provide limited support for clinicians. Now, with this facility, we can safely say that patients will be provided unprecedented treatment on a routine basis."



## ENGINEERING A "GHOST" – BREAKTHROUGH IN LIGHT-MATTER INTERACTIONS

WINNER of the Young Scientist Award 2013, Dr Qiu Cheng Wei (Department of Electrical & Computer Engineering) has always been fascinated by complexities in electromagnetic systems and light-matter interactions. One recent example is his invention, an optical device to engineer "ghosts". Engineering such a phenomenon is the holy grail of researchers in the field, opening up a completely new avenue for cognitive deception.



Dr Qiu is a pioneer in the development of tractor beam, using negative pulling force to reel in particles toward the laser source. He is the recipient of the nation's 2013 Young Scientist Award.

Dr Qiu's paper, co-authored with Dr Han Tiancheng (Electrical & Computer Engineering), Prof Tie Jun Cui, Dr Wei Xiang Jiang (State Key Laboratory of Millimeter Waves, Department of Radio Engineering, Nanjing), and Prof Shuang Zhang (School of Physics and Astronomy, University of Birmingham, UK), entitled "Creation of Ghost Illusions Using Metamaterials in Wave Dynamics" was published in *Advanced Functional Materials* in March. Their paper reported for the first time, the realisation of creating ghosts through optic scattering and metamaterials (artificial materials designed with properties built-in). Their device is capable of creating multiple "ghosts" differing in shape and size from the real object, besides making it disappear.

Added Dr Qiu, "As our work solves several major issues associated with ghost illusion, we believe it will pave way for future applications of advanced optical illusion, camouflage, and cloaking. Our work has enormous potential to enhance our ability to mould, harness, and perceive wave at will. I believe it can stimulate new thoughts of realising something extraordinary that is counter-intuitive."

The team will be developing this technique to make larger microwave devices to achieve radar ghosts and aircraft camouflage suitable for defence purpose.



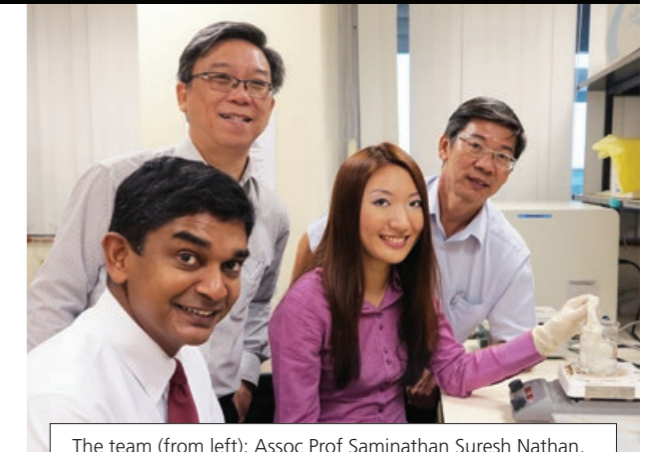
## BIOMEDICAL ENGINEERING TEAM BUILDS REALISTIC 3D TUMOUR MODEL USING SILK SCAFFOLDS

WORKING with the NUS Department of Orthopaedic Surgery, an NUS Engineering team has developed a highly realistic 3D tumour model, able to track the effectiveness and progress of drug therapy. Their model has the potential to be a more effective method for studying tumours than in-vitro and even in-vivo methods.

The team comprising Professor James Goh, Associate Professor Toh Siew Lok and Dr Pamela Tan from the Department of Biomedical Engineering, and Associate Professor Saminathan Suresh Nathan from the Department of Orthopaedic Surgery, carried out their study using osteosarcoma, the most prevalent form of paediatric primary bone cancer.

Dr Tan said: "Despite the urgent need to develop cancer therapeutics, little progress has been made due to the lack of good pre-clinical drug testing models. Current laboratory drug testing methods yield results that differ largely from animal testing because of the use of 2D cell culture systems which cannot replicate the 3D properties of the tumour tissue."

Osteosarcoma cells were grown onto scaffolds fabricated from silk which has been demonstrated to have excellent properties for cell attachment and growth. This is the first time that a realistic 3D tumour has been constructed in a laboratory using silk scaffolds in a pressurised bioreactor.



The team (from left): Assoc Prof Saminathan Suresh Nathan, Prof James Goh, Dr Pamela Tan and Assoc Prof Toh Siew Lok.

Their 3D bioreactor tumour model was able to express markers that indicate the ability of a tumour to initiate blood vessel growth at levels almost identical to that of the mouse model. The tumour constructs also responded to drugs that prevent blood vessel formation in a manner similar to that observed clinically.

Said Assoc Prof Nathan, "Dr Tan's recent contribution has shed remarkable insight into mechanisms of angiogenesis that were previously taken for granted and may now have to be re-addressed. Clinically this will have significant bearing on other drugs as well."



## NEW MICROFLUIDIC DEVICE FOR RAPID SEPARATION AND DETECTION OF BACTERIA

A NOVEL microfluidic device for efficient rapid separation and detection of non-spherical bioparticles may be in the pipeline. This new technique, developed by a team led by Professor Zhang Yong, Department of Biomedical Engineering, can potentially replace current method of detection based on bacterial culture.

Explains Prof Zhang: "Methods based on bacterial culture was developed about 100 years ago, but it is still being used today as the mainstream technique because no new technique is available for effective separation of bacteria from pathological samples like blood. Many of the pathogenic bacteria are non-spherical but most of microfluidic devices today are for separating spherical cells. Our method uses a special I-shape pillar array which is capable of separating non-spherical or irregularly-shaped bioparticles."

Their method can complete the diagnosis process in less than an hour compared to 24-48 hours required for bacterial detection using conventional methods. Their device is also efficient in separating red blood cells (RBCs) from blood samples as RBCs are non-spherical. This enables rapid detection of diagnostic biomarkers which reside in blood sample.

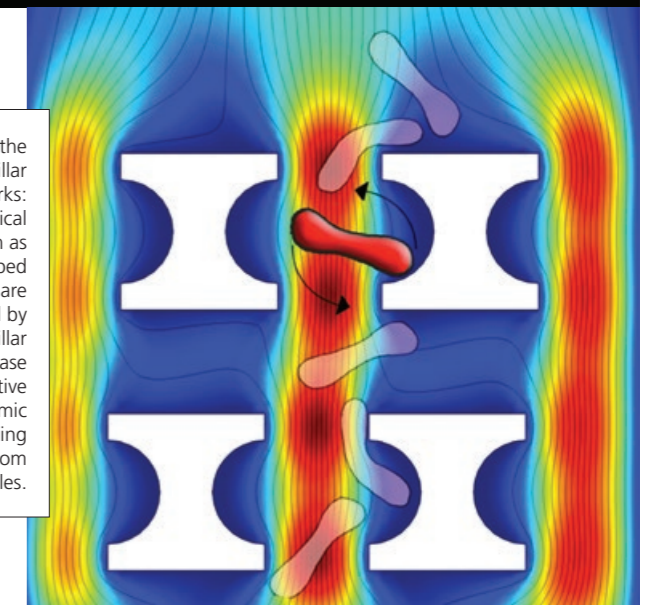
One of the most challenging aspects for the team was designing and fabricating a device that is capable of detecting even the smallest dimension of bioparticles and still provide reasonably good throughput (amount which can be processed through the system in a given time). The I-shape pillar array induces rotational movements of the non-spherical particles which in turn increases the effective hydrodynamic size of the bioparticles flowing in the device, allowing for efficient separation.

Their design is able to provide 100 percent separation of red blood cells from blood samples, out-performing conventional cylindrical pillar array designs.

The device can also potentially separate bioparticles with diverse shapes and sizes. The team has tested their device successfully on rod-shaped bacteria such as *Escherichia coli* (common bacteria which can cause food poisoning). So far, this has been difficult to achieve using conventional microfluidic chips.

Their findings were published in the reputed journal *Nature Communications* (27 March 2013).

How the I-shape pillar array works: Non-spherical cells such as rod-shaped ones are rotated by I-shape pillar to increase their effective hydrodynamic size, isolating them from samples.





## AYOXXA SCORES MORE AS



AyoxxA co-founder Dr Dieter Trau (2nd row, far right) with team.

AyoxxA's technology is aimed at transforming the throughput and accuracy of protein analysis to deliver the analytical power now seen only for DNA arrays. The platform is based on proprietary In-situ Encoded Bead-based Arrays (IEBA) exclusively licensed from NUS which allows the simultaneous measurement of multiple proteins from minute samples. It needs no physical label for multiplex analysis, thus hugely reducing the complexity of downstream analysis while increasing the number of individual proteins that can be analysed at the same time.

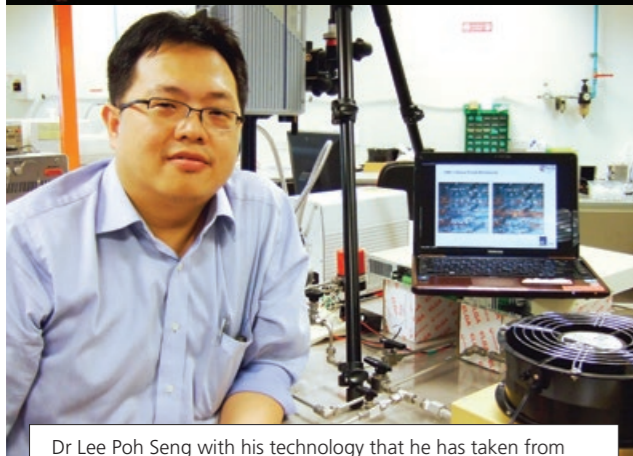
AyoxxA will work with the NUS Department of Biomedical Engineering to further strengthen its discovery and development projects with focus on platform technology in relation to drug targets.

