Institution: Glasgow Caledonian University

Unit of Assessment: 15 General Engineering

a. Overview

The Unit is situated within the recently formed School of Engineering & Built Environment (SEBE). In keeping with the University's mission "for the common weal", the Unit's work is focused on addressing major challenges facing the world's resources and ecosystems and applying technological innovation and engineering principles to solve them whilst ensuring minimal impact on the environment. The staff submitted under UoA15 work in cross-disciplinary research within a cognate area of *Engineering and Energy Systems*.

The research within the Engineering and Energy Systems area is supported by four research themes: Diagnostic Systems and Sensors (DSS); Energy and Power Systems (EPS); Engineering Processes and Manufacturing (EPM) and Environmental Technology and Management (ETM). The underpinning research within these themes covers the broad remit of General Engineering with activities spanning across UoAs 12, 13 and 14 that include; optoelectronics and optical communication systems, communications and networks, sensors, electrical power systems, sustainability engineering, environmental engineering, manufacturing technology and processes and systems.

In March 2013 the University established an Institute for Sustainable Engineering and Technology Research (ISETR) to provide strategic direction and impetus for the Unit's work. The ISETR covers research in three cognate areas: *Engineering and Energy Systems*, described within this return, *Interactive Systems and Communications* and *Sustainability in the Built Environment* that are being returned to UoAs 11 and 16 respectively. The research within each cognate area benefits from being part of the ISETR by developing innovations at cross-disciplinary research boundaries and thereby enabling strategic international collaborations with a broader range of private, public and third sector organisations to be established.

From RAE2008 the Unit has increased research income 460%: from £800k to £3.68M, increased our PhD completions from 23 to 30 and increased the number of outputs from 34 to 76.

The Unit has consolidated and enhanced its research position and international status through (i) greater clarification of its strategic direction situated within a new Institute of Sustainable Engineering & Technology (ii) increased staff resources with 11 new appointments (iii) strategic investment in laboratory facilities (e.g. in chemical analysis) (iv) improved career development pathways for its staff (v) developed stronger international and national collaborations particularly with industry e.g. Doble (USA), FMC Technologies (USA), EDF (UK), Wuhan Electrical Power Company (China) (vi) actively engaged in research pools such as the Glasgow Research Partnership in Engineering and the Energy Technology Partnership.

b. Research strategy

Research Vision. The Unit's vision is aligned with the University mission "for the common weal", and is to conduct research that delivers significant practical benefits and impact for society, for example, the provision of security of energy supply and water quality.

The Unit's research structure since RAE2008 has evolved from two research groups; *High Voltage and Insulation Diagnostics*, and *Product and Materials Technology*, to a single cognate Research Area, Engineering and Energy Systems, and is supported by four Research Themes: (i) *Diagnostic Systems and Sensors (DSS)*, (ii) *Energy and Power Systems* (EPS), (iii) *Engineering Processes and Manufacturing (EPM), and (iv) Environmental Technology and Management (ETM)*. The change in structure was carried out following an extensive review of research strategy undertaken after RAE2008. The review identified existing research strengths within the Unit and mapped these to the major challenges identified by funding bodies and industrial partners. The University made significant investment in the areas of strength, in both infrastructure and personnel, to provide world class facilities and the expertise to enable the Unit to respond to new emergent funding opportunities from public bodies e.g. EPSRC, EU, and to deliver on the research needs of industry.

The strategy for the Unit is driven by (i) addressing the priorities within the relevant Themes and Areas identified by UK Research Councils and Horizon 2020, (ii) addressing priority problems identified by our industrial partners, (iii) a commitment to improve our research policy and practice, (vi) enhancing the impact of our research beyond academia, (v) extending our international peer support networks, and (vi) developing strategic and project collaborations with outstanding colleagues in other universities in the UK and internationally.

Performance since RAE 2008

Income has increased by 460%: from £800k to £3.68m**.** Notable increases have been from

- RCUK research councils increased from £121k to £270k (123%)
- Direct industry funding increased from £445k to £1.34M (201%)
- EU increased from £61k to £1.29M (2150%)

The number of staff returned has increased by 110% from 10.0 FTE in RAE2008 to 21.0 FTE for REF2014. PhD completions have increased by 30% from 23 to 30 and the number of submitted outputs has increased from 34 to 76.

