THE INTERNATIONAL YEAR OF SUSTAINABLE ENERGY FOR ALL

2012 ANNUAL REPORT
“Our partnership with the Foundation has many layers, of students, researchers, and resources flowing back and forth. It assists us to provide the best possible opportunities for each to thrive.”

PROFESSOR BRANKA VUCETIC, HEAD, ELECTRICAL AND INFORMATION ENGINEERING
## CONTENTS

<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>The Foundation</td>
</tr>
<tr>
<td>03</td>
<td>President's report</td>
</tr>
<tr>
<td>04</td>
<td>Head of School's message</td>
</tr>
<tr>
<td>05</td>
<td>28th AGM and Annual Dinner</td>
</tr>
<tr>
<td>06</td>
<td>Energy storage</td>
</tr>
<tr>
<td>08</td>
<td>Major refurbishment projects</td>
</tr>
<tr>
<td>09</td>
<td>Billion dollar skills</td>
</tr>
<tr>
<td>11</td>
<td>Research conversazione</td>
</tr>
<tr>
<td>14</td>
<td>Scholarships &amp; prizes</td>
</tr>
<tr>
<td>19</td>
<td>International scholarships</td>
</tr>
<tr>
<td>20</td>
<td>International partnerships</td>
</tr>
<tr>
<td>21</td>
<td>Indigenous Strategy</td>
</tr>
<tr>
<td>22</td>
<td>Postcard from Oxford</td>
</tr>
<tr>
<td>23</td>
<td>Honorary Award</td>
</tr>
<tr>
<td>24</td>
<td>Honorary Doctorate</td>
</tr>
<tr>
<td>26</td>
<td>Top 100 Influential engineers</td>
</tr>
<tr>
<td>28</td>
<td>Sustainable Energy for All</td>
</tr>
<tr>
<td>30</td>
<td>Graduation</td>
</tr>
</tbody>
</table>

### RESEARCH

<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>Research In Review</td>
</tr>
<tr>
<td>35</td>
<td>Future Energy Networks</td>
</tr>
<tr>
<td>36</td>
<td>Future Grids</td>
</tr>
<tr>
<td>38</td>
<td>ARC Fellowship</td>
</tr>
<tr>
<td>39</td>
<td>Biomedical</td>
</tr>
<tr>
<td>40</td>
<td>Computer</td>
</tr>
<tr>
<td>42</td>
<td>Audio</td>
</tr>
<tr>
<td>43</td>
<td>Photonics</td>
</tr>
<tr>
<td>44</td>
<td>Software</td>
</tr>
</tbody>
</table>

### FINANCIAL STATEMENTS 2012

<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>Membership</td>
</tr>
<tr>
<td>47</td>
<td>Council Members</td>
</tr>
<tr>
<td>50</td>
<td>Governance Statement</td>
</tr>
<tr>
<td>52</td>
<td>Council Members' report</td>
</tr>
<tr>
<td>54</td>
<td>Financial Statements</td>
</tr>
</tbody>
</table>

Cover Images:
Top: Anderson Building, Camperdown Campus
Middle: Kenya Skybox™ with child.
Inside: Students at The Quadrangle, Camperdown Campus.

This report highlights the United Nations General Assembly designation of 2012 the International Year of Sustainable Energy for All
THE FOUNDATION

OUR RULES
The Electrical and Information Engineering Foundation was established by the Senate of the University of Sydney in 1983.

Under the Rules for Foundations, the Foundation’s principal objects are:

— to increase the resources of the University (by fundraising or by otherwise securing gifts and grants or by securing the provision of services or other non-financial contributions, including community engagement) to assist the Senate and the Vice-Chancellor in the promotion of the object of the University in relation to the field of Electrical Engineering through the School of Electrical and Information Engineering.

OUR PURPOSE
We aim to ‘bridge the gap’ between the University, industry and professions to achieve world-class results in the field of electrical engineering.

The Foundation works in close association with the School of Electrical and Information Engineering to provide support for teaching and research.

The support of foundations has become a crucial element in fostering new initiatives at the University and this assistance will continue to be important in a time of decreasing government funding for the university sector.

admits members

This purpose is at the heart of our 2011-15 Strategic Priorities.

OUR OBJECTIVES
Our Strategic Priorities outline a range of strategies to support the School to achieve its vision to be a leading international school in electrical and information engineering research and education.

We aim to implement these priorities through committees. Each committee reports to the Council and has a number of initiatives to be prioritized in consultation with the Head of School.
The year of 2012 was notable for the recognition of outstanding contributions to Australia by University of Sydney electrical engineering alumni. The Foundation extends warm congratulations to Mr Rhett Butler, Dr John O’Sullivan and Prof David Skellern whose distinguished service to science and engineering has been recognised in the Australia Day Honours and by the University. Their contributions are profiled in this year’s annual report.

During the year under review, the Foundation continued its support of the School’s teaching and research programs through the EIEF Undergraduate Scholarship Program which offered five undergraduate entry scholarships; the EIEF Prizes Program offered prizes for outstanding achievement in the final year in all five streams of electrical engineering and in the category of achievement for women in the first year through to the final year; and the many industry prizes for the research poster exhibition sponsored by our members.

At its meeting in September, the Foundation prioritised four of the 32 recommendations from the final report and recommendations of the review of the members’ value proposition for implementation next year. I wish to thank members who took the time to participate in the survey.

Under the leadership of Professor Archie Johnston, the Faculty is ranked in the world’s top 75 in engineering/technology and computer sciences in the Academic Ranking of World Universities (compiled by Shanghai Jiao Tong University to rank universities globally). Engineering is the only individual discipline at Sydney ranked in the top 75 in the Shanghai rankings. In the Excellence in Research for Australia 2012, the faculty was ranked “well above world standard” and “above world standard” for electrical engineering. The Foundation commends the achievements of the School in terms of its operating surplus of $1.26 million and successful capital infrastructure grant of $2.65 million.

It gives me great pleasure to announce the following were invited to join Council in 2012 and have accepted:

- Dr. Michael Brünig
- Mr. Colin Peacock

It is with sadness that I report the death of Mr. Ian Cutler, a valued and respected governor member of the Foundation. A letter of condolence has been sent to Sinclair Knight Merz.

I would like to thank the Council’s office-bearers, Deputy President, Peter Tyree and the Director of the Foundation, John Gaskell. In particular, the support of the Dean and the office of General Counsel is crucial to our effectiveness. I thank Professor Archie Johnston and Shauna Jarrett for the governance support of the Foundations at the University.

I would like to thank Peter Handel and Raj Kapoor who resigned from Council in 2012. Their contribution was very much appreciated. I would also like to thank Dianne Ellis in as Executive Officer to the Council and Foundation whose work makes our strategy so effective.

GEORGE MALTABAROW
HEAD OF SCHOOL'S MESSAGE

It is a pleasure for me to contribute my final report as Head of School to the Annual Report of the Electrical and Information Engineering Foundation. The contribution the Foundation makes to the work of the School is vital; without this support there would be many thinks we simply could not do.

I warmly thank all members of Council who donate their time to support our work. George Maltabarow provides strong leadership as President. I greatly appreciate the counsel of the Director of the Foundation, John Gaskell and the numerous contributions of industry governor members.

In 2012, the School continued to work through its strategic priorities to bring about long lasting improvement to students’ learning experience; graduate outcomes and attributes; program contents that encourage academic rigour and meet industry requirements; and its ability to continue producing world leading research outcomes. These are:

- Increased the undergraduate student numbers by 12% compared to 2011
- Increased the postgraduate research student enrolments by 5% relative to 2011
- Increased the overall research funding by 26% relative to 2011
- Reduced the operating costs through space consolidation and change management in teaching laboratories
- Refurbished two teaching and two research laboratories
- Achieved a financial turnaround with a surplus in the operating budget in 2012 of $1,260,921 and even a higher projected surplus in 2013

Our partnership with the Foundation has many layers, of students, researchers, and resources flowing back and forth. It provides opportunities to leverage industry partnerships with members of the Foundation. We are grateful to the Foundation for its continued support.

PROFESSOR BRANKA VUCETIC
In April 2012 the Foundation hosted the 28th Annual General Meeting and Annual Foundation Dinner. The annual Foundation Dinner provides members with the opportunity to meet with industry and government leaders in a social occasion and to gain insights into key issues that will dominate a relevant industry in the next 10 years.

The Hon Chris Hartcher, NSW Minister for Resources and Energy Minister for the Central Coast and Special Minister of State delivered the keynote address to over 250 distinguished guests, governor members and alumni.

Participating Governor members:
Aurecon
Ampcontrol
Ausgrid
Evans & Peck
GHD
Jubatus Consulting
Leighton Contractors
Lend Lease Infrastructure Services
Siemens
Telstra
Thiess
Thiess-Services
UGL Infrastructure
Xstrata

Our thanks to our sponsors for their generous sponsorship.

(Photo courtesy of The Sydney Magazine and Fairfax Photographic Collection).
ENERGY STORAGE - A QUIET REVOLUTION?

ENERGY STORAGE - THE MISSING TECHNOLOGY

In June, the University hosted a presentation on Energy Storage – the Missing Technology by Prof. Tony Vassallo, Delta Electricity Chair in Sustainable Energy.

First published in EnergyNews.

Together with clean technology, smart or intelligent grids and distributed energy, energy storage is identified as part of a technological revolution that is likely the largest change since the dawn of the industrial revolution and potentially the second industrial revolution. Here is an extract from the presentation.

Electricity is the only major form of energy that cannot be stored in large quantities. Therefore, electricity supply systems have to be designed to cope with maximum demand, even though this may only occur for a few hours every year.

The lack of storage means that wholesale electricity prices in the National Energy Market (NEM) can go as high as the current cap price at A$12 500/MWh.

Interest in energy storage has grown in recent years due to:
- advances in energy storage technologies
- increasing fossil-fuel prices
- deregulated markets for high-value ancillary services
- challenges in building and operating transmission and distribution networks
- development of mini-grid technologies and applications
- opportunities with intermittent renewable generators

One of the limitations of renewable energy sources is that their output is highly variable. Using a storage capability in conjunction with a renewable energy source could reduce short-term fluctuations of output; allow dispatch during times of higher demand and prices; enable greater deployment of renewables without need for ‘shadow supply’; and allow for lower transmission line costs by increasing line utilisation.
The feasibility of using storage with renewables depends on factors such as electricity prices and the capital costs required to build and operate the storage facility. An example of an integrated battery and wind farm includes the Rokkasho Wind Farm in northern Japan.

The other main application of storage is managing peak demand (peak shaving). Peak demand is rising faster than average demand, and expensive network augmentation is required to meet fewer than 100 hours a year.

A 6400 MWh battery could meet the needs of the top 10% of demand in New South Wales. Importantly the storage facility does not need to be one large unit; it could be distributed across the network, as is the load. For example, New South Wales has approximately 650 zone substations. The 6400 MWh of storage could be met by each substation having 10MWh storage. If it were distributed across all distribution substations then barely 30kWh of storage at each unit would be required.

Distributed storage really starts to get interesting with the potential to use the batteries in the growing electric vehicle (EV) market as a mechanism for managing peak demand. Assuming that EVs have 40kWh batteries, it could take as few as 25 000 vehicles to supply 300 MW of power to the grid. Considering that Sydney alone has approximately 1.8 million vehicles, this represents a relatively small fraction of the potential EV population.

Five interacting components need to be considered in power systems that have a significant energy storage infrastructure: intermittent generation; despatchable generation; transmission and distribution; demand; and storage. The variability and correlation of renewable resources on regional, national, and international scales will determine reserve capacity requirements, some of which may be met by energy storage at supply-side or demand-side locations.

Yet widespread adoption of energy storage is inhibited by the limited range of workable business models that presently exist for storage. The relatively high cost of energy storage is offset by the multiple applications that may be served by each installation: renewable energy and demand peak shifting, ancillary services, reserve capacity, market arbitrage, multiple network support roles, contingency support, and others.

It is not easy in present deregulated energy systems to capture the benefits of these applications as a revenue stream for investors in energy storage.

This situation is developing, as regulators and proponents recognize the importance of energy storage in low-emission power systems, and over the next few years the business case for storage should improve significantly through ‘stacking’ multiple benefits.

**ABOUT PROF. TONY VASSALLO**

Prof Tony Vassallo conducts research in the area of sustainable energy development, with a focus on distributed energy and energy storage. His primary research interests concern clean energy technologies and their role in mitigating climate change.