AyoxxA Biosystems has aced the second prize of 1.5 million yens at the Asian Entrepreneurship Award (AEA) 2013, an international business competition for young Asian entrepreneurs. The biotechnology company was also awarded an investment fund of 0.4 million Euro earlier in the year – in addition to the 2.6 million Euro at the Series A financing round which closed in September 2012.

Referring their recent win, Dr Dieter Trau, Department of Biomedical Engineering, co-founder of the company and its Chief Scientific Officer said: "The competition was very strong. There were 20 teams – with six from Japan, three from China the rest from other Asian countries."



## ALL SET TO WOO GLOBAL ELECTRIC VEHICLE MARKET



Dr Lee Poh Seng with his technology that he has taken from lab to the market.

A NEW cooling technology developed by Dr Lee Poh Seng and his team at the Department of Mechanical Engineering, has been licensed by Singapore clean-tech company, GCoreLab Pte Ltd, with eye on the electric vehicle market. The company, co-founded by Dr Lee in 2011, has received funding close to \$600,000 from a Singapore Government incubator, Red Dot Ventures and the National Research Foundation.

Their "oblique fin liquid technology" promises to control thermal issues that have plagued lithium-ion batteries. Battery packs that use lithium-ion cells such as those found in laptops and in electric cars, for example, can suffer from cells failing due to overheating. This can cause a chain reaction with neighbouring cells with disastrous results such as explosions.

The technology relies on cooling plates. Said Dr Lee, "The oblique fin technology can achieve 30 to 50 per cent better results compared with conventional liquid cooling, but still using the same amount of energy."

GCoreLab is currently working with a bus manufacturer in China, which it expects, will be the biggest electric vehicle market globally in the near future. China has set an ambitious target to reach 5 million electric vehicles by 2020, to reduce its reliance on foreign oil.

Dr Lee estimates electric vehicle cooling market to reach \$5.7 billion a year by 2020. Secondary markets include cooling for wind turbines and aerospace applications.



## NUS ENGINEERS TO HELP DEVELOP SINGAPORE'S SATELLITE INDUSTRY



Dean, NUS Faculty of Engineering, Prof Chan Eng Soon (left) with Mr Tang Kum Chuen, President, ST Electronics (Satcom & Sensor Systems) Pte Ltd, at the signing ceremony, held at the Global, Space & Technology Convention 2013.

NUS Electrical & Computer Engineering (ECE) Department has signed a Memorandum of Understanding with ST Electronics to research and develop a low cost hyper-spectra payload for earth observation. Hyper-spectral images are very useful for the analysis of anomaly detection, target detection and material identification. They are widely used for applications in agriculture, mineralogy, physics and surveillance.

The collaboration, inked at the Global, Space & Technology Convention 2013 in February, dovetails ST Electronics' plan to launch TeLEOS-1 into commercial service in 2015, an earth observation satellite that will be made in Singapore. ECE will be involved in the specification, design and system integration of the 50-kg microsatellite with its hyper-spectral imaging payload. Such a payload employs sensors with special processing algorithms to collect information as a set of images over a range of frequency bands.

Professor Yeo Swee Peng, NUS Department of Electrical & Computer Engineering, said: "Micro-satellites are easy to launch and also low cost, compared to the first generation of large-scale satellites. However, the size and weight specifications associated with smaller satellites impose tight constraints on payload capabilities. Various innovative approaches are required to overcome these technological limits. The project we are working with ST Electronics will be among the world's first low-cost hyper-spectral imager that can possibly be implemented on a 50-kg microsatellite."

NUS Engineering aims to contribute to Singapore's plan to attract satellite-related investments by training engineers and researchers for the aerospace industry which has been identified as an exciting and promising new growth area for the nation.



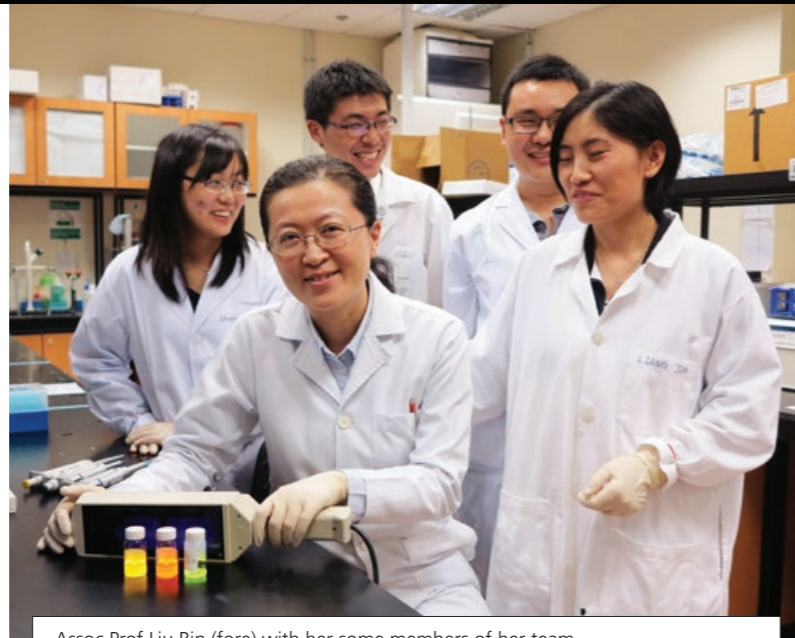
# OUR PEOPLE

STAFF ■ STUDENTS ■ ALUMNI

**SHE RE-ENGINEERS MOLECULES TO DETECT CANCER**

KNOWN for her achievements in polymer chemistry, Associate Professor Liu Bin was conferred the NUS Young Researcher Award 2013. Among other breakthroughs, Assoc Prof Liu has developed a new category of organic luminogens (light-emitting molecules) which are water soluble. Being organic, this means they are of low cytotoxicity and can be used for better bio-imaging to detect or monitor diseases such as cancer.

“Quantum dots release heavy metal ions which are highly toxic and hence are not suitable for long term in-vivo bio-imaging. This has motivated us to come out with alternative far-red/near infrared (FR/NIR) fluorescent probes that have the advantages of quantum dots without the toxicity,” she said.



Assoc Prof Liu Bin (fore) with her some members of her team.

Challenges overcome included the re-engineering of the molecules so that they show high brightness. Their study will open up new opportunities for the development of a new generation of promising probes for the advancement of bio-imaging. The team has published extensively in journals such as *Advanced Healthcare Materials* and *Advanced Functional Materials*. They have also published a paper, “Hyperbranched Conjugated Polyelectrolytes for Biological Sensing and Imaging” in *PubMed*.

Said Assoc Prof Liu Bin who has received many awards, including the 2008 National Science and Technology Award, “Through further bioconjugation, the process of coupling of organic molecules and biomolecules together chemically, our novel probes can have wide applications. For example, they can also be designed to track and detect cell apoptosis (cell death) in real time which will help us understand better how cells can be destroyed by diseases or how we can kill off cancer cells.”

**SHE CONTINUES TO MAKE AN IMPACT ON SOCIETY**



Assoc Prof Ong Soh Khim at the award ceremony held at Istana with Deputy Prime Minister and Coordinating Minister for National Security and Minister for Home Affairs Mr Teo Chee Hean; Acting Minister for Culture, Community and Youth and Senior Minister of State, Ministry of Communications and Information, Mr Lawrence Wong; and Chairman of SYA panel, Mr Edward D’Silva who is also a member of the NUS Board of Trustees.

NINE years ago, she received the Singapore Youth Award (SYA). Not resting on her laurels, Associate Professor Ong Soh Khim won the SYA Medal of Commendation (MOC) this year.

The MOC Medal is conferred upon one who has continued to attain significantly higher levels of achievements and contributions to society for at least five years after winning his or her first SYA Award. They should also be 45 years old and below at the time of nomination.

Said Assoc Prof Ong who is with the Department of Mechanical Engineering, “I am honored to be conferred the SYA 2013 MOC. It is a recognition of my efforts and achievements as an academic and researcher. I hope the Medal will serve as an inspiration to all youths, both male and female, to motivate them to work hard to pursue excellence in their fields.”

**IES HONOURS NUS ENGINEERS AT WORLD ENGINEERS SUMMIT**

A VETERAN and two NUS Engineering teams were honoured by the Institution of Engineers, Singapore (IES) on 13 September, at the inaugural World Engineers Summit.

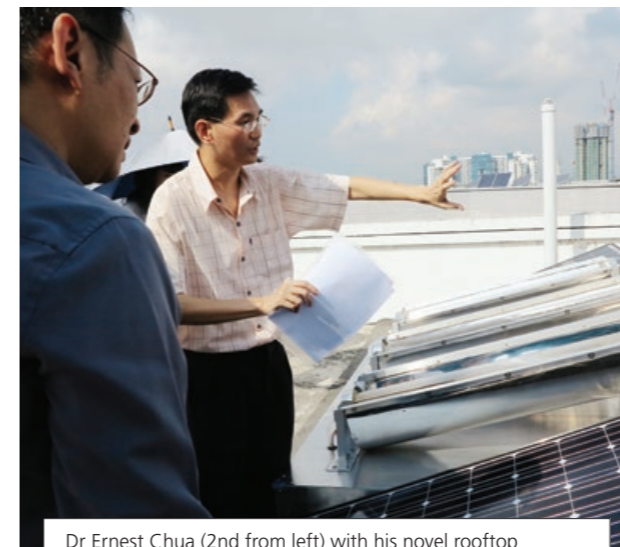
Emeritus Engineer Professor Lee Seng Lip was presented with the inaugural IES Lifetime Engineering Achievement Award. Receiving the IES Prestigious Engineering Achievement Award were a team led by Dr Ernest K J Chua, Engineering Science Programme and Department of Mechanical Engineering; and another team comprising Professor Chen Zhi Ning and Dr Qing Xianming, Department of Electrical & Computer Engineering.