The success of the research strategy is reflected in the increase in overall Research Income, summarised above, and the key achievements in each of the Research Themes detailed below:

1) *Diagnostic Systems and Sensors (DSS)* Developed research activities include: the development of condition monitoring systems, electronic and photonic sensors, wireless sensor networks, chemical diagnostics and remote monitoring engineering.

   Key Achievements: Secured over £1.1 million in Industrial Research Contracts. Formation of two industrial research centres at GCU: "The Doble Centre for Innovation" (£1.2 million 2013-2016) and the "FMC Technologies Subsea Optoelectronics Laboratory", 2 Patents granted. Secured 3 KTP projects.

2) Energy and Power Systems (EPS) Developed research activities include: micro-generation, electric vehicles, and high voltage transmission networks.

   Key Achievements: Successfully transferred technology developed at GCU to EDF Energy and Wuhan Electrical Power (see REF3b for details). Secured £275,000 EPSRC project EP/G028397/G029210, a joint grant with University of Strathclyde, total value £540,000. Direct Industrial Funding, EDF Energy, £260,000.

3) Engineering Processes and Manufacturing (EPM) Developed research activities include advanced manufacture and multi-phase flow analysis.

   Key Achievements: Scottish Enterprise Proof of Concept Award. 1 Patent granted. Secured 3 KTP projects.

4) Environmental Technology and Management (ETM) Research activities include treatment of water and waste water, eco-toxicity assessment of micro-pollutants, low-cost treatment for drinking water supply in developing countries, management of nutrient loads in agriculture.

   Key Achievements: Secured 3 major EU funded projects; BATFARM, PILS, noPILS. (Total project value to GCU of £2.5M)

Future Strategy. Looking forward, the Unit will continue to increase its research within the cognate area of Engineering and Energy Systems with a specific focus in the short term on work related to the following challenges: (i) securing energy supply with an aging infrastructure through the development of novel diagnostic tools and sensors and (ii) the development of diagnostics and sensors for water quality monitoring and remediation. In addition, new and exciting challenges will be taken up in process and reliability modelling and in the development of sensors and diagnostics for multi-phase flows for the oil and gas sector.

Our strategic objectives are to:

(1) increase the scale, quality and impact of the Unit's activities through greater industrial collaboration: this will be supported by the recent University appointment of PVC Business

Development and, within the School, an Associate Dean of Business and Business Development Managers that will support our reach into industry

(2) enhance the research environment, culture and structure to underpin internationally excellent research through; an employment strategy to attract high calibre ECRs and support their progress, by forming collaborations with research intensive institutions through both formal means such as the Scottish Innovation Centres and the Energy Technology Partnership and through natural alliances, by supporting inward and outward visiting Professors and Researchers, and by adopting sector best practice in research management.

(3) increase the volume of research income from UKRC and EU by increasing collaboration with Research Intensive Institutes and improve the quality of applications through a peer-review college.

(4) increase the number of postgraduate research students and their subsequent successful completion and transition them into a positive career destination: this will be achieved through; greater success in securing research funding (see (3) above) to support studentships, investment at University and School level to provide 'seed funding' to develop promising research areas for studentships, and support provided to postgraduate student by the Graduate Centre and School

(5) strengthen our international collaborations in order to address problems that require solutions that work in multiple cultural contexts; for example in the water treatment area where techniques developed through EU collaboration are applied in developing countries in line with the University Mission.

(6) strategically engage with beneficiaries and research users to ensure that our work achieves maximum impact: This is covered in detail in REF3a but in summary involves: active engagement with major industrial or civic partnerships in applied research to solve real world problems, embedding the impact paradigm within the Unit and impact management through dedicated staff functions

The Unit's research strategy is subject to on-going scrutiny and review. To help evaluate progress data collection and monitoring tools such as PURE are implemented in order to feedback performance on output, impact and other KPIs. We also solicit advice and guidance from the School's Industrial Advisory Board with representation including Rolls-Royce, Babcock International, First Group and Clyde Bergemann, Visiting Professor Avi Levy and other industrial partners not on the Advisory Board.