**ARC LINKAGE GRANT PROJECT**

In collaboration with Australian Research Council (ARC) Linkage partners Alpha Chemicals and Redflow, Prof Vassallo and his colleagues aim to develop new material for zinc-bromine flow batteries.

Project Title: New high performance zinc bromine batteries with novel electrode/electrolyte systems.

Project summary: Renewable sources of energy are of particular interest in the era of diminishing fossil fuels. Efficient energy storage is a missing link for renewable energy. This project will aim to fundamentally re design the existing first generation systems to improve power density by 300-400 per cent. $420 000 has been awarded over three years.
The School of Electrical and Information Engineering has been awarded $2.675m funding towards the upgrading of existing facilities for the teaching and research of power and telecommunications engineering.

The funding was received through the University’s capital infrastructure priorities funding ‘2013-2017 and Beyond’.

The project will be delivered by Campus Infrastructure and Services, and will include three projects:

Project 1: Major refurbishment works on Level 4 to provide an upgraded research laboratory with the environmental controls and services required to support the ongoing research of Sydney researchers in power engineering in areas like advanced electronic control of electricity grids using utility power electronics; energy storage and generation with sustainable energy sources; direct current microgrids and high-voltage direct-current power transmissions topologies and control.

Project 2: Refurbishment works on Level 4 to provide facilities and an optimal learning environment to postgraduate and senior undergraduate students in power and radio frequency (RF) engineering and antennas.

Project 3: Refurbishment works on Level 7 to provide an educational hub for undergraduate and postgraduate students, including:

a) facilities to postgraduate research students in the early years of their candidature and students in the final stages of their research degrees;

b) the future home for the Joint Research Centre in Telecommunications with the Chinese Academy of Sciences;

c) new 30-seat seminar room for postgraduate student seminars

d) hospitality suite to accommodate researchers and students.
The recent $20m gift to the University of Sydney by John Grill is a vital step for ongoing Australian success, writes Professor Geoffrey Garrett and Professor Archie Johnston.

First published in the Australian Financial Review.

Multibillion-dollar mega projects like the NBN or Gorgon natural gas facility are an underappreciated new feature of the global economy because they are often seen as just a temporary means to a more enduring end.

While building a port is important, it is the traffic that will flow through it once completed that really matters.

The stakes with mega projects are much higher. On the downside, their sheer scale means the cost of failing to stay on time and on budget is massive, and their complexity makes the risk of overruns endemic. Badly executed projects are anti-gifts that keep on taking, big time.

On the upside, as Australia looks towards its post-mining boom future, our deep dive into the world of mega projects gives the country the opportunity to create the kind of high value added service and advanced manufacturing exports that will drive our prosperity for decades.

Executing large and complex projects requires chief executive-like skills, but with the unique added demand that these skills require pulling everything together all at once.

It is essential that Australia harnesses these skills to complete as efficiently as possible the slate of projects on the national docket. But at the same time, we should also develop the mega project knowhow and leadership skills that completing these projects will demand.

Based on data from Deloitte Access Economics and the Defence Department, we estimate there are currently well over 100 projects valued at $1 billion or more, either under consideration, committed to, or in construction in Australia. About two-fifths of these projects are in mining, another one-fifth in transport, with the remainder spread among sectors as diverse as defence, power, communications and manufacturing.

Not surprisingly, the very biggest Australian projects are in mining. The Chevron-led Gorgon natural gas project leads the way, with an estimated cost of $43 billion. Its Wheatstone follow-up is not too far behind. But the $36 billion NBN comes next, and Building the Education Revolution also makes it into the top 10 at $16 billion.

All told, Australia is home today to 12 projects with price tags above $10 billion, with a total cost approaching $300 billion.

In the longer term the skills Australia develops in executing these mega projects can create a large, new high value added export industry in large-scale complex project leadership.

In scale and complexity, Australian mega projects stack up against the biggest in the world. Saudi Aramco and Dow Chemical have commenced their $20 billion Sadara project to build one of the world's largest integrated chemicals facilities.
California has announced its multi-decade intention to build a high-speed rail link between San Francisco and Los Angeles at a total estimated cost of $68 billion. China is rolling out new high-speed rail lines, airports and building developments, and India's development will require the same, as well as massive power generation and distribution.

The skills needed to deliver projects like these on time and on budget are diverse and extremely high level. Project leaders must of course have a deep familiarity with the technical features of their industries, and they will invariably rise through the ranks of their chosen fields.

But technical skills are only the beginning when it comes to leading mega projects. Leaders must also be aware of the latest thinking and technology for logistics, supply chains and operations management.

What's more, all projects invariably involve governments, often at multiple levels at the same time, as regulator, client or partner. Land buybacks, many times involving indigenous lands, must always be negotiated.

Mega projects are also invariably highly internationalised, in terms of financial stakeholders, ultimate clients, workforces and locations.

Completing Australia's current slate of mega projects is clearly mission-critical for the country. But at the same time developing the next generation of leaders capable of executing mega projects in Australia and around the world will pay off long after today's projects are completed.

That is the goal of the $20 million John Grill Centre for Project Leadership at the University of Sydney. There can be few initiatives better placed to leverage Australia's unique assets into long-term global leadership.

Geoffrey Garrett is dean of the University of Sydney Business School and Archie Johnston is dean of the Faculty of Engineering and Information Technologies at the University of Sydney.
In November 2012 the Foundation continued its support of the Faculty’s Research Conversazione by coordinating the School of Electrical and Information Engineering Research Exhibition.

Key partner TransGrid generously sponsored the School’s research exhibition. Their sponsorship is an opportunity to build and strengthen our relationship, Professor Vucetic said.

“Our strength across many academic disciplines is borne out by the range of successful posters submitted,” says Head of School, Professor Branka Vucetic.

Students across the field of electrical and information engineering are exploring new ways to tackle some of the big issues of the 21st century, using science and technology to address energy efficiency, healthcare and safety issues. Their work will help improve our lives, from removing barriers to the integration of renewable energy in the push towards more efficient energy systems to wired and wireless technology to diagnose, monitor and manage patients, with instruments connected via telephone and web-based services, and on time safety information for vehicular network applications.

Students submitted over 40 research presentations in poster format for RC2012, competing for 21 industry prizes listed overleaf.

WIN A THINKPAD COMPETITION

To enter, students answered the question Tell us in 25 words or less, how your research solves a problem?

Winner

Smitha Shivshankar

Solution: Saving lives with on time safety information should be the future of possible Vehicular Network applications.

My research develops a Content-based dissemination model using highly reliable routing protocol and an efficient compact data structure.
<table>
<thead>
<tr>
<th>Prize Category</th>
<th>Award Type</th>
<th>Winner</th>
<th>Title</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABB PRIZE FOR POWER ENGINEERING (ENERGY)</td>
<td>Undergraduate</td>
<td>Christopher Byrne</td>
<td>Feasibility of Residential Battery Storage for Arbitrage Accommodation</td>
<td>Alan Flett, Account Manager</td>
</tr>
<tr>
<td>ABB PRIZE FOR POWER ENGINEERING (NETWORKS)</td>
<td>Postgraduate</td>
<td>Ruixue Mao</td>
<td>Road Traffic Density Estimation in Vehicular Networks</td>
<td>Alan Flett, Account Manager</td>
</tr>
<tr>
<td>ALSTOM PRIZE FOR POWER ENGINEERING (SMARTGRIDS)</td>
<td>Undergraduate</td>
<td>Jiaping Cai</td>
<td>Performance Analysis of Scheduling Algorithms for Smart Grid Wireless Networks</td>
<td>Chris Raine, Managing Director and President</td>
</tr>
<tr>
<td>ALSTOM PRIZE FOR POWER ENGINEERING (RENEWABLES)</td>
<td>Postgraduate</td>
<td>Khairul Muhammad</td>
<td>Photovoltaic Array Emulator (PVAE)</td>
<td>Chris Raine, Managing Director and President</td>
</tr>
<tr>
<td>AMPCONTROL PRIZE FOR POWER ENGINEERING (CONTROL)</td>
<td>Postgraduate</td>
<td>Yang Du</td>
<td>Power Quality Issues Caused by Integrating Photovoltaic (Solar cell) Inverter into Power Grid</td>
<td>Ian Webster, Manager Group Engineering</td>
</tr>
<tr>
<td>COCHLEAR PRIZE FOR BIOMEDICAL ENGINEERING</td>
<td>Undergraduate</td>
<td>Luke Fries</td>
<td>Mitigating Health Impacts from Occupational Airborne Dust Exposure, Focus on Open/Hand Coal Mining</td>
<td>Paul Carter, Electrodes Technology Cluster Leader</td>
</tr>
<tr>
<td>DULHUNTY POWER PRIZE POTENTIAL FOR COMMERCIALISATION</td>
<td>Undergraduate</td>
<td>Zhiheng Zhao</td>
<td>Instrumentation System Development Project</td>
<td>Marcel Gan, Principal Design and Software Engineer</td>
</tr>
<tr>
<td>FREELANCER.COM PRIZE FOR COMPUTER ENGINEERING</td>
<td>Undergraduate</td>
<td>Michael Westman</td>
<td>iOS App Development with Matching Algorithm for Sheltered Animal Adoption</td>
<td>David Harrison, Vice-President Engineering</td>
</tr>
<tr>
<td>FREELANCER.COM PRIZE FOR SOFTWARE ENGINEERING</td>
<td>Postgraduate</td>
<td>Nargess Nourakhsh</td>
<td>Galvanic Skin Response for Cognitive Load Measurement.</td>
<td>David Harrison, Vice-President, Engineering</td>
</tr>
<tr>
<td>NICTA PRIZE FOR NEXT GENERATION APPLICATIONS (TELECOMS)</td>
<td>Undergraduate</td>
<td>Duncan Moss</td>
<td>A Novel Echo-Sounder and iPad System</td>
<td>Len Bass, Senior Principal Researcher</td>
</tr>
<tr>
<td>RESMED PRIZE FOR BIOMEDICAL ENGINEERING</td>
<td>Undergraduate</td>
<td>Chen Qiu</td>
<td>Applications of quartz tuning forks in spectroscopic gas sensing</td>
<td>Ning Wang, Senior Engineer</td>
</tr>
<tr>
<td>RESMED PRIZE FOR BIOMEDICAL ENGINEERING</td>
<td>Postgraduate</td>
<td>Doan Trang Nguyen</td>
<td>Non-Invasive ventilation/Perfusion Imaging with EIT</td>
<td>Ning Wang, Senior Engineer</td>
</tr>
</tbody>
</table>
TELSTRA PRIZE FOR POTENTIAL FOR COMMERCIALISATION (TELECOMS) UNDERGRADUATE

Winner: Christopher Miceli
Title: Facilitating High Speed Prediction using the Cloud
Presenter: Anthony Goonan, Director Network and Commercial Planning

TELSTRA PRIZE FOR TELECOMMUNICATIONS ENGINEERING POSTGRADUATE

Winner: Smitha Shivshankar
Title: Content-based Routing Using Multicasting in Vehicular Networks
Presenter: Anthony Goonan, Director Network and Commercial Planning

TRANSGRID PRIZE FOR POTENTIAL FOR COMMERCIALISATION (POWER) UNDERGRADUATE

Winner: David McKenzie
Title: High Voltage Rectifier Differential Protection
Presented by: Harry Schnapp, Network Support Manager

TRANSGRID PRIZE FOR POWER ENGINEERING (SMARTGRIDS) POSTGRADUATE

Winner: Md. Farhad Hossain
Title: Reduced Energy Cost in LTE Networks Using Dynamic Sectorization of eNodeBs
Presented by: Harry Schnapp, Network Support Manager

TYREE INDUSTRIES PRIZE FOR ELECTRICAL ENGINEERING UNDERGRADUATE

Winner: James Hunter
Title: Electric Motorbike Project: An Electric Vehicle Designed for Commuting
Presented by: Michael Stack, General Manager and Technical Lead

TYREE INDUSTRIES PRIZE FOR ELECTRICAL ENGINEERING POSTGRADUATE

Winner: Liwei Li
Title: Multiple Parameter Real Time Sensing Using Photonic Sensor Array
Presented by: Michael Stack, General Manager and Technical Lead
In May 2012, the Foundation continued to support the School of Electrical and Information Engineering by sponsoring scholarships and prizes valued at over $50,000 and by coordinating the Scholarships and Prizes Presentation. The Scholarships and Prizes Presentation recognizes the achievements of the School’s outstanding students and graduands.

The Presentation was opened with a welcome to student and their families and industry representatives by Professor Robert Minasian, Deputy Head of School who presided as Master of Ceremonies. This year, the Foundation expanded the number of prizes awarded to female students in the first, second, third and fourth year of their studies.