Prof Lee Seng Lip, recipient of the IES Lifetime Engineering Achievement Award, speaking at the ceremony.

The Lifetime Engineering Achievement Award is given to an outstanding engineering leader, whose lifetime achievements have made a profound impact in the industry and who has brought honour to Singapore. Prof Lee is an expert in infrastructural engineering as well as structural geotechnical and construction technology.

His contributions has included helping in the construction of Marina Bay Sands and the Changi Airport control tower. At 88 years old, Prof Lee still goes to the office four times a week, working as a consulting engineer.



Dr Ernest Chua (2nd from left) with his novel rooftop system to extract hydrogen from rainwater.



Prof Chen Zhi Ning (right) and Dr Qing Xianming (centre) with Singapore Minister for Environment and Water Resources, Dr Vivian Balakrishnan, guest-of-honour at the award ceremony.

## HIS HEALTH MONITORING SYSTEM RECEIVES MSIG RESEARCH GRANT



Assoc Prof Tan Kok Kiong and his team gets the MSIWF Research Grant to develop the e-Guardian, an economical and scalable remote monitoring system for the elderly staying on their own.

and notification system. A pilot trial will start at centres for the elderly and homes needing such services. This leg of the research "Scaling and Development of e-Guardian to Eldercare Centres and Single Elderly Homes" will be led by Assoc Prof Tan (Department of Electrical & Computer Engineering) with Dr Yuan Jian, NUS Graduate School for Integrative Sciences and Engineering and Ms Er Poi Voon, Research Engineer with the Department of Electrical & Computer Engineering.

The e-Guardian system which is low-cost, energy efficient, simple in operation and robust in performance was a finalist at the IASTED International Conference of Engineering and Applied Science EAS 2012. Its use is also being explored in a remote village in Sri Lanka.

Said Assoc Prof Tan, "e-Guardian can be effectively deployed in HDB blocks as well, where all seniors inside could share a single system. The system can help caregivers keep track of their clients' routine checks, accidental falls and unexpected absence, especially for dementia patients."

WINNER of the Mitsui Sumitomo Insurance Welfare Foundation (MSIWF) Research Grant in 2010, Associate Professor Tan Kok Kiong is taking his e-Guardian project to the next level, having received the Award again this year.

The grant (with a maximum value of \$10,000), awarded by MSIG (an established regional general insurance company) will go into developing the next phase of the e-Guardian project, a home-based health monitoring

## ISE HEAD ELECTED REGIONAL VICE PRESIDENT (ASIA), INSTITUTE OF INDUSTRIAL ENGINEERS

PROFESSOR Tang Loon Ching, Head of Industrial & Systems Engineering Department, has been elected Regional Vice President (Asia) of the Institute of Industrial Engineers (IIE) for the term 2013-2016. He is thereby appointed to the International Council of IIE.

Founded in 1948, IIE is the largest international, non-profit, professional society dedicated to advancing the technical and managerial excellence of industrial engineers. It is recognised internationally for its leadership role in the application, education, training, research, and development of industrial engineering.

Elaborating on how he would make things better for industrial engineers in his capacity as Regional Vice President position, Prof Tang said, "There are more than 450 IE departments in East Asia, excluding India, and more than 10,000 industrial engineers will be produced every year. I shall work towards providing stronger linkages between the IE communities in Asia with IIE. This will include, but not



limited to, promoting IIE as the premier professional society in uniting the global IE community and establishing an international certification programme in IE. In addition, there is a need to promote IE beyond the sphere of manufacturing sector and thus enhancing the visibility and influence of IE."

Enrolments in the B Eng (ISE) programme at NUS Engineering have increased by nearly three folds, from an annual intake of 40 per year to 110 per year over the last 10 years. Similarly, in mainland China, IE has been ranked 6 in terms of career choice due to strong demand from industry and the number of IE departments has grown from less than 10 in the 90s to more than 200 today. In developed countries such as Singapore, South Korea, Taiwan and Hong Kong, in tandem with the changing economic structure from manufacturing-centric to service centric, IE schools in these countries have also shifted their focuses from traditional IE to more diverse service sectors such as in IT, logistics, energy, healthcare and finance.

## OTHER NOTABLE STAFF ACHIEVEMENTS

**Prof Adeyeye Adekunle Olusola** was awarded NRF grant of \$9,228,416 (1 Dec 2013 to 30 Nov 2018) for his research, Pure Spin Current and Spin Wave Devices.

**Assoc Prof Marcelo Ang** was awarded \$1,357,200 A\*STAR grant for his project "Robot Application Development and Operating Environment" (1 Sept 2013 to 31 Aug 2016).

**Dr Akshay Kumar Rathore** was awarded 2013 IEEE Industry Applications Society Andrew W Smith Outstanding Young Member Award, USA (1 Aug) which recognises outstanding achievement and contributions to the profession by an IAS member less than 35 years of age.

**Prof Choo Yoo Sang** has been appointed a member of the Lloyd's Register Offshore Technical Committee for a period of 5 years. He was also awarded the SPRING Singapore Merit Award 2013 for his significant contributions to the national standards programme.

**Prof Neal Chung** was awarded NRF grant of \$4,392,200 for his project, Membrane Development of Osmotic Power Generation – Materials Development and Membrane Fabrication for the period, 1 Jan 2013 to 31 Dec, 2016.

**Dr Dieter Trau**, co-founder of NUS startup company, AyoxxA Pte Ltd, won 2nd Prize "Asian Entrepreneurship Award 2013" at the International Business Competition for young Asian entrepreneurs, in Japan.

**Assoc Prof Karina Gin** was awarded NRF grant of \$2,668,100 for her research, Monitoring of algal blooms and understanding the mechanisms of toxin and off-flavors production, for the period 1 Jan 2013 to 31 Dec 2017.

**Prof Ge Shuzhi** was awarded \$1,149,600 A\*STAR grant for his project "Distributed Sensing and Perception" (1 Sept 2013 to 31 Aug 2016).

**Assoc Prof Guo Yong Xin** was appointed Associate Editor of IEEE Antennas and Propagation.

**Prof Richard Liew Jat Yuen** was among the team from Meinhardt (Singapore), NUS and Hong Kong Polytechnic University which received the Grand Award, Hong Kong Institute of Engineers (HKIE) Structural Excellence Award 2013 (Overseas Project) for their Flower Dome and Cloud Forest Conservations -- Gardens by the Bay in Singapore. The award was conferred by the Joint Structural Division of the Hong Kong Institution of Engineers and The Institution of Structural Engineers UK.

**Dr Michael Joseph Hochberg** was awarded the NRF Fellowship 2013, garnering \$3,499,410 NRF grant for his project, "Silicon as a Platform for Ultra-High-Speed Photonic-Electronic Integration" (3 Aug 2013 to 2 Aug 2018).

**Assoc Prof He Jianzhong** was awarded NRF grant of \$2,082,500 for her research, Composition and dynamics of microbial communities and antibiotic resistant genes in water catchments, for the period 7 Jan 2013 to 6 Jan 2018.

**Prof Ng Kim Choon** was awarded NRF grant of \$7,441,190 (April 2013 to March 2018) for his research on air conditioning systems Efficiency.

**Prof Ng How Yong** was awarded Bill & Melinda Gates grant of \$1,397,611 (April 2013 to June 2014) for his project, "Low cost Decentralized Sanitary System for Treatment, Water and Resources Recovery (Phase 2)".



## OTHER NOTABLE STAFF ACHIEVEMENTS

**Mr Padmaja Krishnan, Prof Zhang Min-Hong, Prof Yu Liya and Dr Feng Huajun** won the Outstanding & Original Paper Award for their paper "Multi-functional building materials for photocatalytic degradation of particulate pollutants and self-cleaning of building surfaces" at the Conference on Our World in Concrete & Structures, Japan (21-23 Aug).

**Dr Daniel Pickard** was awarded NRF grant of \$9,973,000 for his research, Fundamental Limits and Applications of the Atomic Level Ion Source (Angstrom Level Imaging and Quantum Foundry) for the period 1 Feb 2013 to 31 Jan 2018.

**Assoc Prof Srinivasan Dipti** was awarded NRF grant of \$1,537,000 (April 2013 to March 2016) for her project, "Dynamic Optimisation and Energy Management for Smart Grids."

**Assoc Prof Vincent Tan Beng Chye** garnered \$2,394,000 MINDEF grant for his project "Analysis of Buried Pipes subjected to Shock and Impact Loads" (21 Aug 2013 to 20 Aug 2016).

**Dr Teo Chiang Juay** was awarded \$1,381,200 MINDEF grant for his project "Shimo" (30 Aug 2013 to 28 Feb 2015).

**Assoc Prof Tong Yen Wah** secured NRF grant of \$4,138,500 for his research, Fabrication, Demonstration and Pilot Study of Biomimetic Membranes for Desalination and Water Reuse, for the period, 1 Jan 2013 to 31 Dec 2017.