The recently formed ISETR is in the process of establishing an international Academic Advisory Board that will provide guidance and assessment of the Unit's strategy, the quality of outputs and their impact, the strategic and targeted response to the research priorities, the development of career pathways for all researchers, and knowledge of best practice around the world.

We also contributed to the formation of the recently formed Innovation Centres in Sensors & Imaging (CENSIS), funded by the SFC, and are currently participating in the dialogue for the proposed Innovation Centre in Oil and Gas. The industry lead Innovation Centres will form an important part of the Unit's research framework going forward to 2020.

c. People, including:

i. Staffing strategy and staff development

Following the strategy review that took place after RAE2008 the University identified a number of areas where investment in new and existing staff with specific expertise was required to support and grow the research themes. New staff were recruited to (i) Environmental Technology and Management with expertise in water treatment (Professor Jiang, Dr Chubar), (ii) Diagnostic Systems and Sensors with expertise in high voltage condition monitoring (Dr Reid, Dr Farokhi, Dr Nekahi) and expertise in sensor networks and communications (Dr Popoola, Dr Sinanovic, Dr Karadalgic), (iii) Energy and Power Systems with expertise in Sustainable Energy (Dr Farrag) and (iv) Engineering Processes and Manufacturing with expertise in control systems (Dr Chen) and advanced manufacturing (Dr Harrison). Seven of the new appointments are ECRs reflecting the Units long term growth strategy through staff development.

15 of the 21 staff being returned to REF2014 were not submitted in GCU's return to RAE2008. Of these 4 developed their research careers at GCU through the support mechanisms described below and 11 are new appointments as detailed above.

To support the development of research active staff the School provides a personal development budget equivalent to £2500 per annum for travel to conferences, Doctoral Studies and CPD courses. Research Theme leaders advise and mentor research aspirational staff with peer review of research proposals and targeting research outputs to high impact international journals.

ECRs (eg Karadaglic, Reid, Farokhi, Nekahi, Chen, Popoola, Sinanovic,) are supported and mentored by established staff and are entitled to a reduction in teaching duties for the first three years of their career to focus on their research. The School also prioritises the allocation of PhD studentships towards the ECRs. A specific programme for ECRs has been developed by the Graduate School (which, in 2010 received a UK Times Higher Education Award for its Outstanding Support for Early Career Researchers Category) aimed at supporting the development of a culture based on international research excellence and addressing nascent research strategy and policy initiatives.

UoA15 fully endorses and utilises 'The Concordat to Support the Career Development of Researchers' and gives due recognition to the importance of recruiting, selecting and retaining researchers with the highest potential to achieve excellence in research. GCU has recently been awarded the HR Excellence in Research Award by the European Commission in recognition of our adherence to the principles of the European Charter for Researchers and the Code of Conduct for their Recruitment.

Our researchers are openly recognised and valued as an essential part of the human resource pool and vital components in achieving the university's overall strategy for development and delivery of world-class research. All our researchers are supported in their efforts to be flexible and adaptable in what is an increasingly global, diverse, and mobile research environment. We encourage researchers to take, and share, responsibility for being pro-active in engagement with their life-long learning, career, and personal development. We deploy a Performance Development Annual Review process (PDAR) that examines this and encourages, supports and rewards research achievements including: publishing, conference presentations, grant applications, editorial work and review work for research councils and other grant bodies.

The University's Dignity at Work and Equality and Diversity policies and practices are deployed across all aspects of the recruitment, career management of all of our researchers and PhD candidates. All staff subscribe to these policies and undergo training to ensure that individual and collective approaches to such matters are robust. The policies ensure that decisions made are transparent and sound.

The University continues to be an active member of the Athena SWAN Scottish Regional Network and we will submit our application for the Athena SWAN bronze in April 2014. Our REF2014 submission across all UoAs will be underpinned by our high percentage of female professors (33%) compared to a sector average of 19.8% and a 7% increase on 2011/12.