**UNIVERSITY MEDAL IN (ELECTRICAL ENGINEERING)**

Mattia Pagani (pictured) has been awarded the University’s highest recognition for outstanding academic achievement upon completing the 4-year Honours degree in the Bachelor of Engineering (Electrical). He was the recipient of the EIE Foundation’s Prize for Top Final Year Student overall and in Electrical Engineering.

**VICE-CHANCELLOR’S RESEARCH SCHOLARSHIP**

Mattia Pagani has also been awarded the Vice-Chancellor’s Research Scholarship to the value of $35,000 for up to 3.5 years to pursue full-time PhD studies. He is one of only ten scholars across the university to be awarded the VCRS. Mattia will continue his studies as a PhD candidate under the supervision of Prof. Robert Minasian in the Photonic Research Group.

The Foundation would like to warmly congratulate all of our scholarship and prize winners and to thank sponsors for their continuing support.
INDUSTRY
THE AUSTRALIAN ELECTRICAL AND ELECTRONICS MANUFACTURERS’ ASSOCIATION OF NSW.PRIZE IN ELECTRICAL POWER ENGINEERING
Alan Luc

ENGINEERS AUSTRALIA SYDNEY DIVISION, ELECTRICAL AND IT BRANCH PRIZE
Mattia Pagani

THE INSTITUTE OF ENGINEERING & TECHNOLOGY (IET) AUSTRALIA STUDENT PRIZE
Mattia Pagani

G S CAIRD SCHOLARSHIP IN ELECTRICAL AND INFORMATION ENGINEERING
Suen Xin Chew

IAN JAMES MCPHERSON PRIZE
YiQiao Zhang

PERCY L WESTON PRIZE
Zhiheng Zhao

R E JEFFRIES MEMORIAL PRIZE
Liana Paolino

EIE FOUNDATION
EIE FOUNDATION PRIZE FOR TOP FINAL YEAR STUDENT
Mattia Pagani

EIE FOUNDATION PRIZE FOR FINAL YEAR ACHIEVEMENT (ELECTRICAL)
Mattia Pagani

EIE FOUNDATION PRIZE FOR FINAL YEAR ACHIEVEMENT (POWER)
Alan Luc

EIE FOUNDATION PRIZE FOR FINAL YEAR ACHIEVEMENT (SOFTWARE)
Andrew Naoum

EIE FOUNDATION PRIZE FOR ACHIEVEMENT (WOMEN) FIRST YEAR
Mengbai Sun

EIE FOUNDATION PRIZE FOR ACHIEVEMENT (WOMEN) SECOND YEAR
Liana Paolino

EIE FOUNDATION PRIZE FOR ACHIEVEMENT (WOMEN) THIRD YEAR
Katrina Nally

EIE FOUNDATION PRIZE FOR ACHIEVEMENT (WOMEN) FOURTH YEAR
Gayatri Singh

UNIVERSITY MEDAL IN ENGINEERING (ELECTRICAL)
A university medal is awarded at the discretion of the Faculty to the highest achieving student in each stream who in the opinion of the Faculty has an outstanding academic record.
Mattia Pagani

DEAN’S AWARD FOR OUTSTANDING TEACHING
Associate Professor Philip Leong
Veolia Water Solutions & Technologies generously provided Zhiheng with an opportunity to have first semester requirements replaced with 6 months full-time work undertaking a high-level investigative project, under industrial and academic direction.

"Zhiheng worked on a project that involved the development of standards and systems for our Electrical / Instrumentation Engineering department. Veolia has benefited from Zhiheng’s project as we have rolled out the database he created into our business and this has resulted in greater efficiency for our Electrical Engineers," says Wendy Thomas, Human Resources Manager at Veolia (pictured).

"It is my great honour to be involved in the MIPPS program and I enjoyed the whole project."

Zhiheng Zhao (pictured), a top fourth year undergraduate student and MIPPS scholar with Veolia Water Solutions and Technologies.

'It is my great honour to be involved in the MIPPS program. Because the project is worth 24 credit points, I was able to gain valuable work experience without spending extra time to extend the length of my degree. I enjoyed the whole project, not only the professional working environment, but also the efficient communication between different departments. I learned practical skills from work and applied them to my project directly, I can see the results immediately and what I learned day by day. I would strongly recommend possible students to apply for the MIPPS program in the future, to learn from work," says Zhiheng.
INDUSTRY SCHOLARSHIPS

CSIRO ICT CENTRE IT
UNDERGRADUATE ENTRANCE SCHOLARSHIP
Pawan Narayan

CSIRO ICT CENTRE IT
UNDERGRADUATE SCHOLARSHIP
John Raymond Lingad

EIE FOUNDATION SCHOLARSHIP
Aarohi Dalal
Riley Ruming
Sunny Luk

THE ROADS & TRAFFIC AUTHORITY SCHOLARSHIP IN ENGINEERING (ELECTRICAL)
Harley Broer

VEOLIA WATER SOLUTIONS & TECHNOLOGIES
Major Industrial Project Placement Scheme
Zhiheng Zhao

XSTRATA COAL UNDERGRADUATE SCHOLARSHIP IN ENGINEERING (ELECTRICAL)
Timothy Kirk

UNIVERSITY OF SYDNEY

EIE POSTGRADUATE COURSEWORK SCHOLARSHIP
Dhiren Baniya

COMMONWEALTH SUPPORTED PLACE SCHOLARSHIPS
Petra Ivana Kovacevic

EIE SUMMER RESEARCH PROJECT SCHOLARSHIPS
Charbel Antoun
Shuning Bian
Joshua Fodera
Peter Leitner
Jack Umenberger
Chenyu Wang
Zheng Wang

VICE-CHANCELLOR’S RESEARCH SCHOLARSHIP
Mattia Pagani

NORMAN I PRICE SCHOLARSHIP
The Norman I Price Supplementary Scholarship is awarded to all full-time PhD and MPhil students enrolled in the School of Electrical and Information Engineering.

INTERNATIONAL SCHOLARSHIPS

DR. ABDUL KALAM INTERNATIONAL UNDERGRADUATE SCHOLARSHIP
Bushra Ahmed

DR. ABDUL KALAM INTERNATIONAL POSTGRADUATE SCHOLARSHIP
Alexandre Cadet
Yiwen Li

SYDNEY ACHIEVERS INTERNATIONAL SCHOLARSHIP
Caroline Perinet

Master of Engineering (Electrical)
2011 Recipient: Yusuf Ahmed
Bachelor of Engineering (Electrical) (Power)
Completed first year in 2011

2011 Recipient: Timothy Kirk
Bachelor of Engineering (Electrical) (Power)
Completed first year in 2011

2011 Recipient: Harrison Tri Tue Nguyen
Bachelor of Engineering (Electrical)
Completed first year in 2011

2011 Recipient: Margaret Jennifer Samoty
Bachelor of Engineering (Electrical)
Withdrawn in 2011

2011 Recipient: Patricia Lokyee Way
Bachelor of Engineering (Electrical) (Power)
Completed first year in 2011

2012 Recipient: Aarohi Dalal
Bachelor of Engineering (Electrical)
Completed first year in 2012

2012 Recipient: Riley Ruming
Bachelor of Engineering (Electrical)
Completed first year in 2012

2012 Recipient: Sunny Jin Pack
Bachelor of Engineering (Electrical)
Completing first year in 2013
INTERNATIONAL SCHOLARSHIP RECIPIENTS

Alexandre Cadet and Caroline Perinet (pictured), both of France, moved to Australia together to study the Master's of Electrical Engineering. Caroline earned a Sydney Achievers International Scholarship, while Alexandre won a Dr Abdul Kalam International Scholarship, awarded by the Faculty of Engineering and Information Technologies.

"Australia is seen as a bit of a dream country in France for its culture and environment," says Caroline.

"Most French students go to the UK to study. We wanted to improve our English by studying in an English-speaking country, but also to spend time in Sydney's beautiful environment and relaxed culture."

The recipients were selected for scholarships based on the conversion of their academic record in their home countries into a University of Sydney GPA.

"When the University established these scholarships in July 2011, the intention was to attract some of the brightest minds to undertake study at the University of Sydney. We also wanted to diversify the countries from which our scholarship recipients came, and to ensure the scholarships were made for study across the University's vast range of disciplines.

We have certainly achieved these goals," Professor Armstrong said.

"By awarding these scholarships, we aim to enable more promising students to come to Sydney, particularly at a time when the strength of the Australian dollar can make it more difficult to travel to Australia. We hope these scholarships can make a real difference to our students' time at university," said Professor Armstrong.

The Sydney Achievers International Scholarships and the Dr Abdul Kalam International Scholarships were announced last year with the aim of attracting more academically high achieving international students to study at Sydney.

The University of Sydney currently has almost 50,000 students. Around one-fifth of them are international students, who come from more than 130 countries.
INTERNATIONAL PARTNERSHIPS

Harbin Institute of Technology
Renewed (2+2) undergraduate programs in electrical engineering and enrolled 11 students in the (2+2) program in 2012.

Beihang University
Established the (2+2) with School of Electronic and Information Engineering as well as a Coututelle program.

Beijing JiaoTong University
Established the (2+2) with School of Electronic and Information Engineering.

Harbin Engineering University
Renewed (2+2) undergraduate programs in software engineering.

Chinese Academy of Sciences
Established a joint Research Centre in Telecommunications with the Centre of Excellence in Telecommunications at the University.

Visit by a delegation from the Chinese Academy of Sciences, Beijing Municipal Science and Technology Commission and the Beijing Science and Technology Information Centre to discuss Smart Grid collaboration.

The School continued to build on its international partnerships during the year. The School established a joint research centre in telecommunications with the Chinese Academy of Sciences, confirming its position as a leader in world-class collaborative research.
INDIGENOUS AUSTRALIAN ENGINEERING SUMMER SCHOOL

ENGINEERING A DREAM

The educational dream of six Aboriginal students saw them return to the Faculty of Engineering and Information Technologies at the University of Sydney for a second in-depth workshop aimed at increasing their opportunity for tertiary studies.

The faculty responded to the success of a course held earlier in the year, the Indigenous Australian Engineering Summer School, and developed the intensive Indigenous Student Engineering Workshop.

The workshop is a next-step course for the students who were given a taste for a university course in engineering and an engineering career.

One-third of the students who took part in the initial engineering course are returning for the hands-program says Executive Director of Engineering Sydney, Keiran Passmore.

"This is about encouraging young Aboriginal and Torres Strait Islander students to reach their full potential," says Passmore.

"We are committed to building capability and creating opportunity for Australia's Indigenous populations and engaging their young people in the education and research being conducted at the Faculty of Engineering and Information Technologies," he said.

This time the group will go on several site visits and meet real life young engineering role models. The students will also participate in intensive maths and exam preparation workshops to be held at the University's Centre for Continuing Education.

"If we can help these students to maximise their Australian Tertiary Admissions Rankings they have a better chance of achieving university entry levels and becoming students at a university like the University of Sydney," says Dean of the Faculty of Engineering and Information Technologies, Professor Archie Johnston.

"We want to nurture and equip our participants with the skills that are necessary to successfully transition from the high school classroom to engineering studies at university," he says.

Professor Shane Houston, Deputy Vice-Chancellor (Indigenous Strategy and Services) says: “The University is serious about finding new ways of engaging with Aboriginal and Torres Strait Islander students and communities. We want to be part of making their dreams a reality.

"We are committed to helping talented young Aboriginal people succeed."

Young participant 17-year-old Tyrone Urquhart-Singh (pictured) from the rural township of Robinvale in Victoria, says his parents never finished high school but they are supportive and encouraging of his desire to go to university.

"I am trying really hard at school to achieve this as it's my dream and my parents' dream for me too!" says Tyrone.
Steve Bian's honours thesis project towards a Bachelor of Engineering (Electrical) was developing a portable, non-invasive, solar-powered device measuring body fat in newborns. Monitoring body composition helps detect newborn malnutrition, a key to reducing infant mortality worldwide.

The device, powered by a nine-volt battery, gathers data from a newborn using near-infrared light technology also used in TV remote controls. A baby’s body composition analysis is fed back to the device’s main processing unit, which contains an embedded computer about the size of an iPod. The prototype can tell the difference between fat tissue and other tissue.

In 2012, Steve was part of a team, led by Dr Alistair McEwan from the School of Electrical and Information Engineering and Professor Heather Jeffery from the School of Public Health which was awarded a US$100 000 grant from the Bill and Melinda Gates Foundation to further test the efficacy of their prototype.