**Dr Qiu Anqi** in collaboration with another member from O&G Department was awarded \$1,078,185 by Ministry of Health for their project "Do Maternal Anxiety, Depression and Associated Parenting Practices Impact Infant Prefrontal Structure and Function?" for the period 7 Aug 2013 to 31 July 2016.

**Prof Yong Kwet Yew** has been appointed Co-Chair and Scientific Lead, R&D Committee on "Land & Liveability" National Innovation Challenge in June, for 3 years from 2013 to 2016. He has also been re-appointed Chairman, Accredited Checkers and Specialist Accredited Checkers (Geotechnical) Societies for another 3 years from 2013 to 2016.

**Assoc Prof Yu Liya** was awarded Reviewing Excellence by the international journal *Atmospheric Environment* in recognition of her high quality work and contribution to the advancement of scientific knowledge.

**Prof Wang Chien Ming** was elected Chairman of the IES/IStructE Joint Committee and IStructE Council Member for the period 1 January 2013 to 31 December 2014. He was also awarded Certificate of Grant of Patent for the invention of "A Pontoon-Type Floating Structure" for 20 years till 11 Jan 2025.

**Prof Wang Chi-Hwa** was appointed Executive Editor for Chemical Engineering Science Editorial Board, Elsevier, in Feb 2013.

**Mr Zhang Lei, Dr Raymond Ong and Prof Fwa Tien Fang** received Best Paper Award for Technological Innovation in the 10th International Conference of Eastern Asia Society for Transportation Studies, Taipei, Taiwan (9-13 Sept). The paper is entitled "A Numerical Study on the Influence of Aggregate Size on Skid Resistance Performance of Porous Pavements".

**Dr Zhou Zhi** secured NRF grant of \$1,246,400 for his research, Rapid and Accurate Quantification of Antibiotic Resistant Bacteria and Quantitative Risk Assessment for Water Security, for the period 7 Jan 2013 to 6 Jan 2016.



## GEP SCHOLAR FINISHES B ENG IN JUST 2.5 YEARS

HE obtained his B Eng degree in just 2½ years – the first student to do so at the NUS Faculty of Engineering. The degree usually takes four years to complete – or three years for Global Engineering Programme (GEP) students. But Mr Tan Peng Soon, 23, a Chemical Engineering student with the GEP did it in record time.

Peng Soon is now pursuing his Master's in Chemical Engineering at ETH-Zurich in Switzerland. "I wanted to challenge myself. I have been treading on prescribed routes through most of my education. But upon joining NUS, I wanted to try something that departs from the norm. GEP allows me to do just that. I had the freedom to choose my own modules and arrange my schedules accordingly. I really like the flexibility that GEP offers. With planning and hard work, it is possible to graduate in two and a half years," he said.

Peng Soon joined GEP in 2010 which provides students with opportunities to go abroad for study, work and play. "The experiences pushed us out of our comfort zones. The experience of having interned in the US, Netherlands and France, is truly enriching. In fact, I

spent approximately a third of my undergraduate studies overseas. This is something unique to the GEP," he said.

"I went to France for a Nanotechnology programme not knowing anything more than bonjour. I struggled with the language, but at the end of the day, I was able to integrate well with the locals and it turned out to be a life-changing experience for me. It gave me the confidence to pursue my Master's course in a predominantly non-English speaking university, ETH Zurich, instead of the usual American or English universities."



Mr Tan Peng Soon, GEP graduate majoring in Chemical Engineering, enjoys challenges.



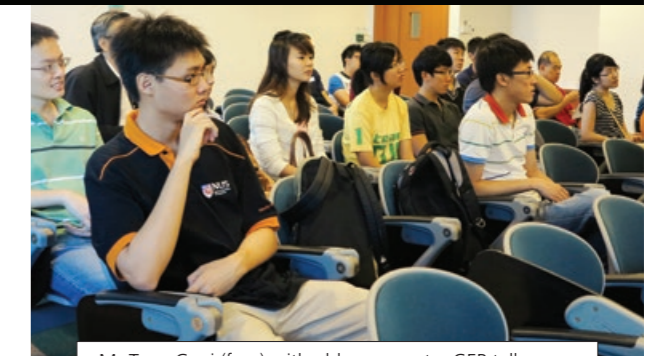
## HE GETS HIS B ENG DEGREE AT JUST 19

STRAIGHT from NUS High School to the NUS Faculty of Engineering, Mr Terry Gani Zhi Hao, 19, graduated with a B Eng (Chemical Engineering). A student with the Global Engineering Programme (GEP), Terry is the youngest to have obtained a B Eng in the history of NUS Engineering.

Recounting his experience in NUS, Terry said it has been very positive so far. "But sometimes, it can be tricky to find conversation topics with the guys who have completed their NS and who are essentially working-age adults at least five years older than I," said Terry.

Terry has always been intrigued with numbers and how things worked. He recalled being really interested in encyclopaedias and was set on a science or math-related career when he was in secondary school.

"At NUS High School, I had the chance to participate in several research projects including a six-month part time project on microfluidics in the Department of Physics at NUS. I enjoyed these projects and this led me to consider a career in research," he said.



Mr Terry Gani (fore) with older peers at a GEP talk.

"I found physical chemistry particularly deep, enthralling and in some sense, elegant. I am still very much fascinated by other disciplines like physics and math. I decided on chemical engineering just after I graduated from NUS High. I was very interested in the core ideas of chemical engineering – how large scale processes are developed based on the molecular properties of reactions and the physics of reactors."

Terry has plans to do his PhD after he finishes his national service.



## SHE STARTS SOCIAL ENTERPRISE ON DESIGN THINKING

HER training with Design-Centric Programme (DCP) has got her hooked on design thinking. Today, Ms Lee Pin Qi runs her own company, providing training on

not sustainable or effective. Hence, I would like to continue to make a difference to the teams I engage in, injecting learning components and programme planning know-how to the leaders."

With the help of a like-minded friend whom she got to know in one of her overseas trips to Cambodia, they have been customising curriculums for clients. Their clients are mainly school teachers, student leaders and working professionals dealing with community work. Design Thinking is a module they offer, under the umbrella of Social Entrepreneurship courses.

Pin Qi, who read Mechanical Engineering as a DCP student, said, "I was intrigued by the benefits which Design Thinking Methodology could bring to the society. 'Fail Fast, Fail Often' is one of the things I strongly believe

in. Innovators should not hold every idea so dearly, and should move on after each failure to create a better and more useful system."

Her social enterprise has also organised a kindness race called *Dash of Kindness* on National Day to promote daily acts of kindness. "These are small steps we are taking to complement our Service Learning trainings to achieve our grander vision of a more gracious society," she said.



DCP pioneer graduate, Ms Lee Pin Qi (2nd from right) now runs her own company on design thinking for community service providers. Picture shows her with her team mates at a street survey, very much a part of DCP training.

Design Thinking for organisations to come out with sustainable solutions for the community. Pin Qi started Service And Learning Training (SALT) Solution Pte Ltd in February, even before she graduated in July.

Said Pin Qi, "Since 2007, I have been actively involved in Service Learning Projects to Yunnan, Cambodia and Vietnam. Many teams go abroad each year to do service, but many may not understand the purpose behind these projects. As a result, they are often



## NEVER TOO OLD TO GO FURTHER IN ENGINEERING

HE started his own company, LSW Consulting Engineers, 23 years ago – with only two colleagues. Today, they are a registered private limited company with 38 staff. Mr Lauw Su Wee, 60, is the Managing Director – and a proud holder of a Master's degree in Geotechnical Engineering.

Said Mr Lauw who received his B Eng degree in Scotland some 30 years ago – and his Master's degree at NUS Engineering in 2013, "Given the increasing complexities in civil engineering design work faced by our engineers today, the knowledge that I have acquired has gone a long way to help me come up with more innovative solutions to overcome the problems that arise in doing an engineering analysis. I'm also more confident about approaching complex calculations and telling our clients what methods we should adopt to solve the engineering obstacles faced during construction."



Managing Director, Mr Lauw (circled) manages to overcome tight schedules and sleepless nights to obtain his Master's degree in Geotechnical Engineering at NUS Engineering Commencement 2013.

On why he decided to continue his studies when he was already an accomplished engineer running his own business, he said: "As engineers, we possess a spirit of curiosity, where we want to find solutions to challenges and unknowns we face at work from day to day. For this reason, I pursued a Masters in Geotechnical Engineering because I felt the need to deepen my understanding in this area of underground and foundation engineering."

He said that Geotechnical Engineering has evolved from being an engineering art to a more defined science today.

"This meant that there are many academic discoveries that I am keen to learn, so that my industry experience can be further complemented with a good foundation of theoretical understanding. It doesn't matter whether I'm 60 or 40 years old, what was more important to me is the opportunity to be taught new things at the University," he added.



## PIONEER DCP GRADUATE RETURNS TO TEACH

PIONEER Design-Centric Programme (DCP) student Ms Lim Fang Ming is rather well-heelled. So is the device she has designed and built with her team – a solution for stroke patients to continue their gait rehabilitation while lying down. The device has accompanied her to the US in 2012 where it was voted at the 2012 IEEE Healthcare Innovation Conference in Houston as the quickest device to gain market entry and the top device to have potentially the biggest impact on healthcare. In 2013, it also emerged champion out of 31 competing entries at the international session of the 2013 Capstone Design Fair organised by the Korean Association for Innovation Engineering Education, and the Accreditation Board for Engineering Education.