A co-ordinating group known as CREDO (Caledonian Research Excellence Development Opportunities) guides this development under the aegis of the University Research Committee. The group, chaired by the Director Academic Research Development, includes School Heads of Research, members of the GCU Research Peer Review College, the Graduate School, the Research Institutes and colleagues from HR. CREDO draws on the expertise of in seeking to enhance career pathway and staff development opportunities for all research staff across the university at all levels (contract research staff, early career researchers, principal investigators, and research group leaders). The University has also engaged in cross-sector research staff development and sharing of training provision with other Scottish HEIs via the Scottish Researcher Career Developers Forum.

The School's business development managers will expand our reach into industry and to help mentor staff around engaging and working with partners particularly around planning for impact. We also work with Communications and Marketing colleagues to plan and manage our dissemination platforms, and our outputs have attracted interest from new academic, business and

industrial partners so expanding our network for collaboration.

ii. Research students

The School of Engineering and Built Environment has a total complement of some 124 full-time and 56 part-time PhD candidates which provides a depth of experience for each of the candidates. The Unit has a current population of 29 full-time and 13 part-time research students evenly spread across the 4 research themes. The increase in PhD completions during the assessment period (+30%) reflects the significant strategic investment in postgraduate research provision. In collaboration with the Graduate Centre, the school has established an extensive support mechanism for post graduate research students and in 2012/13 achieved a completion rate within 4 years of 86%.

The University and School provide 14 funded PhD studentships per year aligned with the Unit's research strategy and targeted to increase collaboration with research-intensive Universities, grow research quality and provide support for ECRs. New research student appointments are made following interview in accordance with the University Equality and Diversity procedures.

All PhD candidates have a Director of Studies and supervisory team appointed before the start of their studies. All Directors of Study and Supervisors have secured PhDs, or have significant industrial experience, in their own cognate areas and undergo initial and on-going training in the management of PhD candidates.

Overall monitoring of student engagement and progress by the supervisory team is recorded and administered by a dedicated member of administration staff. Students are subject to an annual review, and transition from MPhil to PhD includes a substantial report and viva examination. The postgraduate students in the Unit are supported by a successful Graduate School which offers specific research skills training including an academic writing centre and utilises both internal and external facilitators in workshops. All PhD students must satisfactorily complete a research skills programme prior to completion. This includes the provision of a workshop programme for researchers that has been recognised by a THES award and which is aligned with the Vitae Researcher Development. In the recent HEA Postgraduate Research Student Survey 2013, 90% of research students were satisfied with their student experience.

Research students take part in regular (3 per year) cross School research colloquia and prizes are awarded for the best presentation of research work. Students are encouraged by their supervisory team to disseminate their research to the wider academic communities by publishing in a range of refereed journals and through attendance and presentations at national and international conferences, for which the School provides approximately £2000 per student. In preparation for conference attendance, students have an opportunity to make a presentation at the regular research theme meetings.

d. Income, infrastructure and facilities

During the census period staff in the research area have a total research income of £3.68M comprising; £270k from funding councils (EPSRC Grants), £1.29M from EU, £770k from knowledge transfer partnerships and Proof of Concept funding, and £1.34M from direct industrial research contracts. Consultancy and professional services are considered as indicators of the esteem that the researchers are held in by industry: during the assessment period the unit's activities have generated £750k through direct consultancy and CPD. The research, consultancy, Knowledge Transfer and business development activities of the unit's staff are supported by the University's Research, Innovation and Enterprise (RIE) department and the School's business development managers.

We have a wide range of specialist apparatus and dedicated laboratory facilities supported by trained and experienced technical staff including: a High Voltage Laboratory with two 100kV transformers, a Water Purification and Remediation Facility, Sustainable Energy Laboratory integrating micro-renewable sources and a Gas-Solids Multi-Phase flow facility. The Unit encourages collaboration with neighbouring Universities to utilise specialist facilities such as the

James Watt Nanofabrication Centre at the University of Glasgow.

The unit has a wide range of spectroscopic and microscopic equipment that supports activities across all research themes and includes: Gas-Liquid Chromatography, High Performance Liquid Chromatography, Gas Chromatography-Mass Spectrometry, Liquid Chromatography-Mass Spectrometry, Fluorescence Spectrometers, FT-IR Spectrometer, Raman Microscope, Laser Scanning Confocal Microscope, Atomic Force Microscope (AFM) with STM capability, Scanning Electron Microscope (SEM) with EDX and Transmission Electron Microscope (TEM).