Steve Bian writes from Oxford about the doctoral training program in biomedical engineering.

“I am currently reading for a DPhil in Healthcare Innovations at Oxford University, within the Institute of Biomedical Engineering (IBME). This is a biomedical engineering DPhil, with emphasis on clinical applications. I am enrolled in a Centre for Doctoral Training (CDT) programme, which consists of one year of semi-taught modules, and three years of normal DPhil. This programme is a new initiative within the UK, and the extra year of taught material is meant to simultaneously teach us the skills and techniques relevant to research in the field of biomedical engineering, and to also showcase the work that being done with in the IBME. Towards the end of the current academic year, I will decide on the project which will become my DPhil.

So far at the CDT we have covered topics in nanoparticles, computer learning, image processing, biomedical signal processing, personalised modelling, hospital placement, computation methods. Future modules include market intelligence and affordable healthcare. The material has been interesting and sometimes challenging. In particular, culturing cancer cells and evaluating the effect of various chemotherapy agents, has been very fulfilling.
HONORARY AWARD

DAVID SKELLERN BE (Elec ’74)
BSc. PhD HonDEng
Research Scientist and
Electrical Engineer

In 2012, distinguished alumnus, David Skellern was appointed an officer of the Order of Australia (AO) for distinguished service to science and engineering as a leading researcher, and to the design and development of world-leading information technology.

This achievement follows on from Professor Skellern’s recent honorary doctorate awarded by Macquarie University and reinforces the contribution that he has made to scientific research, industrial R&D, and engineering education over the past 40 years.

A former Macquarie academic and head of the then Department of Electronics, Professor Skellern collaborated with colleague Professor Neil Weste on a joint Macquarie-CSIRO research project on Wireless Local Area Networks. Their work ultimately led to a revolution in world communications which we all benefit from today.

Professor Skellern co-founded spin-off company Radiata with Professor Weste in 1997 to commercialise their research. Their main product was a set of chips that made Wireless Local Area Networks fast and robust. Today, when we check email or surf the Internet using a WiFi network, we are using technology they and their colleagues developed.

Radiata was incorporated in the US in 1999 and received $6 million in venture capital from world leading companies Cisco Systems and Broadcom. In 2001, Radiata was acquired by Cisco and Professor Skellern became Technology Director of Cisco’s Wireless Networking Business Unit.

In 2003, Professor Skellern was appointed to the National ICT Australia (NICTA) Board, eventually becoming its CEO. Throughout his career, Professor Skellern has received many awards including the CSIRO Research Medal and, in 2010 the ATSE Clunies Ross award. He has been a major supporter of education and research through the Skellern Family Foundation.

As a result of Professor Skellern’s pioneering collaboration with the CSIRO, Macquarie University was awarded $2 million from the Science Industry Endowment Fund with the CSIRO ICT Centre to establish a new Chair in Wireless Communications at Macquarie.
HONORARY DOCTORATE

JOHN O’SULLIVAN BE(Hons)(Elec) BSc PhD HonDEng
Research Scientist and Electrical Engineer

On May 18, 2012 Dr John O’Sullivan was admitted to the degree of Doctor of Engineering (honoris causa) in recognition of his exceptional accomplishments in the field of advanced signal processing techniques for radioastronomy.

His achievements in this area are internationally renowned, and his work on one of the world’s leading radio telescopes, the Australian Square Kilometre Array Pathfinder, will provide Australian and international astronomers with another world-leading radio astronomy observatory and may lead to the next phase of transformational personal communication technology.

The following is an extract from his occasional address.

Deputy Chancellor, Deputy Vice-Chancellor, Professors, guests and Graduands

I would like to congratulate you all for what is a major milestone in your lives. Graduation is the culmination of what has been a long and considerable effort.

I am also extremely proud and honoured to be receiving this honorary degree. I was already overseas at the time of the graduation ceremony for my PhD and missed that ceremony but more importantly, it is wonderful to be back here at Sydney University because of what I got out of my time as an undergraduate and a postgraduate student at this institution. My professors and lecturers, my fellow students and teammates on the sporting field all contributed to the overall learning experience during that time. I hope you too in the future will look back and reflect on some important lessons learned from your time in university.

Engineering and science in particular are subject to continual change. Technology is ever more dependant on tools – ranging from computer design to all sorts of tools for diagnostic, measurement and construction purposes. It is also all about building the tools taken for granted by others.

Technologies change, tools change, methods change, projects change and products change. I dare say so will you change along with the nature of your jobs and roles throughout your career.
We all hear often how this is to be the new world of continuous change but in my experience, it is as it ever was – valves gave way to transistors which gave way to integrated circuits, to personal computers to embedded computers and so it goes on in all branches of engineering. The pace of change and level of competition does however seem to be continuously accelerating. We all learn to adapt or get left behind.

I left university eager to learn new things and embrace change and that was a magnificent gift I received along of course, with the solid understanding and theoretical underpinning on which to build new learning. I am sure it is one of the important characteristics you have also picked up along the way to your degrees and it will stand you well to keep adapting to the changing world out there.

At CSIRO, my boss and mentor was Bob Frater who had been previously Prof of Electrical Engineering at this university. When I arrived back from a 9 year stint working in radio astronomy in The Netherlands, Bob challenged me to find commercial applications of the skills and technologies that had been built up in radio astronomy. Somewhat later, we formed a new team with fresh ideas not afraid to try for a very ambitious goal of making wireless networks go every bit as fast as the best wired networks at the time. The combination of fresh ideas resulting from accepting a change in field of endeavour and the ambitious goal were a substantial ingredient in our success. That single goal of matching the speed of 100 million bits per second of the best fibre optic computer network of the time meant we had to come up with something quite different.

I would advise you to not be afraid to “reach for the stars” or in other words to set ambitious goals. One does need to be mindful of the fall back positions but striving to do something you are not sure at first that you can do brings out the best in us. A corollary would be: Don’t be afraid to tackle an area outside of your current comfort zone – the interfaces between different domains of expertise are especially fertile.

Our successful wireless network technology invention was partly attributable to an earlier failed attempt to detect the electromagnetic pulses from exploding mini-black holes which were thought to be made at the beginnings of the universe.

That attempt was inspired by Stephen Hawking, the revered wheelchair bound British physicist who had just controversially developed a new theory where black holes could not be completely black and would in fact slowly evaporate. Their final moments would be kind of like a small nuclear explosion in space.

A subsequent much more complex attempt to detect Fast pulses followed but that failed to find anything as well. As a result I decided there must be a better way and started looking at fast digital processing methods. A few years later I grabbed the opportunity to build a team to make a Fast Fourier Transform integrated circuit to do just the sort of processing needed very, very fast. So fast in fact that it bettered one of the best super computers of the time!

This transform technology and the theoretical willingness to see problems from various perspectives lead us to part of our wireless network solution. The trick of looking at a problem from multiple different ways until you find the most simple view was, by the way, yet another important message from Bob Frater when he was one of my lecturers at Sydney University.

Increasingly we find now that projects require substantial teams and this means more difficulty getting approval and funding, more management, more inefficiencies, more oversight etc. It also brings positives. Teams comprised of members with diverse skills who respect each other and feed off each other can be very powerful. A team, bringing together engineers, physicists, a mathematician and a computer scientist who had worked in a range of areas was another essential ingredient to the wireless network technology invention. It was above all a team effort as ideas were bounced around and solutions found.

There is much more to the wireless network or WiFi technology story including further teams and a company Radiata which was started by some of the researchers and which made the first wireless network chips using the invention. That was also an exciting and successful time for both myself and the other members of that team. The ongoing and courageous support of both the original research and the later legal efforts by CSIRO was also vitally important.

I hope some of you might be encouraged by my experience of change and also look to work in a variety of environments from research through to the commercial world. I have found it both fruitful and enjoyable as I continued to learn.

Success comes in many forms and I would like to close by congratulating you all on your achievement which is being recognised today and by wishing you all rewarding and challenging careers. So, best wishes and success!

Thank you.
MATT BARRIE
Founder, Chief Executive Officer, Freelancer.com
Sydney
Electrical Engineer, University of Sydney

As an entrepreneur and CEO Matt Barrie regards his engineering degree as “the most fundamental building block discipline in problem solving and, for me, the most important degree to have”.

“It’s been invaluable to providing a deep grasp of technology, a passion to innovate, a ‘can do’ attitude, and an analytical mind.

I couldn’t recommend a degree at university more strongly to someone. With an engineering background, you can excel in any role put in front of you – whether it’s in technology, management, finance or even sales and marketing.

Engineering provides you with a foundation to understand the world and think about ways to improve it. The business part is easy to learn on the job.”

Barrie has had quite a year; he was named the inaugural BRW Entrepreneur of the Year, and was then awarded the Ernst & Young Technology Entrepreneur of the Year. Most recently freelancer.com was awarded its third Webby Award, which is touted as “the Internet’s highest honour” by the International Academy of Digital Arts and Sciences.

The biggest highlight for Barrie though has been seeing the business and online economy grow on Freelancer. He said key to the success was “moving faster than the competitors and out innovating them”. Barrie has also been speaking at a number of industry events, presenting keynotes at the Summit Series and The Next Web, and was one of 19 featured speakers at SXSW in Austin, Texas.
SANTO RIZZUTO
Chief Executive Officer and Managing Director
SKM, Brisbane
Electrical Engineer, University of Sydney

Santo Rizzuto was appointed chief executive and managing director of strategic consulting, engineering and project delivery firm Sinclair Knight Merz in October 2011.

Rizzuto was promoted from within the ranks, having joined in 1997 and led SKM’s entry into the South American market, culminating in the acquisition of Minmetal in Chile.

In 2006, he became SKM’s global client manager for BHP Billiton and was later appointed general manager of SKM’s Mining and Metals business. SKM’s total revenues for 2010/2011 were more than AS1.2 billion. SKM recently completed several important strategic mergers with transport planning consultancy Colin Buchanan & Partners, Architectural and engineering firm S2F; water engineering consultancy ERH, and acquisition of rail engineering assets from Mouchel.

Rizzuto said influential engineers need a combination of three broad skill sets – technical skills, people skills and business skills, which vary in importance over a career.

He said, “As engineers we are predisposed to the technical, and as our education systems reinforce that predisposition, we tend to pay less attention to the development of the ‘non-technical’ skills that are vital to an influencing role.”

Rizzuto argues that people skills are more important than the others. These are the hardest to “learn” because human interactions are by their nature varied and complex – there is no manual or set formula that can deal with all possibilities.

However, he said, “There is no way you are going to be able to influence others without first having a good hard look at yourself. Self-awareness is the key to being influential.

Understanding how your own strengths and weaknesses impact on a particular situation and then being prepared to adapt your approach accordingly is a good start.”
FILTRATION BRINGS CLEAN WATER TO DEVELOPING COUNTRIES

A new safe water filtration unit, called SkyBox™, was launched on World Water Day, 22 March, by Australian organization SkyJuice Foundation Inc.

SkyJuice founder and Sydney mechanical engineer Rhett Butler was appointed a Member of the Order of Australia (AM) for providing sustainable safe water solutions in the developing world.

The SkyJuice Foundation is a non-profit organization which aims to help achieve Millennium Development Goals for access to clean water. Its original water filtration system was SkyHydrant™. Over the past eight years, more than 1200 units have been installed in 50 countries through partnerships with nongovernment organisations (NGOs).

The SkyHydrant™ operates using 1m head without an electrical power supply. There is no pretreatment or chemical treatment. It can produce up to 10kL/d. The filtration barrier is a microporous low-pressure Siemens Memcor membrane that removes suspended solids, bacteria, helminths, protozoa and some viruses. It is not designed for brackish source water.

Multiple units can be arranged in parallel to run under constant head pressure. In this configuration, the system can deliver 100kL/d-200kL/d.

The SkyBox™ operates using the same technology as the SkyHydrant™ but produces around 500L/d. It consists of a 50L container and an ultrafiltration membrane. Water is directed, poured or pumped into the unit. The membrane has to be cleaned manually by shaking the box every 100 cycles. Every 1000-1500 cycles, it has to be cleaned with chlorine to prevent fouling and organic build-up.

The SkyBox™ has been developed in response to NGOs wanting smaller units to supply 5-10 families rather than entire communities. SkyJuice is working with partners in Kenya and Uganda to set up SkyBox™ distribution as a “cottage industry”.