Fang Ming has since graduated in July – and back with NUS Engineering as a teaching assistant with DCP. She has also been offered a Management Associate post at a bank but decided to return to DCP – her way of "paying back" to the University. Recalling why she had joined DCP when she was a freshman, she said:

"I was really intrigued by what the programme had to offer – the opportunity to work in a multi-disciplinary team and on a multi-year project. This was to me, the door to endless learning opportunities and possibilities. Being able to work in a multi-disciplinary team meant that one does not need to be afraid of tackling topics unfamiliar to one's discipline but can instead take this

opportunity to engage in peer learning. Working on a multi-year project meant that ideas could be taken to the next level, from conceptualisation through to design, implementation and operation. Being able to embark on a project under themes such as Engineering in Medicine, Future Transportation Systems, and Smart Sustainable Cities was also a refreshing concept. With the opportunity to work on projects different from the mainstream, and to read and experience engineering from a different perspective, it was difficult not to be drawn to the programme."

In the long term, Fang Ming plans to pursue further education in the medical field.



The NUS team at 2013 Capstone Design Fair. From left: Engineering Deputy Dean, Prof Lim Seh Chun, Dr Yu Hao, Ms Lim Fang Ming, and Ruyi with their design product, the Supine Gait Training Device for Stroke Rehabilitation.

## THEIR SMART WATCH WINS INTERNATIONAL RECOGNITION



The team, Rahul Rajeev (2nd from left), Shambavi (centre) and Christian Halberg (2nd from right) at UC Berkeley.

A team of Design-Centric Programme (DCP) students Shambavi Krishnamurthi, Rahul Rajeev and Nguyen Vo working with an NUS MBA student, Christian Halberg have designed a smart watch which measures vital signs such as heart rate, body temperature, physical activity and blood glucose.

The team has pocketed quite a few awards for their project. On home ground, they were short-listed as one of the 28 finalists in Start-Up@Singapore 2013 from

over 460 teams, as well as judged the Best Project in the NUS School of Computing Term-end Project Showcase 2013 for Interaction Design. They also garnered the Merit Award in the National Assistive and Rehabilitative Technologies Challenge 2013 (Design Category).

Internationally, they won the 1st Prize (Biotechnology Category) at the 2013 GlobalTiC Talentpreneur Award & Forum, Taipei, Taiwan, besides grabbing the "Best Exhibition" title. They also returned from the Intel Global Challenge at UC Berkeley with the "Best Team of Young Entrepreneurs" title and a cash prize of US\$5,000.

"Over 350 million people all over the world prick themselves every day to get their blood glucose levels. It is painful, inconvenient and costly. We want to help patients harness the power of personal analytics," said Shambavi.

"We aim to further optimise our technology. We are conducting more trials to ensure accuracy and repeatability. Upon receiving positive results, we aim to bring this device to the hands of diabetics," added Rahul.

## CIVIL ENGINEERING STUDENT PUTS TOUGH TIMES BEHIND

HER first thought upon graduation was to take her parents and siblings on a holiday overseas. Ms Tay Suet Wai, who graduated in July, said she would like to give her family a treat – her parents have not been overseas since their honeymoon.

Getting a B Eng degree has not been easy for Suet Wai. Finding part time jobs has become very much a part of her life since she was 16. Coming from a poor family, she has not received pocket money after she finished her A-levels.

"I used to walk to NUS for my classes to save on transport fees. I did my work and studied at the university most of the time so that my consumption of electricity will not add to the household bill," said Suet Wai.

Despite being uneducated, her parents have managed to pass down valuable lessons from the school of life. "They are very down to earth people who work hard to be self sufficient. I learnt from them not be overly competitive but to help others as much as we can," she said.



Having a positive outlook has helped Suet Wai overcome some hard times.

"I'm really grateful to have been offered help in my education all these years. The Phan Kah Foh Bursary has especially helped me and my family when we were undergoing the most stressful period, when expenditures shot up as my siblings and I began to attend institutions of higher learning. Come to think of it, I really feel fortunate and all the more I should strive hard in whatever I do, and be able to help others whenever possible."

## NO SKY'S TOO HIGH



NUS and Nanjing University of Science & Technology (NUST) formed joint UAV Team, NUS2T Lion to win the New Innovation Star Award, and 2nd prize (Rotor-Wing Category) of the Beijing International UAV Innovation Grand Prix.

UNMANNED Systems Research Group from the NUS Department of Electrical & Computer Engineering returned triumphant from the Beijing International UAV Innovation Grand Prix (19-25 Sept) – taking home the New Innovation Star Award (CNY 10,000) in the Creativity Category and 2nd prize (CNY 80,000) in the Rotor-Wing Category.

Joining hands with Nanjing University of Science & Technology (NUST), they formed two teams to take part in the two categories. They competed with a total of 120 teams from universities, as well as civilian and military research institutes such as the Chinese Academy of Sciences, Tsinghua University, Beijing University of Astronautics and Aeronautics and Nanjing University of Astronautics and Aeronautics.

In the Rotor-Wing Prix, competitors had to perform several tasks using a rotorcraft such as a helicopter. The UAV has to be fully autonomous when performing a list of tasks, like navigating to a moving ship and transferring the buckets on its side to another moving ship.

Said NUS rotorcraft team co-leader, Mr Phang Swee King, "Being precise when grabbing and releasing the buckets was one of the most challenging tasks.

As commercial GPS was not able to give us the accuracy we are looking for, we had to incorporate multiple sensors, using a camera and a laser scanner."

In the Creativity Prix, competitors had to design a new type of aircraft and to prove that it works. Though the NUS team achieved 11th position out of 76 teams, they garnered the New Innovation Star Award for their craft's unique features.

"Our platform primarily is able to perform vertical take-off and landing while transforming into fixed-winged mode to enhance flight efficiency and endurance. It has unique features such as the vector-thrust contra-rotating motors and adjustable canards to achieve stable hovering control and a 4-bar linkage mechanism which allows the folding of its wings, resulting in a compact platform design. It also features automatic adjustment of the centre of gravity while switching between modes to improve overall stability. We are one of the few teams that could achieve safe take-off, level flight and landing while exhibiting the innovative features of our platform," said Mr Kevin Ang, leader of the Creativity team.



## OTHER NOTABLE STUDENT ACHIEVEMENTS

**Abhra Roy Chowdhury**, PhD student supervised by A/P Panda Sanjib Kumar, received IEEE Oceanic Engineering Society Scholarship, Falmouth, Massachusetts, USA. This scholarship is given to the students enrolled full-time at an accredited college or university in a field of study that will lead to a career in ocean engineering or a related ocean science field.

**Ashwani Kumar** (joint author with Dr Teo Kwong Meng) won the Brian Mar Best Student Paper Award for their paper, "A Systems Perspective to Commuter Cycling in Urban Mobility" at the 23rd Annual International Symposium of the International Council on Systems Engineering (INCOSE) 2013, held in Philadelphia, USA.

**Chen Hangzheng, Chen Xinwei** and **Yu Xiaoxiao** were awarded individually, the World Future Foundation Prize in Environmental and Sustainability Research for having outstanding theses in the area of Environmental and Sustainability Research.

**Chen Yiguo**, PhD student supervised by Assoc Prof Hong Minghui, Prof Stefan Maier, Imperial College and Prof Boris Luk'yanchuk, DSI, received Best Young Researcher Paper, 9th Asia-Pacific Near-Field Optics Conference, Singapore.

**Goh Bing Hui, Terence** was awarded Student Presentation Award – Best Poster at the 13th International Symposium for Therapeutic Ultrasound 2013, Shanghai, China, organised by the International Society for Therapeutic Ultrasound.

**Jiang Xinjia** received the National Semiconductor Gold Medal for being the higher degree graduate in the Department of Industrial & Systems Engineering who has published the best research paper that has been accepted by an international journal.

**Ong Khim Ping**, supervised by Prof Fwa Tien Fang, was awarded best paper award in the 8th International Conference in Road and Airfield Pavement Technology in Taipei, Taiwan. His paper was selected among the 214 papers presented in the conference which was attended by more than 800 participants from 32 countries.

**Tong Yi**, PhD student supervised by Dr Yeo Yee Chia, received Solid-State Devices and Materials (SSDM) Young Researcher Award 2013, Japan.



## OTHER NOTABLE STUDENT ACHIEVEMENTS

**Zhan Chunlei**, supervised by Dr Yeo Yee Chia, won the Best Student Paper Award, 2013 Very Large Scale Integration – Technology, Systems and Applications Conference, Hsinchu, Taiwan.

Team comprising **Cheng Youyang, Deng Di, Wang Kangli, Li Xiang** and **Tian Hongyu** won the gold medal for Automated Championship Award at the Singapore Amazing Flying Machine Contest 2013, as well as two other gold awards – Autonomous Best Performance Award and Most Creative Award. Team comprising PhD students **Wang Fei, Phang Swee King, Kevin Ang Zong Yao** and **Liu Peidong** won the Gold medal for the Most Creative Platform.

Team comprising comprising **Guo Yueheng** and **Arjun Arora** emerged first-runner up at Peaktime 2013 held in Riga, Latvia.

Team comprising **Raymond Kwek, Mok Siu Pan, Isaiah Lim, Goh Yong Liang** and **Reico Ng** won top prize in the Autonomous Systems Category at the Singapore Space Challenge 2013.

Team comprising **Chen Shiyi, Aw Gan Siong, Desmond Wei, Reuben Phoa Bao Cun** and **Er Yong Quan** won top prize in the Mini-Satellite Category at the Singapore Space Challenge.