Since 2008 the University has invested over £2.3 million in infrastructure and capital projects to support research activities within the School of Engineering and Built Environment. Specific investments made since 2008 include: £500K to create a new high voltage laboratory; £700K in new chemical analysis facilities and water treatment laboratories and £100K in a new sustainable energy laboratory.

The University has also invested £213k in information systems to support academic staff in their research activity. The new PURE research information system is used to manage research activity and to monitor progress by capturing and associating research activities in relation to publications, impact, esteem funding applications, projects and press clippings. A linked repository system provides public access to research outputs.

The GCU Library subscribes to key academic content in over 30,000 full-text journals, giving access to 35,000,000 peer reviewed journal articles. GCU spend 47% (£1.6m) of its library budget on information provision, 84% of this spend is on access to electronic content (SCONUL mean for 2012/13 is 77%). GCU were early adopters of EThOS (Electronic Theses Online Service) and have more than 300 PhD theses digitized and freely available for download. Since 2007/08 GCU users have downloaded over a million articles every year, and in 2012/13 over a million ebook chapters.

The broader School's research activities are co-ordinated by a Research Committee chaired by the Associate Dean Research. Membership comprises representatives of the research themes in the School including research students and research assistants. There are two sub-committees: Research, and Ethics. The School Research Committee aligns with the University's Research Committee ensuring robust alignment and development of the School's research strategy.

Future Investment Plan:

Our plan for the next five years will be to continue with the current level of investment in areas of success, through internal investment in new laboratory facilities and staff appointments aligned with research themes. The University has awarded funding for investment in 2014 for an upgrade of the chemical analysis capability to support research in Water Treatment (£320K) and the development of an Advanced Manufacturing facility (£500K). Additional areas that have been identified for future strategic investment include expansion of the High Voltage laboratory and a Multi-Phase Flow facility providing a gas-liquid-solids multiphase flow rig and instrumentation laboratory that will form part of a UK consortium being proposed by TUV NEL.

e. Collaboration or contribution to the discipline or research base

As a growing enterprise the staff in the Unit work collaboratively with research colleagues in Universities across the UK and internationally. This has resulted in joint research funding and co-authored output from institutions such as; the University of Strathclyde, the University of Glasgow, the University of Edinburgh, the University of Aberdeen, Imperial College London, Shangdong University (China), Wuhan University (China), and INTIA (Spain), NEIKER (Spain), TEAGASC (Ireland), IRSTEA (France), ISA (Portugal), Emschergenossenschaft (Germany), Lippeverband (Germany), CRPHT (Luxembourg), UniLimoges (France), RIVMV (Netherlands), Waterschaap Groot Salland (Netherlands).

Industrial collaboration is an important aspect of the work of the staff in the Unit and is actualised through direct funding and knowledge transfer partnerships. Doble (USA) have invested £1.3 million in R&D contracts since 2008 and in 2012 they invested a further £1.2M to establish an Innovation Centre in high voltage condition monitoring systems at GCU (see Impact Case Study in REF3b) . In 2011 FMC Technologies (USA) established the FMC Technologies Subsea

Optoelectronics laboratory at GCU, this collaboration combines expertise in electronics, optoelectronics, electrical power and instrumentation at GCU with that of subsea engineering and optoelectronics within FMC. FMC Technologies have funded 1 RA, 3 KTP Associates and 2 PhD studentships along with considerable in-kind support in staff time and donated equipment. Further industrial collaboration in the form of KTPs with local companies include First ScotRail, Shearwater Marine Services, Highland Coaters and Mahle Engine Systems UK Ltd attracted funding to the value of £540k.

The Unit supports sabbatical visits from staff to other international Institutes, between Feb- April 2013 Dr A Reid had a short term sabbatical at California Institute of Technology (CALTECH) Center for Advanced Computing Research (CACR) with Prof. Mani Chandy that resulted in a patent application with Reid named as inventor. The visit was funded by the Glasgow Research Partnership in Engineering (GRPE).