Butler said the membranes have a lifespan of 5-10 years and they haven’t yet needed to be replaced. He said that eventually SkyJuice’s partner organizations would have to facilitate people exchanging old membranes for new ones. “It is envisaged that this membrane exchange initiative will develop into a longer term mutually beneficial industry partnership.”

According to Butler, the underlying philosophy of SkyJuice is that people in developing countries deserve the same quality of water technology as people in Sydney or London. But rather than waiting for developing countries to build centralised water systems, SkyJuice helps communities benefit immediately from decentralised supplies.

“We need at least another one million units installed and there is still a lot of work in front of us,” Butler said.

“Australia has some of the world’s leading expertise in water and sanitation. Over the years we have developed some world best solutions in low cost sanitation and water treatment. Australians are proven innovators.”
A parched inland village in Peru has an innovative water resource thanks to a simple ‘fog harvesting’ system installed by two University of Sydney honours students.

The pair, Catherine Goonan and Andrew Yeo from the Faculty of Engineering and Information Technologies, has been undertaking a humanitarian-aid focused project ‘Water for Life Peru’ as part of their civil engineering honours degree.

The project, which is underway in the shanty-township of La Rinconada De Pamplona Alta, on the outskirts of the capital Lima, is focussed on educating and engaging locals in the construction of the inexpensive but effective fog catching systems.

In Lima, Peru, more than 1.3 million people have no access to drinking water. Many of the local residents are living below the poverty line and are not connected to the municipal water supply. “Their only option is to purchase water from water trucks that charge more than five times the price than that in the city,” says Goonan.

“We found families living in these towns spending as much as seven percent of their income on water and consequently using the resource very sparingly. This means that hygiene and sanitation is often sacrificed or very low on their list of priorities.

“Until now fog harvesting has been limited to wealthy areas. We aimed to adapt the technology in an affordable and sustainable way to the poorest settings where it’s most needed,” says Goonan.

“Fog harvesting systems are a simple technology that allow the small water droplets in fog to collect on a mesh screen, grow heavier and trickle down the screen where they drip into a trough and are directed to a storage tank.”

Goonan and Yeo worked with a community team using only local materials to design and construct two prototype structures to test both the appropriateness of the location and the design of the fog collector. Hoses in trenches extend from the fog catching site at the apex of the village hillside, down to its base and the township where the water will be measured and used. “These fog-catchers are easy to build and are assembled on site. The installation and connection of the collection panels is quick and simple and the assembly of the structures is not labour intensive or difficult,” says Yeo.

“The system is perfect for the town where finances and resources are extremely limited. No energy is needed to operate the system or transport the water. Maintenance and repair requirements are generally minimal.

“This simple technique could be life changing, freeing people from excessive water prices,” states Yeo.
GRADUATION 2012

DOCTOR OF PHILOSOPHY

Abrar Salim
Thesis: Characterisation and development of an optical intrusion detection system for current and next generation of optical networks.

Shu Kong Ki
Thesis: Analysis and design of transformerless single-phase power-factor-corrected switching converters.

Ming Liu
Thesis: Automatic question generation for academic writing support.

King Yiu Tam
Thesis: Video summarisation based on speaker unit.

Jorge Jose Villaion
Thesis: Automated generation of concept maps to support writing.

Tadeusz Antoni Wysocki

Jin Hui Yao
Thesis: Strong accountability for trustworthiness in service oriented systems.

Phee Lep Yeoh

Jingyu Zhang
Thesis: A service orientated mobile-cloud framework for biodefence research.

Zijie Zhang

MASTER OF PHILOSOPHY

Anthony Armen Minasian
MASTER OF ENGINEERING
Muhammad Asad (Network)
David John Browne (Power)
Min Wei Chai (Electrical)
Antonio Kai-Ann Chen (Electrical)
Jason Hew Fung Choi (Electrical)
Xin Guo (Network)
Md Saddam Hossain (Electrical)
Clement Huet (Electrical)
Tao Jiang (Wireless)
Xingqiao Jing (Electrical)
Hye Ri Kim (Wireless)
Huihui Li (Electrical)
Jason McCamley (Electrical)
Kohila Manogaran (Power)
Safrijal Muhammad Jamil (Wireless)
Anil Joy Panikumar (Power)
Zhengmeng Shi (Electrical)
Rendong Wang (Wireless)
Shu Wang (Electrical)
Wangyin Zhao (Electrical)

MASTER OF PROFESSIONAL ENGINEERING
Nasir Uddin Chowdhury (Power)
Krishnan Karimbul (Power)
Varun Khanna (Power)
Jian Hong Li (Wireless)
Yang Kai Li (Network)
Shengning Liu (Power)
Gayathiri Prem Kumar (Power)
Chenyu Wang (Electrical)
Yilian Wang (Electrical)
Tianchen Zhang (Electrical)
Yue Zhang (Electrical)

BACHELOR OF ENGINEERING
(COMPUTER)
Jun Lin
Denis Milanovic
Harris Kristanto Widjaja
Yiqiao Zhang

BACHELOR OF ENGINEERING
(ELECTRICAL)
Charbel Antoun
Samuel Barclay
Adam Byrnes
Shuoyi Gao
David Griffin
Daeyoun Han
Andrew Isaac
Ho Min William Kang

BACHELOR OF ENGINEERING
(ELECTRICAL)
Chanditha Karunanayake
Dallas Ka How Ko
Alan Siu Lun Lo
Li Ma
Mattia Pagani
Mohd Faq Naquiddin Md Pazin
Reneil Joseph Sabater
Omar Soufi
Peter Steve Stratilas
Robert Edward Douglas Webster
Bryan Yue Wu

BACHELOR OF ENGINEERING
(ELECTRICAL) (POWER)
Alan Luc
John Bae
Ashokkumar Govindbhai Chaudhari
Kerry Chiu Yee Chin
Merrilyn Kerry James
David James Lang
Eraheng Li
Alan Luc
Andrew Scott

BACHELOR OF ENGINEERING
(SOFTWARE)
Rima Bou-Abdou
Duncan Davies
Sajjad Falamaki
Eric Ip
Eui Sub Kim
Lei Li
Andrew Naoum
Mohammad Hosein Saadati
Gayatri Singh
Paul Khant Myat Swe
Danan Thanikanathan
Heng Xu
Xiangrui Yang
Xiao Yu

BACHELOR OF ENGINEERING
(TELECOMMUNICATIONS)
Ali Altaciu
Philip William Milligan
Praveen Joe Paul
Arief Wardhana Trianto

GRADUATE CERTIFICATE IN
ENGINEERING
Shijie Song

THE SYDNEY GRADUATE
For students, the University of Sydney experience should be one that builds on their aspirations and provides opportunities for them to develop new ways of thinking; as global citizens, inquiring scholars, and as individuals with a lifelong passion and flair for learning. These are the qualities described by the University's statement of Graduate Attributes and are some of the outcomes of a University of Sydney education that allow our graduates to excel in the world of work and contribute as leaders and agents of social good in our society. As a university community we seek to foster the development of these attributes through students, participation in the rich intellectual and social life of the university, through the learning experiences of their courses and the diverse extra-curricular activities available.
ENGINEERING GENDER BALANCE: FEMALE GRADUATE NUMBERS INCREASING

According to Dr Tim Wilkinson, Associate Dean (Education), the faculty has experienced a steady increase in the number of female students enrolling and graduating from its many disciplines.

“While engineering and IT student numbers have increased across the board, 10 years ago the University had as few as 50 female engineering graduates. Last year we doubled that figure,” says Dr Wilkinson.

“This year, the faculty is anticipating well over 100 female graduates.”

Among those graduates is Merrilyn James. Flanked by her two sisters, Isobel and Rebecca, who are also engineering students at the University, Merrilyn will receive her degree in power engineering.

As part of her coursework Merrilyn investigated the effect of space weather on our power system, particularly power transformers, and whether geomagnetically induced currents cause saturation and even failure of our power transformers.

“An outage due to space weather could be widespread and expensive to repair supply to all customers,” says Merrilyn who now works as a graduate engineer at Ausgrid. She hopes in the future to develop these models further.

While female graduates are reaching 20 percent of the engineering graduates, only 10.5 percent of practicing engineers are women, despite continuing efforts of academic institution and employer interventions to address the gender gap.

Professor Archie Johnston, Dean of the Faculty of Engineering and Information Technologies, says the faculty encourages all female high school students to consider the exciting range of engineering and IT careers that are on offer. The faculty runs a number of interesting and informative outreach programs including the Girls’ Programming Network – one-day workshops run by girls, for girls. Participants develop their own games, learn about digital media, and create smart phone applications.

He says while the numbers are increasing and are encouraging there is no time to be complacent.

“Engineers support the growth of all our communities. They are creative thinkers who rely on their understanding of mathematics and science as well as their knowledge of business and legal processes to meet the expectations of these communities,” says Dr Johnston.

“We still need to focus on increasing the number of school students taking higher levels of mathematics and sciences to underpin growth in all of the engineering qualifications. And every effort must be continued further lift the rates of women enrolling in engineering and IT undergraduate programs at Australian universities.”
2012 IN REVIEW BY THE DEPUTY VICE-CHANCELLOR (RESEARCH)

2012 has been a year of change and significant accomplishments for researchers at Sydney.

Our collaborative way of working became more visible with the launch of the fourth of our multi-disciplinary research Centres – the Sydney Southeast Asia Centre. Significant progress was also made in the other three Centres: the Brain and Mind Research Institute, China Studies Centre and the Charles Perkins Centre (CPC).

The CPC gained a name, (formerly the Centre for Obesity, Diabetes and Cardiovascular Disease), a new Academic Director and will soon gain 10 new Chairs and Professors. The hard work continues to unfold as we discover how researchers can work and thrive in a truly collaborative environment and how best they can be supported.

This is a challenge for the entire University and I know it will be one that all will relish. I look forward to working on this with you in 2013.

The University obtained fantastic funding results: achieving the highest national ranking in Discovery Projects is a result of which you should be particularly proud. Funding in both the Australian Research Council and NHMRC funding rounds was significant.

One highlight for me was the work I was privileged to do with researchers from across the University defending the freedom to publish research. I would like to acknowledge the role University of Sydney researchers played in having the Defence Trade Control Bill reconsidered. It was an example of how researchers can make a difference to the policy process and how important it is that we consider and continue to build our role beyond the walls of the University.

Finally, the year has been rounded off with spectacular results in The Excellence in Research for Australia (ERA). Sydney was assessed in 99 of the 157 4-digit fields. We were at or above world standard in 100% of our fields. 18 disciplines achieved a rating of 5 for the first time.

I attribute our success in ERA to the University’s ability to set a collective vision and work together in achieving it. There were so many different things that contributed to our result, which is as important as the results themselves.
**COMPUTER**

ARC Discovery Early Career Researcher Award  
2013—2015  
Next generation acoustic sensor arrays for super resolution imaging  
$270,847 to develop a new type of acoustic lens that enhances incoherent sensing. This compressive acoustic sensing approach will achieve super-resolution imaging that is robust to noise. The technology has diverse applications including medical imaging, petroleum prospecting, sonar and acoustic holography and will lead to new technology for Australia. (Dr Nicolas Epain)

**SOFTWARE**

Australian Government Office of Learning and Teaching  
2012—2014  
Driving curriculum and technological change  
$219,000 to support writing in the engineering disciplines. Dr. Rafael Calvo teams with Dr. Sarah Howard from the University of Wollongong and Dr. David Lowe and Helen Drury from the University of Sydney and academics from UNSW and UWS.

**TELECOMMUNICATIONS**

ARC Discovery 2013—2015  
Inter-cell interference special and control in future cellular systems  
$320,000 over three years.  
Small cells and frequency reuse are the key concepts in increasing the capacity of wireless cellular networks. However, the deployment of dense cells increases interference and limits the network capacity. This project will deliver novel interference control methods, capable of improving the spectral and energy efficiency in cellular networks. (Prof. Branka Vucetic and Dr. Wibowo Hardjawana).

**PHOTONICS**

International Program Development Fund  
2012—2014  
Biomedical devices integrated with micro-structured fiber sensors for interaction force measurements and in-vivo bio-sensing.  
Associate Professor Javid Atai has won an International Program Development Fund grant to collaborate with world-leading researchers from Harvard School of Engineering and Applied Sciences and Harvard Medical School. The project aims to develop novel techniques and algorithms to improve the capabilities of biomedical imaging devices so that real-time high-definition video can be transmitted and analyzed.