Team comprising **Loh Wei Yang, Brian, Chan Andre Mikal, Han Nuomin, Ee En Min Hannah, Jeremy Lee Kong Yoong** and **Leong Qian Wei** won top prize in the Aviation & Aerospace Category at the Singapore Space Challenge.

Team comprising **Siddharth Rajgopalan Kshitij Jhunjhunwala, Nishant Jalgaonkar, Prateek Sinha** and **Yashvardhan Agarwal** won the Humanism Award by the Feng Yuan Education Foundation at the Teco Green Tech Contest (27 Aug) held at the National Taiwan Science Education Centre. Their invention, Low Cost Chili Dehydrator also won the Highest Popularity Award as the team presented a mock-up of their product and actively engaged the audience by talking to them about the plight of the farmers in India & allowing them to taste Indian food made from dried chili.



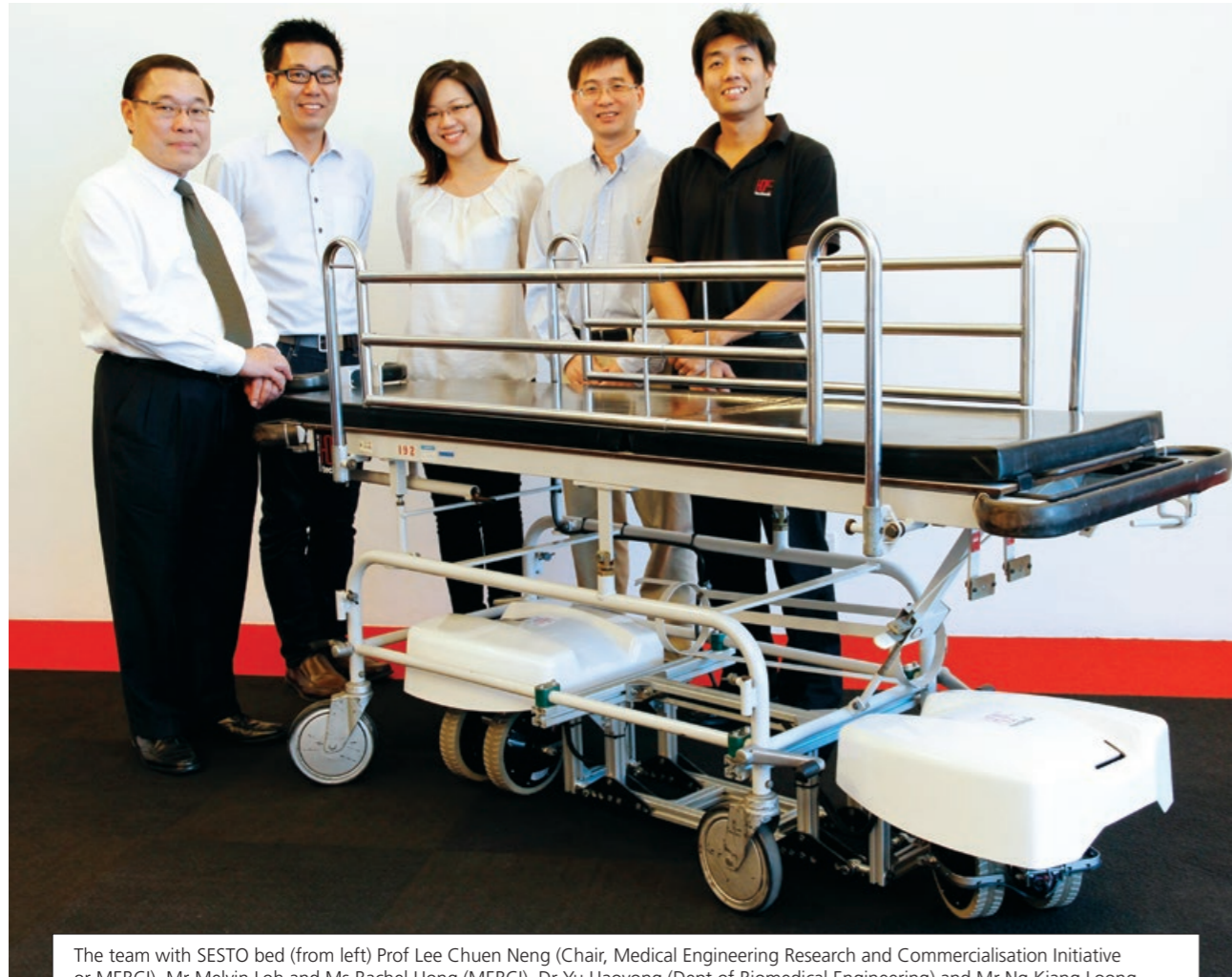
## ALUMNI WORK WITH NUS TO DESIGN SAFE AND EASY-TO-MOVE HOSPITAL BEDS

HOPE Technik founded by NUS Engineering alumni has always believed in the development of technologies to add value to society and the community. The company is currently working with NUS researchers to translate a motorised hospital bed prototype into a commercially viable product.

The hospital bed, called SESTO, requires only one person to handle. It can be easily wheeled from one place to another as well as maneuver tight corners. The key lies in an omni-directional mobility wheel designed by a team led by Dr Yu Haoyong, NUS Department of Biomedical Engineering, and the

NUS Engineering Design & Innovation Centre (EDIC). Said Dr Yu Haoyong:

“The bed can move in any direction instantly and easily, without any complicated maneuvering, making it ideal for the busy hospital environment. I am delighted that my long-time industry collaborators, Hope Technik, will co-develop and drive the commercialisation of this product. Moving forward, EDIC would also like to continue developing the technology involved, as we see potentials for it to be applied to a wide range of applications, for example, personal mobility aids for the aged in eldercare facilities.”



The team with SESTO bed (from left) Prof Lee Chuen Neng (Chair, Medical Engineering Research and Commercialisation Initiative or MERCI), Mr Melvin Loh and Ms Rachel Hong (MERCI), Dr Yu Haoyong (Dept of Biomedical Engineering) and Mr Ng Kiang Loong, Hope Technik.



## GALA AWARDS FOR STERLING CONTRIBUTIONS BY NUS ENGINEERING ALUMNI



Senior Minister of State Mr Lee Yi Shyan (far left) being congratulated by NUS President, Prof Tan Chorh Chuan. Mr Tan Sim Chuan (centre), EASH recipient, gets a firm handshake from Prof Victor Shim, Vice Dean (External Relations).

IT was not too long ago when the Engineering Alumni Gala Dinner marked the 55th anniversary of Engineering at NUS. Three years later, the NUS Faculty of Engineering has risen from 9th to 7th place according to the QS World University Rankings. Alumni strength has also grown from fewer than 50 in the initial cohort to more than 47,000. Many have done well in their careers and in their contributions to nation and society. The recipients of the 2013 Distinguished Engineering Alumni Award (DEAA) and the Engineering Alumni Service Honours (EASH) are notable examples.

Mr Lee Yi Shyan, Senior Minister of State, Ministry of Trade and Industry and Ministry of National Development from the Class of 1986 was conferred the 2013 DEAA; while Mr Tan Sim Chuan, the Faculty's young Class Ambassador from the Class of 2009 was conferred the EASH.

The two Engineer-Leaders were honoured at the Engineering Alumni Gala Dinner 2013 held on 1 November, at the Kent Ridge Guild House. The occasion was attended by more than 200 with alumni going back all the way to the Class of 1974.



## TIES BINDING THREE ENGINEERING ALUMNI ALSO CEMENT THEIR SUCCESS

THREE NUS Engineering alumni – Vincent Tan (Mechanical Engineering), Henry Seah (Chemical Engineering) and Tan Jinglun (Computer Engineering) founded the online motoring portal sgCarMart in 2004 when they were undergraduates. When two of them were graduating (2006) they had to make a tough decision – to give up their business – or find a job which would probably pay more than what they were getting at that time.

They chose to keep their business. They worked even harder, earning the trust of car dealers, often visiting them three times a week to take pictures of cars to upload them on their online site. The company managed to break even in 2007, and grew from a three-person team



Engineering alumnus, Mr Vincent Tan, managing director of sgCarMart.

to more than 60 staff. In March 2012, sgCarMart is reported to have annual revenue of \$5 million with over 10,000 listings on its site.

If they had given up during the hard times, they would not be where they are today. After selling SgCarMart to Singapore Press Holdings (SPH) for a cool \$60 million, they continue to be good friends and colleagues working with SPH to run sgCarMart. Vincent is the managing director. Jinglun heads the IT while Henry leads the marketing and public relations.

A celebrity in his own right, Vincent had always said that the glue that kept them together as friends is the same glue for success today.



## ENGINEER WITH A PASSION FOR ENVIRONMENTAL PUBLIC POLICIES

BEEN there, done that? NUS Engineering alumnus Amlan Saha would be the last person to admit this. There are still a lot of things which he wants to do.

The Electrical & Computer Engineering alumnus (Class of 98) is currently Vice President of the energy/environmental consulting firm MJ Bradley and Associates (MJB&A). After graduating with a B Eng degree, Mr Amlan worked at a national research laboratory before setting up an internet/telecoms company. The startup went bust in 2001 along with the burst of the dotcom bubble.

Undaunted, he went to work for the German engineering giant Siemens, even as he began to think about graduate school. On a boat journey along the River Nile, an inspiring conversation with a fellow passenger who had just returned from volunteering with the Peace Corps in Ghana, led him to think of weaving public policy in his graduate school plans.