**FACULTY RESEARCH CLUSTERS**

The research undertaken in the Faculty of Engineering and Information Technologies is multidisciplinary and centred around the key themes:

- biomedical engineering & technology
- clean energy
- complex systems
- materials and structures
- robotics
- water and the environment

These research themes break down traditional disciplinary barriers and enable us to work collaboratively to develop truly holistic solutions to today’s big issues, including health and ageing, communication needs, workplace safety and climate change.
NEW NAME FOR CENTRE OF EXCELLENCE IN POWER ENGINEERING

The University of Sydney has re-named its Centre of Excellence in Power Engineering to the Centre for Future Energy Networks.

Director for the Centre, Professor David Hill, said the new name for the Centre:

- reflects the Centre’s evolution to become a multidisciplinary research centre for Future Energy Networks (CFEN)
- highlights the University’s aim to be Australia’s leading research institution in advanced smart grid research with emphasis on power grids and their control
- builds on Sydney’s distinctive field of research heritage, retaining its traditional research strength in power engineering; and providing a new emphasis on power grids and their control across areas of electricity networks, telecommunications, power electronics, decision and control, data management, embedded systems, and large software systems.

Professor Hill said the Centre will look ahead to and beyond 2050 to find solutions for zero carbon power generation that go beyond interim solutions, like greater use of natural gas, and provide for self-sufficient energy clusters, like smart homes and utility micro-grids supported by grids to ‘top-up’ locally generated electricity.

The case for a new name for the Centre was driven by the outstanding performance of Sydney researchers in attracting research and infrastructure grants including:

- $12.7m CSIRO Future Grids project
- $3.54m ARC project grants in smart grid
- $2.675m Capital Infrastructure project grant for existing teaching and research facilities in power and telecommunications engineering.
- Dedicated solar-powered cabin donated by Blue Planet Buildings.

Professor Hill said the CSIRO Future Grids Flagship project led by Sydney is an example of new collaborations where a single institution alone cannot deliver the desired result.
The University of Sydney is the lead partner in a $12.7M major collaborative research project between the CSIRO and the university sector under the CSIRO Future Grid Flagship cluster. Four universities, hosting seven teams are working on four projects with a common interest. Throughout the term of the projects, they will be sharing information and providing a big boost to the reality of an Intelligent Grid.

Changing Energy Futures
The Future Grid project will deliver the first analytical framework of its kind to systematically investigate the most economically efficient energy network (electricity and natural gas) configurations for Australia. Within this framework, to identify the lowest cost pathway to integrate significant amounts of large and small scale renewables into our grid with existing technologies while maintaining operational stability. To pave the way for significant emissions reductions in Australia’s most carbon intensive economic sector.

Research with real outcomes
- Static and dynamic engineering models of the power system that assess the technical feasibility and reliability of possible future energy scenarios.
- Planning of grids with a high-share of renewable generators and co-optimisation of electricity and gas networks where ‘networks of networks’ interact according to long-term changes in generation, load and market structure.
- Power and gas network investment models that use multi-objective optimisation techniques to identify least cost, maximum benefit outcomes from a range of future energy system scenarios.
- Robust policy analysis and development that will encourage market participants to deliver the desired long-term objectives.
P1
POWER AND ENERGY SYSTEMS MODELLING AND SECURITY - UNIVERSITY OF SYDNEY

To provide a special framework for the future Australian electricity grid out to 2050. To analyse beyond energy balancing to include grid power flows, stability implications, security and resilience to changing technologies.

P2
GRID PLANNING AND CO-OPTIMISATION - UNIVERSITY OF NEWCASTLE

To develop a co-optimisation framework to ensure that the electricity and natural gas networks are co-optimised for prescribed scenarios consistent with long-term planning approaches and short-term operational requirements. The objective is to specialise overall social benefit subject to constraints associated with the natural gas and electricity grid networks.

P3
ECONOMIC AND INVESTMENT MODELS FOR FUTURE GRIDS - UNIVERSITY OF QUEENSLAND

To model impacts on the National Electricity Market (NEM) in terms of price and volatility resulting from different network topologies identified in P1 and P2. Determine additional costs of investment in transmission and distribution networks for the different network topologies especially on retail costs and examination of alternative transmission network topologies to enhance greater deployment of generation and interconnection, including ‘renewable clusters’ in the NEM.

P4
ROBUST ENERGY POLICY FRAMEWORKS FOR INVESTMENT IN THE FUTURE GRID - UNIVERSITY OF NEW SOUTH WALES

To provide a unifying policy analysis and framework for policy makers and stakeholders consistent with objectives and outcomes P1-P3. To develop an interdisciplinary policy assessment framework to assess existing and proposed policy options for driving appropriate investment in the electricity industry. To develop a high level quantitative policy analysis tool for exploring the potential impact of different policies on the most economic future electricity generation portfolios, using portfolio ‘efficient frontier’ concepts. To apply these tools to develop high level insights on coherent and comprehensive climate and energy policy frameworks to drive appropriate investment in the future grid especially to minimise conflicts between multiple policy instruments e.g. renewable energy targets and network investment drivers.

FUTURE GRID FORUM

CSIRO is convening an Australian first, whole-of-system Future Grid Forum. Participants will include industry, government and regulators. Visit csiro.au/future-grid-forum.
ARC FUTURE FELLOWSHIP

SYDNEY RESEARCHER BUILDING COMMUNICATIONS SYSTEMS TO CONSTRUCT AUSTRALIA’S INTELLIGENT INFRASTRUCTURE

In July 2012 Senator Chris Evans, Minister for Science and Research announced 209 Australian Research Council Future Fellowships totalling $151 million to provide research opportunities to some of the world’s best mid-career researchers.

The University of Sydney received 22 of these, the largest single cohort of any institution.

Deputy Vice-Chancellor (Research) Professor Jill Trewhella said “It is fabulous to see our mid-career researchers recognised with these Fellowships. These really are important for the University in that they go some way towards securing the future of world-class research here and in Australia broadly.

“Again we have achieved funding across a broad range of disciplines, a testament to the continuing depth and breath of research quality at the University of Sydney.”

Among the 22 Future Fellows from the Faculty of Engineering and Information Technologies is Associate Professor Yonghui Li.

Professor Li has been received $708 456 over five years to make the critical theoretical advances to enable the building of large-scale machine-to-machine communications systems. This will be the essential precursor to technologies for constructing Australia’s intelligent infrastructure and smart cities.

The aim of Future Fellowships is to attract and retain the best and brightest mid-career researchers to conduct their research in Australia. Preference is given to those researchers who can demonstrate a capacity to build collaboration across industry and/or research institutions and/or with other disciplines. Future Fellowships aim to encourage outstanding Australian researchers currently based overseas to return to Australia.
In March 2012, the Institute of Biomedical Engineering and Technology (BMET) was officially opened at the University of Sydney and will significantly advance this multidisciplinary research for life sciences and medicine.

Established by the Faculty of Engineering and Information Technologies, BMET will bring together a team of around 35 researchers within the faculty dedicated to investigating core technologies that can assist in specializing in the field of biomedical research.

Electrical engineering is advancing biomedical research through wired and wireless technology to diagnose, monitor and manage patients with instruments connected via telephone and web-based services. “Fundamentals of Biomedical Engineering” is offered in the Bachelor of Engineering (Electrical).

The current key research themes covered by BMET include the following four areas coordinated by four Research Theme Leaders:

1. **Biomechanics, Biomaterials and Tissue Engineering**
   Developing reabsorbable, biodegradable, biocompatible and nanocomposite scaffolds for joint regeneration will be an important step in relieving patient discomfort and associated trauma.

2. **Biotechnology and Biomolecular Engineering**
   Researchers are developing advanced technology for engineering fine particles and nano carriers such as stable stimuli responsive micelles for targeted delivery of drugs, specifically anticancer.

3. **Biomedical Devices and Instrumentation**
   Researchers are developing ambulatory solutions using impedance imaging, bio-impedance and bio-potential monitoring with a particular focus on the areas of neurology, cardiology and nutrition.

4. **Imaging, Visualisation and Information Technologies**
   Researchers are focusing on the core enabling technologies and their novel clinical applications to bring significant improvements in health care.

Professor Feng addressed Foundation members at the September meeting.
MOVING FORWARD: A MARKET WORTH MILLIONS

In the face of an insatiable global appetite for new electronic technology, electrical engineers are in high demand. When the dot-com bubble burst, demand for computer engineering courses fell, and in some institutions, still hasn’t recovered.

This is a vast waste of opportunity, according to Associate Professor Leong.

Embedded systems, a sub-field of computer engineering, is an area of particularly strong growth. The term relates to computer systems designed for one or a few specific purposes, such as those used in mobile phones, GPS receivers and some implantable medical devices.

According to IDC’s Intelligent Systems: The Next Big Opportunity report, 1.8 billion embedded systems will be shipped in 2011, creating $1 trillion in revenue for component makers, software companies and integrators. By 2015, more than 4 billion units will be shipped creating $2 trillion in revenue.

“It is clear that embedded systems have become ubiquitous, and moving forward they’re becoming more and more prominent,” Leong says.

“New portable devices, such as smart phones, have several microprocessors in them and are very powerful computers in themselves.”

Other devices which were traditionally mechanical have become wholly or partially computerized. Cars are a prime example. An S-class Mercedes, for one, is fitted with close to 100 microprocessors. “There are separate systems to control the entertainment system, the engine brakes, and airbags.” Collision avoidance is soon to become a reality – the whole car is a sophisticated embedded system. The development of indoor 42specializes42 systems and field robotics, both useful in mining projects, are among the other growth areas in computer engineering.

Demand for new talent in computer engineering is reflected in the remuneration on offer in the field. According to a 2009 salary survey by Kinetic Recruitment Australia, graduate salaries in hardware, firmware and embedded systems engineering start at a median of $59 000 rising to a median of $150 000 for an engineering manager with 10 years’ experience.

“Embedded systems are still in their infancy. We are really waiting for creative people to take up the challenge, to use technology to better society,” Leong says.
During 2012, the School of Electrical and Information Engineering assumed responsibility to teach the embedded systems component in the National Computer Science Summer School in 2013.

The aim of NCSS is to improve the quality of IT education in schools around Australia and address the significant problem of low interest among secondary school students in information and communications technology-related tertiary study and careers.

A new programme was developed by Dr Johnson Thie and Associate Professor Philip Leong based on the popular Arduino platform. Participants developed a GPS tracker which recorded the location of the device, and sent its updated position to an arbitrary mobile phone via SMS. Videos, created by the students, describing their work are available from youtube.com/user/NCSSMedia.

INSPIRING AUSTRALIANS TO PURSUE SCIENCE AT SCHOOL AND UNIVERSITY

The NCSS supplements the opportunity for secondary students to learn computer programming with high quality coursework developed by university and industry professionals. The NCSS hosts two main events each year open to high school students across Australia:

- The NCSS Summer School
  - A ten-day residential program on campus

- The NCSS Challenge
  - A five-week online computer programming competition

- Girls Programming Network
  - A one-day workshop held each term for high school girls interested in learning to program and improve their software programming skills.
COMPUTER AND AUDIO LABORATORY

The Computing and Audio Research Laboratory (CARlab) specializes in three main research areas:

Spatial Audio research deals with all aspects of the spatial perception of sound.

Neuromorphic Engineering research investigates biological auditory processing and applies principles learned from biology to electronic systems.

BioElectronics research aims to develop hardware and algorithms to measure and classify biological signals, such as ECG, EMG, EEG, 3D position and location, skin conductivity, and blood oxygenation. We are researching a portable Electronic Impedance Tomography Spectroscopy device which measures tissue impedance to create an image of the tissue impedance distribution. This EITS system can be used for instance for monitoring stroke, epilepsy, and for detecting cancer.

NEXT GENERATION ACOUSTIC SENSOR ARRAYS FOR SUPER RESOLUTION IMAGING

Dr. Nicolas Epain has won an ARC Discovery Early Career Researcher Award $270 847 over three years to develop a new type of acoustic lens that enhances incoherent sensing. This compressive acoustic sensing approach will achieve super-resolution imaging that is robust to noise. The technology has diverse applications including medical imaging, petroleum prospecting, sonar and acoustic holography and will lead to new technology for Australia.

Dr Epain’s research focusses on the analysis and synthesis of spatial sound fields. During his tenure at France Telecom R&D (Lannion, France), he focused on the design and evaluation of spherical and cylindrical microphone arrays. This resulted in the development of a microphone array having an extended frequency range.
THE FIBRE-OPTICS AND PHOTONICS LABORATORY

The Fibre-optics and Photonics Laboratory (FPL) specializes in research into advanced optical techniques for photonic signal processing, microwave photonics, optical communications, nonlinear fibre optics, optically-controlled phased arrays, and terahertz/gigahertz photonics in communication and radar systems. Our research into photonic signal processing explores new, powerful paradigms for processing high bandwidth signals. This approach allows direct processing of high-frequency signals that are already in the optical domain, and has applications to radar, radio over fibre, defence, and radio astronomy arrays. The Fibre-optics and Photonics Laboratory is one of the leading research laboratories in the world in this field, and also participates as a core partner in the Institute of Photonics and Optical Science.

Highlights of the research include the discovery of new microwave photonic technique to realize an array of multiple true-time-delay elements that can be independently and continuously tuned to enable phased array antennas to operate with a wide instantaneous bandwidth; and new ultra-wide tunable high-resolution microwave photonic filters based on stimulated Brillouin scattering exhibiting the widest continuously tunable frequency range reported to date. Our paper on photonic signal processing was featured in the Optical Society of America (OSA) Spotlight on Optics 2012, nominated by the OSA’s Topical and Associate Editors to identify articles that have excellent scientific quality.

HARVARD AND SYDNEY COLLABORATION - FRONTIERS IN OPTICS

In international developments, Associate Professor Javid Atai has won an International Program Development Fund grant to collaborate with world-leading researchers from Harvard School of Engineering and Applied Sciences and Harvard Medical School. The project “Biomedical devices based on RF technologies” aims to develop novel techniques and algorithms to improve the capabilities of biomedical imaging devices so that real-time high-definition video can be transmitted and analyzed. Moreover, Dr Xiaoke Yi and Professor Robert Minasian, by means of an International Research Collaboration grant from Shanghai Jiaotong University, have created an international partnership in research into photonic signal processing.
AFFECTIVE LEARNING AND WRITING

Rafael Calvo’s research at the Learning & Affect Technologies Engineering (LATTE) group aspires to complement traditional teaching methods by developing tools that support different forms of learning. This includes tools that use facial recognition to automatically detect a student’s emotional response to a tutorial and software that improves a student’s writing by providing different forms of automated and semi-automated feedback.

“Writing activities are learning activities, and the rhetorical structure you follow actually has a lot to do with the conceptions you have about the activity.”

“The way you write tells us a lot about the way you think, and the way you work,” said Associate Professor in software engineering and LATTE director, Rafael Calvo.

Learning Environments Across Disciplines” $2.5 million - Social Sciences & Humanities Research Council of Canada.

ABOUT RAFAEL

2012 Citation for Outstanding Contributions to Student Learning.

- For his commitment to helping engineering students gain invaluable writing skills through innovative online tools. The tool, iWrite, has now been made available to academics outside of engineering. He is interested in investigating how people can learn better with the support of technology.

The citations are awarded annually by the federal government to recognize quality teaching practice and contributions towards student learning. “Our best teachers succeed because they are driven by the passion and academic rigour to make a difference,” said the Vice-Chancellor, Dr Michal Spence.

“They inspire and motivate our students to explore and push their own frontiers of knowledge.”
FOUNDATION COUNCIL 2012

Mr George Maltabarow, President
Mr Peter Tyree, Deputy President
Mr John Gaskell, Director of the Foundation
Mr Russell Ash, Independent Councillor
Mr Trevor Ashton, Independent Councillor
Dr Michael Brünig, Independent Councillor
Mr Matt Barrie, Independent Councillor
Mr David Hammond, Independent Councillor
Mr Peter Handel, Independent Councillor
Mr Raj Kapoor, Independent Councillor
Mr Colin Peacock, Independent Councillor

Ex officio
Professor Archie Johnston, University Officer (Foundations)
Ms. Shauna Jarrett, Provost and DVC nominee

Executive Officer to Council
Ms. Dianne Ellis

PERSONAL MEMBERS

Prof. Alex Baitch
Dr Trevor Bird (resigned July)
Dr Ashok Manglick
Mr David Stuart-Smith
Mr Eddie Fong
EIE Academic Staff

HONORARY LIFE MEMBERS

Mr. Allan Gillespie
Professor Mike Dureau

OBSERVER MEMBERS

Mr Keiran Passmore
Mr Steven Finlay
Prof Branka Vucetic

GOVERNOR MEMBERS

ABB Australia Pty Ltd
AECOM
AEMO
ALSTOM
Ampcontrol
Ausgrid
Endeavour Energy
Evans & Peck
Freelancer Australia
Fujitsu
Garde Services
GHD
IBM Australia Limited
Jubatus Pty Ltd
Landis + Gyr
Leighton Contractors
Lend Lease Infrastructure Services
NHP Electrical Engineering Products
Olex Australia
Parsons Brinckerhoff
RailCorp NSW
Schneider Electric
Siemens Ltd
Sinclair Knight Merz
SingTel Optus
Taihan Electric Australia
Telstra Corporation
Thiess Pty Ltd
Thiess-Services Pty Ltd
Tyree Industries
UGL Limited

A directory of Governor members is provided in the Appendix to this report
OFFICE-BEARERS - EXECUTIVE

GEORGE MALTABAROW
BE (Elec), BEd, FAICD, FIEAust, FTSE
President
Independent Non-Executive

George Maltabarow was appointed to the Foundation Council in July 2006. He is President of the Foundation Council. He is a former Managing Director of Ausgrid. He was previously Executive Director of NSW Treasury, where his focus was microeconomic reform, and Deputy Chairman of NSW Treasury Corporation. George is an energy specialist whose career has included utility and policy roles in all sectors of the electricity industry and government energy policy with the former NSW Energy Authority. He is a former Chairman and Board member of the Energy Networks Association of Australia and a former Director of the Energy Supply Association of Australia.

PETER TYREE
CPEng, Hon FIE (Aust.), FTSE
Deputy President
Independent Non-Executive

Peter Tyree is a chartered professional engineer and non-executive company director. He is the Immediate Past President of the Business/Higher Education Round Table (B-HERT). He holds or has held the following positions: Chairman of the Copper Development Centre (Australia), Member of the governing council of CIGRE, the global electricity industry’s technical forum. He is also a Governor of the Warren Centre for Advanced Engineering and Councillor of the Australian Industry Group. He was formerly Chairman/Chief Executive Officer of the Tyree Group of Companies, one of the largest non public companies in Australia. He advises engineering and energy faculties at the universities of Sydney, NSW and Wollongong.

JOHN GASKELL
B.Sc. (Hons) (Elec Eng), C.Eng, FIET
Director of the Foundation

John Gaskell was appointed to the Foundation Council in March 2010. He is the non-executive Director of the Foundation. He was previously Chief Executive Officer of ABB Australia Pty Ltd with responsibility for ABB’s operations in Australia and New Zealand. He has had a long career in Managing Director roles with ABB and its predecessor companies, with Rolls-Royce and with Kennedy and Donkin across Europe, the Middle East, North America and Asia.

OFFICE-BEARERS - EXECUTIVE

PROFESSOR ARCHIE JOHNSTON
BE, PhD, FTSE, FIEAust, FICE, FAICD
Ex-Officio Member of Council

Archie Johnston has been an ex-officio member of the Foundation Council since September 2009. He represents the University of Sydney in his capacity as University Officer (Foundations). He is Dean of the Faculty of Engineering and Information Technologies, a Fellow of the Australian Academy of Technological Sciences & Engineering, Engineers Australia, and, the Institution of Civil Engineers. He is Chair of the Centre for Leadership and Management (Engineers Australia), Deputy Chair of the Education Forum of the Australian Academy of Technological Sciences and Engineering (ATSE). He is a Director of the Warren Centre for Advanced Engineering, the Smart Services CRC and the CRC for Advanced Composite Structures Ltd.

SHAUNA JARRETT
BA (Hons) LLB
Ex-Officio Member of Council

Shauna Jarrett has been an ex-officio member of the Foundation since August 2008. She is the nominee of the Provost and Deputy Vice Chancellor of The University of Sydney. Shauna was appointed Assistant Group Secretary in the Office of General Counsel at the University of Sydney in August 2008. The University has established the Group Secretarial Office within the Office of General Counsel as one measure to assist the University improve its corporate governance and enhance the University’s ability to manage and support Regulated Entities such as institutes, foundations, centres, student organisations and corporate subsidiaries. She is also on the Board of the Public Interest Advisory Centre.
COUNCIL MEMBERS

RUSSELL ASH
Independent Non-Executive Member of Council
Russell Ash was appointed to the Foundation Council in August 2011. He is General Manager Energy at Thiess Services Pty Ltd. He is the nominated representative for Thiess-Services. Russell was previously General Manager Infrastructure Connex Infrastructure.

TREVOR ASHTON
DipElecEng
Independent Non-Executive Member of Council
Trevor Ashton was co-opted to the Foundation Council in November 2011. He is an independent non-executive Director. He is Director of Electro-Skills Group Training Company, Gynko Pty Ltd and the Business and Higher Education Round Table (BHERT). He is a contractor (part time) with Ausgrid. Trevor was contracted by the University of Sydney one day a week from May 2009 – May 2010 in the role of Membership Development Manager. His contract was extended to 31 December 2010. Since January 2011, he has performed this role as a volunteer.

MATT BARRIE
BE (Hons) BSc (Hons) MAppFin GAICD
Independent Non-Executive Member of Council
Matt Barrie was appointed to the Foundation Council in August 2011. He is Chief Executive of Freelancer.com. He is the nominated representative for Freelancer.com. Freelancer became a member of the Electrical and Information Engineering Foundation in the category ‘Governor’ on 4 November 2010. He was the founder and CEO of Sensory Networks Inc., the leading developer of OEM high performance network security processors. Prior to this he cofounded a hardware vendor supplying the global telecommunications market. At Sensory, He is an advisor to QuintessenceLabs, a quantum communications company in the defence sector, and was a non-executive director of Julius Finance, Inc. (now Benchmark Solutions). Since 2000, he has been an external lecturer at the School of Electrical and Information Engineering in Information Security, and Technology Venture Formation. He is the co-author of over 20 US patent applications.

DR MICHAEL BRÜNING
MSc, PhD
Independent Non-Executive Member of Council
Michael Brüning was appointed to the Foundation Council in December 2012. He is Director of CSIRO ICT Centre. He was previously Research Director of CSIRO’s cross-divisional Transformational Capability Platform in Sensors and Sensor Networks, one of only four large scale strategic research platforms in CSIRO. Dr Brüning was head of the Autonomous Systems Research Lab in CSIRO, one of the top three research labs in field robotics in the world. Prior to his engagement with CSIRO, Dr Brüning was with Robert Bosch Corp., USA, where he lead a research program that connected technology scouting in Silicon Valley and results from the U.S. top universities, with the company’s strategic interests.

DAVID HAMMOND
Independent Non-Executive Member of Council
David Hammond was appointed to the Foundation Council in March 2010. He was Chief Executive Officer of the Mechanical, Electrical and Plumbing Division of the Hastie Group. He was appointed to this position in September 2004. David Hammond entered the electrical contracting industry as an apprentice in 1979. He was previously Chief Executive Officer of Heyday Group which expanded with the acquisition of Watters Electrical (Aust) in December 2007. David is also Chairman of the major contractors group of the National Electrical and Communications Association (NECA-NSW) and Director of the not for profit ElectroGroup Skills and Group Training.

PETER HANDEL
BE
Independent Non-Executive Member of Council
Peter Handel was appointed to the Foundation Council in May 2010. He is Chair of the Community Engagement Committee. Peter Handel is Executive General Manager Industrial & Energy Division of Leighton Contractors. With more than 30 years in the construction industry, Peter oversees a diverse and growing construction business with 900 employees spanning the civil infrastructure and non-residential building markets in NSW, the ACT and New Zealand as well as the rail infrastructure market across Australia.
COUNCIL MEMBERS

RAJ KAPOOR
BSc (Computer Technology)
Independent Non-Executive Member of Council

Raj Kapoor was appointed to the Foundation Council in August 2011. He is General Manager Regions for Siemens Ltd. He is the nominated representative for Siemens. He was previously Chief Executive Officer of British Telecom and Orange Business Services. Raj commenced his career as a software engineer with IBM UK, before joining Fujitsu as a Consultant. Born in East Africa, of Indian origin, Raj has worked in London, Singapore, Korea, Hong Kong and Japan.