An engineer at heart, he found it exciting to be able to shape political processes that create rules, regulations, and programmes to impact society. So in 2004, he enrolled in the Fletcher School of Law and Diplomacy (MALD) and HEC Paris (MBA) dual degree programme. In the MBA part of the program he focused on economics and finance while at Fletcher public policy and international security studies took up most of his time.

His work at MJB&A involves assisting energy companies to navigate regulatory and market issues as well as assessing economic implications of environmental regulations. He also drives the wholesale electricity market development.

“Uniquely satisfying rewards at work include, among others, having the Chairman of the Environmental and Public Works Committee in the US Senate refer to my analysis when discussing energy legislation; and a Congressman using my work as a prop to explain to constituents his support for an energy bill,” said Mr Amlan.



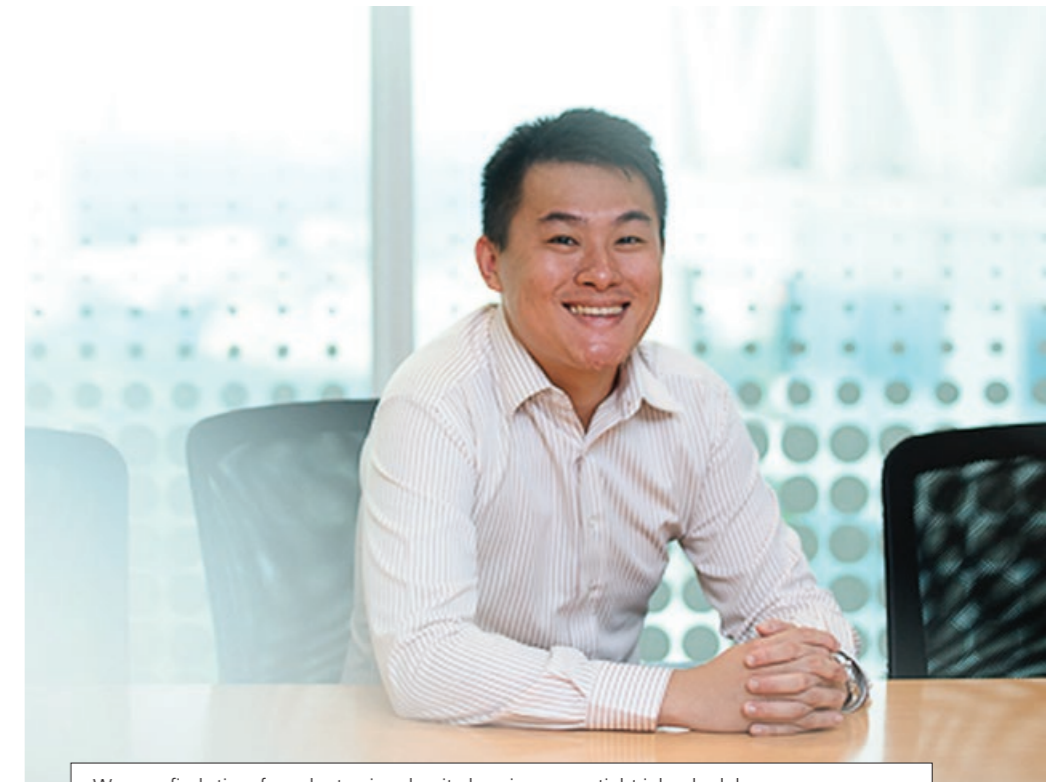
## ESP ALUMNUS CONTINUES HIS HABIT OF HELPING OTHERS

HIS heart for the community does not skip a beat. Engineering Science Programme (ESP) graduate, Mr Tan Wenyu holds a demanding job with the equity-financing division of SPRING Singapore but still finds time to volunteer with social enterprises such as Princeton Mind and ISCOS (Industrial & Services Co-operative Society Ltd) which helps former offenders reintegrate into society.

Wenyu (Class of 2011) has been active in social entrepreneurship since his undergraduate days. “My NUS Overseas Colleges stint in rural India has served me well. Even now, I am continuing some of the work which I have done there, such as mentoring youths,” he said.

“Princeton Mind helps ex-offenders reintegrate into society through entrepreneurship. We taught our first class in August last year, to help those who have the ambition to start their own business but no idea how make this happen. There is also *Got Food?* an F&B outlet which employs ex-offenders as apprentices and providing them the opportunity to learn new skills and to become entrepreneurs,” said Wenyu.

“Not only will they learn to cook great food they will also learn how to manage a store, from customer service to logistics and marketing. We then assess their



Wenyu finds time for volunteering despite keeping a very tight job schedule.

suitability to be an entrepreneur. Those found suitable will be allowed to hold sub-franchise licence so that they can start their own enterprises. We are working very hard to secure good locations for disadvantaged individuals to run their businesses,” he added.

## STUDENTS

### CLASS OF 2013

BEng	1575
MSc	693
MEng	57
PhD	270
<b>TOTAL</b>	<b>2595</b>



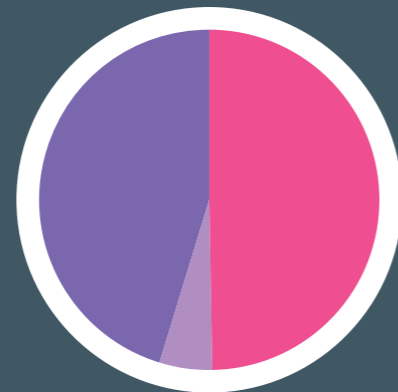
### UNDERGRADUATE STUDENT ENROLMENT

Engineering	83
B Tech	1235
Bioengineering	372
Civil Engineering	433
Electrical Engineering	946
Industrial & Systems Engineering	411
Materials Science & Engineering	266
Mechanical Engineering	1417
Chemical Engineering	1186
Computer Engineering	485
Engineering Science	165
Environmental Engineering	299
<b>TOTAL</b>	<b>7298</b>



### GRADUATE STUDENT ENROLMENT

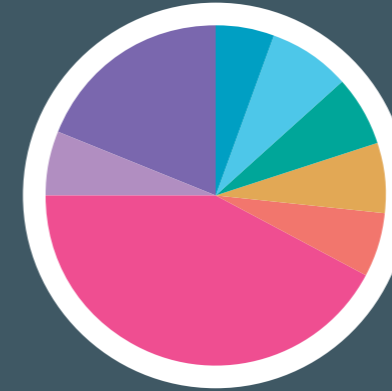
MSc	1267
MEng	130
PhD	1149
<b>TOTAL</b>	<b>2546</b>



## STAFF

### STAFF PROFILE

Professors	90
Associate Professors	126
Assistant Professors	103
<b>TOTAL NUMBER OF FULL-TIME FACULTY MEMBERS</b>	<b>319</b>
Adjunct Staff	109
Other Teaching Staff	96
Research Staff	673
Executive & Professional Staff	97
Non-Academic Staff	301
<b>TOTAL STAFF STRENGTH</b>	<b>1595</b>



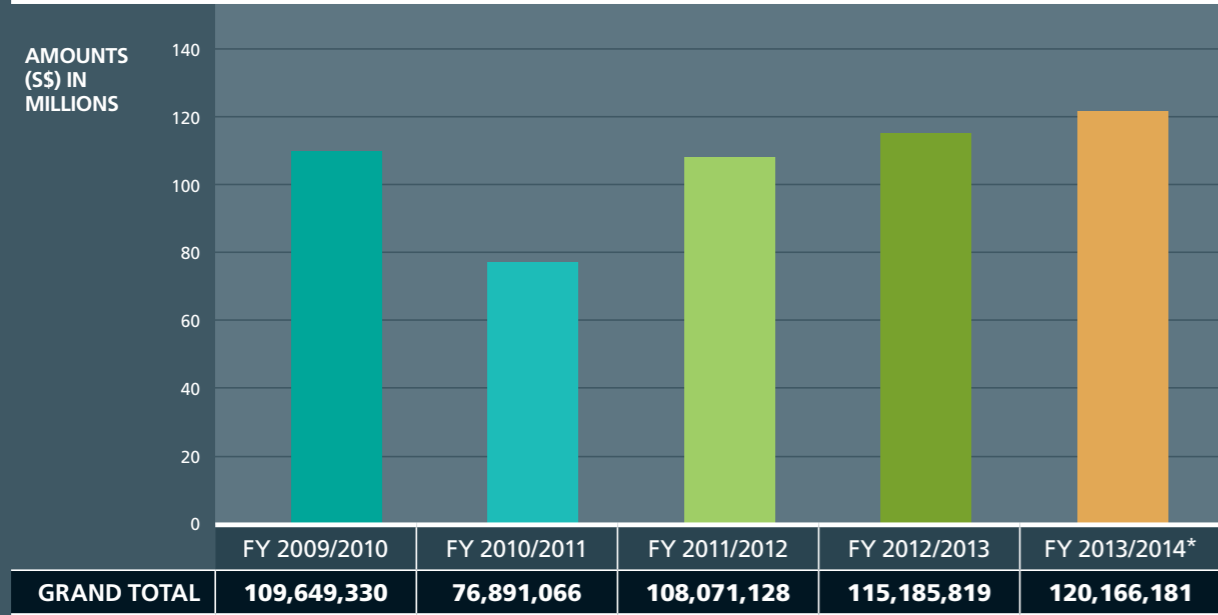
## RESEARCH

### ENTREPRENEURIAL ACTIVITIES AT NUS FACULTY OF ENGINEERING (as at 31 December 2013)



## RESEARCH

### RESEARCH GRANTS AWARDED TO FACULTY OF ENGINEERING (excluding Research Scholarships)

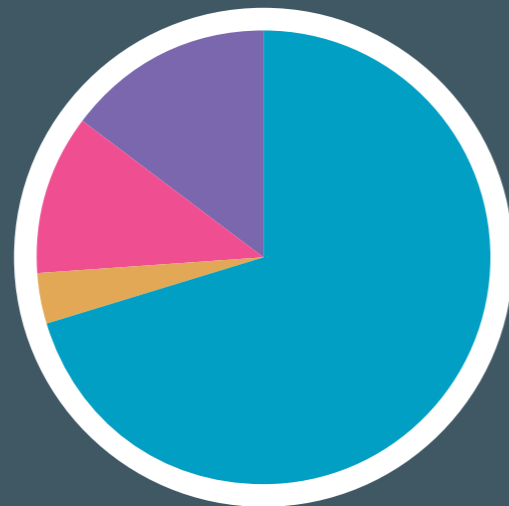


\*Period reported: 1 April 2013 – 31 December 2013

### RESEARCH GRANTS AND SCHOLARSHIPS AWARDED IN FY 2013/2014

(period reported: 1 April 2013 – 31 December 2013)