COLIN PEACOCK
DipElecEng MEngMngmnt
Independent Non-Executive Member of Council

Colin Peacock was appointed to the Foundation Council in December 2012. He was admitted to membership of the Electrical and Information Engineering Foundation in the category ‘Personal’ on 8 June 2012. He is a Chartered Professional Engineer who has 38 years of experience in electrical utilities in the electrical distribution industry with more than 16 years in various management roles in Ausgrid, including Executive Manager Transmission Mains responsible for the maintenance, installation and replacement of HV underground cable systems and HV overhead lines. In this role, he represented Ausgrid on various committees and expert panels of Cigré, International council for large electric systems.

COUNCIL COMMITTEES

Nomination Committee
Rule 6.11 of the Rules for Foundations provides that there shall be a Nomination Committee of the Council. The Nomination committee will serve the purpose of:
   i) Identifying new members who may contribute to the Council or replace retiring members;
   ii) reviewing nominations for members against the required skills; and
   iii) making recommendations to the Council.

The following council committees are under review:
Community Engagement Committee
Industry & Academic Collaboration Committee
Strategy & Development Committee
The Electrical and Information Engineering Foundation recognises the importance and benefit of reviewing its adoption and alignment with governance principles and provides the following report.

**PRINCIPLE 1**

Lay solid foundations for management and oversight

**Nature of the entity**

The Electrical and Information Engineering Foundation is a part of the University of Sydney ABN 15211513464 and not separately incorporated under a state or commonwealth Act. The Foundation is required to gain prior approval for its fundraising activities from the appropriate University delegate. The Foundation’s activities are not-for-profit and covered by the DGR status of the University of Sydney. The University is exempted from the requirement to hold an Authority to Fundraise and obligations upon holders of such an authority but is still required to comply with the balance of provisions of the Charitable Fundraising Act.

**Roles of Council and management**

The Foundation operates under the authority of the Senate of the University of Sydney, as approved in 1983 and has no powers of delegation. The Foundation conducts its affairs pursuant to the Foundation Rules and the relevant policies of the University. The Foundation must have its annual fundraising plan approved. The Foundation is to be reviewed every three years from the date of its approval. No review was undertaken during 2012.

**PRINCIPLE 2**

Structure of the council to add value

The composition of the Council of the Foundation in 2012 is provided at page 43.

Council members were elected and/or co-opted at the Foundation’s AGM on 2 April 2012. There is a nomination committee of Council but does not convene. The full Council resolves on nominations for co-opting of members to fill vacancies outside of the process of election at the AGM. There was not a performance evaluation of the Council undertaken in the reporting period.

**PRINCIPLE 3**

Promote ethical and responsible decision-making

Council members have been provided with the University of Sydney Foundation Governance Guide, Foundation Rules, Code of Conduct, Occupational Health & Safety Policy and the External Interests Policy. All these policies are available on the University’s policy register as are other relevant University policies regarding harassment, and grievance procedures.

**PRINCIPLE 4**

Safeguard integrity in financial reporting

The annual accounts of the Foundation are prepared by the financial staff of the University, signed off by the Finance Director and included in this Annual Report to the Senate. The Foundation is part of the University and therefore does not have its own audit sub-committee. The University is audited by the Audit Office of NSW.

In conducting fundraising appeals the Foundation must take all reasonable steps to ensure that commissions paid or payable to any person as part of a fundraising appeal did not exceed one-third of the gross money obtained by that person in the appeal and appropriate particulars of all items of gross income received or receivable, all items of expenditure incurred, including the application or disposition of any income obtained from the appeal and particulars of those transactions to which they related must be recorded in the minutes of the Foundation. The Foundation did not undertake any fundraising appeals during 2012.

**PRINCIPLE 5**

Make timely and balanced disclosure

The Foundation complied with the reporting and disclosure requirements of the Senate. These include an annual budget and this Annual Report.

Members and Council have been made aware of the processes for disclosure pursuant to the Code of Conduct, External Interests policy, which include protected disclosure to the ICAC, to the Ombudsman or the Auditor General.

---

1 Reg 9(6) Charitable Fundraising Regulation 2008
2 See s22(2)(b) Charitable Fundraising Act 1991 (NSW)
PRINCIPLE 6  
Respect the rights of shareholders, members, staff, volunteers, clients, & other stakeholders

The Foundation Council and/or membership consist of members of the community, industry bodies and the University whose input is invited via the Annual General Meeting and Council meetings of the Foundation. The following forums/mechanisms have been held during the year to involve stakeholders in election of the Council, activities of the foundation or other stakeholder participation:

Meetings held during the year:
- Annual General Meeting: 2 April 2012
- Ordinary Meetings: 13 June and 12 September 2012
- Council Meetings: 19 March, 5 September and 12 December
- Committee Meetings: Nil

Under the Charitable Fundraising Act, the University may be questioned about any appeal on details of the purpose of the appeal such as the appeal target, objectives, distribution of proceeds, etc and the process to provide answers. During the year the Foundation published information on its website and outlines those activities in this annual report. There have been no specific requests for information responded to by the Foundation office. Other enquiries may have been made to other parts of the University.

PRINCIPLE 7  
Recognise and manage risk

The Foundation recognises its activities within University premises or other premises require risks such as health and safety, environmental protection, privacy, trade practices, and compliance with the Charitable Fundraising Act to be considered and managed. The Foundation has managed these risks during the year by ensuring compliance with relevant legislation.

PRINCIPLE 8  
Remunerate fairly and responsibly

No member of a Council is entitled to receive any remuneration for acting in that capacity except reasonable remuneration on a basis which has first been approved in writing by the University Officer (Foundations).

Members of the Foundation Council may be reimbursed for reasonable expenses after written approval of the University Officer (Foundations). Any such instances are recorded in the minutes of the Council.
COUNCIL MEMBERS
The Council Members of the Foundation at any time during or since the end of the year are:

George Maltabarow  
(elected 26 July 2006)

Peter Tyree  
(elected 26 July 2006)

John Gaskell  
(elected 23 March 2010)

Russell Ash  
(appointed 10 August 2011)

Trevor Ashton  
(appointed 30 November 2011)

Matt Barrie  
(appointed 10 August 2011)

Dr. Michael Brünig  
(appointed 12 December 2012)

David Hammond  
(elected 23 March 2010)

Peter Handel  
(appointed 26 May 2010 - resigned 1 March 2012)

Raj Kapoor  
(appointed 10 August 2011 - resigned December 2012)

Colin Peacock  
(appointed 12 December 2012)

EX-OFFICIO

Archie Johnston  
(University Officer (Foundations)  
(Dean, Faculty of Engineering and Information Technologies, appointed 1 September 2009)

Shauna Jarrett  
(Nominee for Provost and Deputy Vice-Chancellor, appointed 1 August 2008)

Details of Council members, their qualifications, experience and any special responsibilities, including Foundation Committee Memberships, are set out on pages 47–49).

PRINCIPAL ACTIVITIES
The principal activities of the Foundation during the course of the year were the operation of membership-based association and the provision of membership services.

COUNCIL MEETINGS
The number of Council Meetings (including Meetings of Committees of Council) held during the year are detailed on page 50.

REVIEW OF FOUNDATIONS
The activities of the Foundation will be monitored against the proposed objectives and targets (including financial targets) of the Foundation, by the Foundations Office as part of the annual reporting process to Senate via the Audit and Risk Management Committee of Senate. (Policy 7.1)
## ATTENDANCE BY MEMBERS AT COUNCIL AND ITS COMMITTEES IN 2012

<table>
<thead>
<tr>
<th>Name</th>
<th>COU A</th>
<th>CEC A</th>
<th>ICC B</th>
<th>NC A</th>
<th>SDC A</th>
<th>COU B</th>
<th>CEC B</th>
<th>ICC B</th>
<th>NC B</th>
<th>SDC B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. R. Ash</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mr. T. Ashton</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mr. M. Barrie</td>
<td>3</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dr. M. Brünig</td>
<td>1</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mr. J. Gaskell</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mr. D. Hammond</td>
<td>3</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mr. P. Handel</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ms. S. Jarrett</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Prof. A. Johnston</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mr. R. Kapoor</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mr. G. Maltabarow</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mr. C. Peacock</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mr. P. Tyree</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**KEY:**

- **A:** Number of meetings held during the time the member was a member of Council
- **B:** Number of meetings attended

- **COU:** Council
- **CEC:** Community Engagement Committee
- **ICC:** Industry & Academic Collaboration Committee
- **NC:** Nomination Committee
- **SDC:** Strategy & Development Committee

Note: The Nomination Committee of Council does not convene. The full Council resolves on nominations for co-opting of members to fill vacancies outside of the process of election at the AGM.
## INCOME STATEMENT
FOR THE YEAR ENDED 31ST DECEMBER 2012

<table>
<thead>
<tr>
<th>Category</th>
<th>2012</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>INCOME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scholarships, Donations and Bequests</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Business and Investment Income</td>
<td>6,505</td>
<td>13,117</td>
</tr>
<tr>
<td>Membership and Subscriptions</td>
<td>96,000</td>
<td>186,000</td>
</tr>
<tr>
<td>Special Events Income</td>
<td>47,751</td>
<td>35,491</td>
</tr>
<tr>
<td>External Contributions</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Faculty contribution</td>
<td>914</td>
<td>13,243</td>
</tr>
<tr>
<td>Other Income</td>
<td>320</td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL INCOME</strong></td>
<td>151,500</td>
<td>247,851</td>
</tr>
<tr>
<td>EXPENDITURE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salaries</td>
<td>132,477</td>
<td>126,741</td>
</tr>
<tr>
<td>Consumables</td>
<td>546</td>
<td>249</td>
</tr>
<tr>
<td>Services and Utilities</td>
<td>1,158</td>
<td>2,529</td>
</tr>
<tr>
<td>Travel, Conferences, Entertainment</td>
<td>34,685</td>
<td>23,436</td>
</tr>
<tr>
<td>Student &amp; Printing</td>
<td>32,048</td>
<td>35,896</td>
</tr>
<tr>
<td>Consultants and Contractors</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>University Services Cost Recovery</td>
<td>914</td>
<td>13,243</td>
</tr>
<tr>
<td>Other expenses</td>
<td>60</td>
<td>2,249</td>
</tr>
<tr>
<td><strong>TOTAL EXPENDITURE</strong></td>
<td>201,888</td>
<td>204,343</td>
</tr>
<tr>
<td>SURPLUS / (DEFICIT)</td>
<td>(50,389)</td>
<td>43,508</td>
</tr>
<tr>
<td>Accumulated Funds as at 1st January</td>
<td>213,546</td>
<td>183,038</td>
</tr>
<tr>
<td>Prior Year Adjustment</td>
<td>-</td>
<td>(13,000)</td>
</tr>
<tr>
<td>Accumulated Funds as at 1st January</td>
<td>213,546</td>
<td>170,038</td>
</tr>
<tr>
<td><strong>ACCULMATED FUNDS AS AT 31ST DECEMBER</strong></td>
<td>163,158</td>
<td>213,546</td>
</tr>
</tbody>
</table>
# BALANCE SHEET
FOR THE YEAR ENDED 31ST DECEMBER 2012

<table>
<thead>
<tr>
<th>ASSETS</th>
<th>2012 $</th>
<th>2011 $</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURRENT ASSETS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Funds Participating in University Pool interest</td>
<td>163,158</td>
<td>213,546</td>
</tr>
<tr>
<td>Total Current Assets</td>
<td>163,158</td>
<td>213,546</td>
</tr>
<tr>
<td>TOTAL ASSETS</td>
<td>163,158</td>
<td>213,546</td>
</tr>
<tr>
<td>NET ASSETS</td>
<td>163,158</td>
<td>213,546</td>
</tr>
<tr>
<td>EQUITY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accumulated Funds</td>
<td>163,158</td>
<td>213,546</td>
</tr>
<tr>
<td>TOTAL EQUITY</td>
<td>163,158</td>
<td>213,546</td>
</tr>
</tbody>
</table>

## NOTES TO FINANCIAL STATEMENTS

1. **Accounting Policies**
   - The financial statements have been prepared on a modified accrual accounting basis.
   - All fixed assets expenses are expended in the year of purchase.
   - Employee entitlements for Long Service Leave are held centrally in the University’s accounts.
   - The University (including the Foundations) is exempt from income tax.

2. Prior year adjustment of $13,000 relates to Scholarship Income incorrectly credited in 2010 to this Foundation.

*I certify that the Income Statement and Balance Sheet of the Foundation have been prepared in accordance with the University’s accounting practices and procedures. These Foundation accounts form part of The University of Sydney’s financial reports which have been audited by the Auditor-General, New South Wales.*

Greg Robinson  
Finance Director  
Divisions of Natural Sciences, Engineering and Information Technologies and the Business School  
14TH March 2013