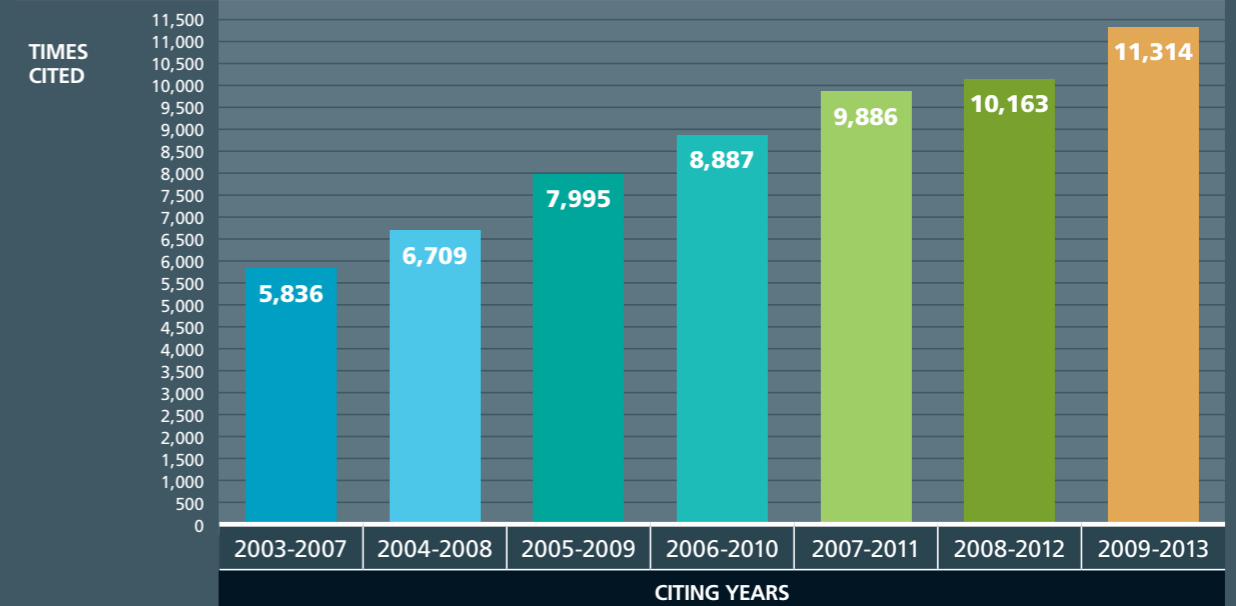
External Research Grants	<b>S\$103,650,066</b>
70.50%	
External Research Scholarships	<b>S\$5,336,482</b>
3.63%	
MOE Research Grants	<b>S\$16,516,115</b>
11.23%	
MOE Research Scholarships	<b>S\$21,516,435</b>
14.64%	
<b>GRAND TOTAL</b>	<b>S\$147,019,098</b>



## RESEARCH

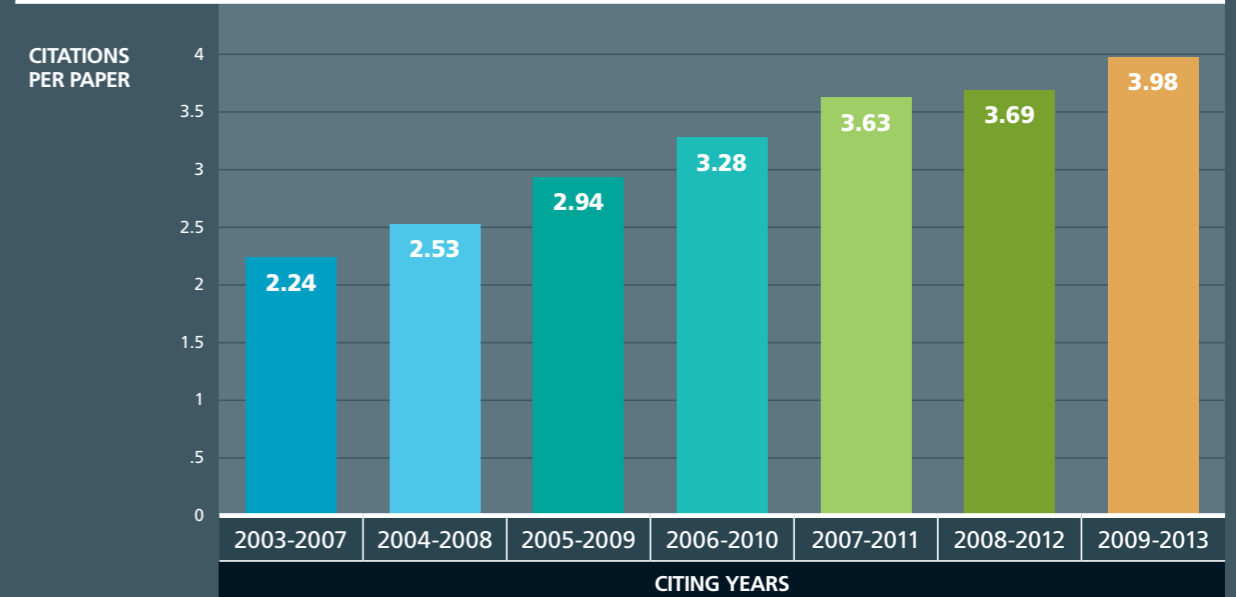
### NUMBER OF CITATIONS (in 5-year intervals)

Essential Science Indicators has been updated as of November 1, 2013 to cover a 10-year plus eight-month period, January 1, 2003 – August 31, 2013.



### AVERAGE CITATIONS PER PAPER (in 5-year intervals)

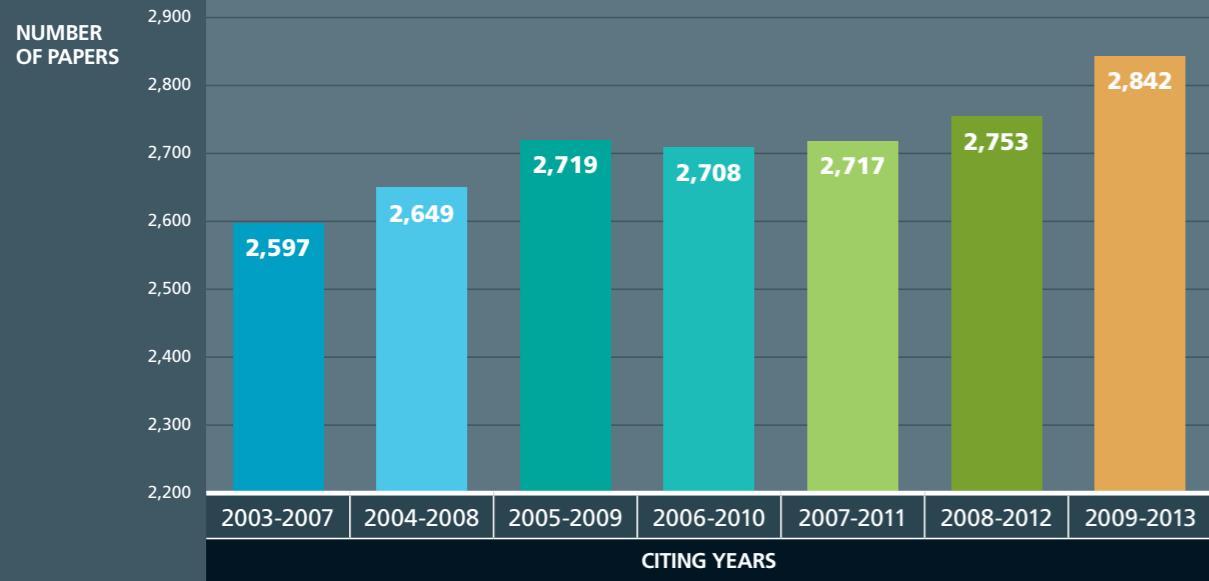
Essential Science Indicators has been updated as of November 1, 2013 to cover a 10-year plus eight-month period, January 1, 2003 – August 31, 2013.



## RESEARCH

### NUMBER OF PAPERS (in 5-year intervals)

Essential Science Indicators has been updated as of November 1, 2013 to cover a 10-year plus eight-month period, January 1, 2003 – August 31, 2013.



## **FACULTY OF ENGINEERING**

**National University of Singapore**

9 Engineering Drive 1

Singapore 117575

Tel: (65) 6516 3445

Fax: (65) 6779 5594

[www.eng.nus.edu.sg](http://www.eng.nus.edu.sg)