The Unit prioritises the award of the University and School funded PhD studentships to collaborative proposals with other Universities and this has established projects with a number of Universities, namely Glasgow, Strathclyde, Heriot-Watt, Edinburgh, Imperial College London, Technical University of Lisbon and University of Electronic Science & Technology (China). The School has been awarded 3 studentships funded by the Energy Technology Partnership (ETP) (an alliance of Scottish Universities) in collaboration with the Universities of Strathclyde and Heriot-Watt.

Professional Leadership Prof Pugh is Vice-President and Trustee of the Institute of Measurement and Control and Chairs the Learned Society Board. Prof Stewart is a Member of IEEE Dielectrics and Electrical Insulation Society Administration Committee (AdCom) 2010 – 2016, IEEE DEIS Secretary, and Member of IEEE DEIS Executive. Prof Zhou is a Member of CIGRE WG D1.39 and Fellow of IET, SMIEEE, Visiting Professor to Wuhan University, China. Prof Jiang Fellow, Chartered Institution of Water and Environmental Management Visiting Professor, Shandong University, Prof McGlinchey Member IMechE Bulk Materials Handling Committee. Dr Macdonald Member of the Editorial Board for the International Journal of Thin Walled Structures. Dr Popoola Participation in EU-COST Actions (an EU funded international research network), Participating Member ICT COST Action IC1101: Optical Wireless Communications - An Emerging Technology, Participating Member of Working Group 3 of COST Action IC0802, Visiting Researcher University of Edinburgh, Institute for Digital Communications.

PhD External Examining for PhD qualifications include: Indian Institute of Technology, Delhi; Newcastle University (Australia); University of Wollongong (Australia); University of Edinburgh, Massey University (New Zealand), University of Glasgow; Anna University (India), Southampton, Manchester, Strathclyde, Cardiff, Delft University of Technology (Holland); University of Rahman (Malasia); King's College London; Mondragon Goi Eskola Politeknikoa.

Examples of Conference Organisation:

Prof Zhou: Co-Chair of Technical committee of International Conference on Smart Grid and Clean Energy, 2012-2013.

Prof Jian: Member of Executive Programme Committee, 13th International Conference on Environmental Science and Technology, 2013, Athens, Greece, 5-7 September 2013. Member of Programme Committee, 2013 International Symposium on Environmental Science and Technology, Dalian, China, 4-7June 2013

Prof McGlinchey: Board Member of Bulk Solids Europe 2010 / Co-Chair IMechE Symposium "New Frontiers in Bulk Materials Handling", Glasgow, UK, 9-10 September 2010, International Scientific Committee The UK-China Particle Technology Forum IV, Shanghai, China, October 15-19, 2013. Member of Organising Committee, The UK-China Particle Technology Forum II, Guiyang, China, 1-4 September 2009, Member of Scientific Committee / International Advisory Committee for The 4th International Symposium on Reliable Flow of Particulate Solids (RELPOWFLO), Tromsø, Norway, 10 - 12 June 2008. International Organizing Committee Member The 8th International Symposium on Measurement Techniques for Multiphase Flows, December 13-15, 2013, Guangzhou , P.R. China

Dr Popoola: International Conference Technical Programme Committee Membership: 2nd

International Workshop on Optical Wireless Communications, October 21, 2013, Northumbria University, Newcastle upon Tyne, UK, 2nd IEEE International Conference on Communications in China (IEEE/CIC ICCC 2013), 12-14 August 2013, Xi'An, China, 12th International conference on optical communications and networks (ICOCN'2013), July 26-28, 2013, Chengdu/Xiling Snow Mountain, China, 18th European Conference on Network and Optical Communications (NOC 2013), July 10-12, 2013, Graz, Austria, 3rd Colloquium in Optical Wireless Communications, 8th IEEE, IET Int. Symposium on Communication Systems, Networks and Digital Signal Processing (CSNDSP), 18-20 July 2012, Poznan University of Technology, Poznań, Poland, 4th International Symposium on Applied Sciences in Biomedical and Communication Technologies (ISABEL), October 26-29, 2011, Barcelona, Catalonia, Spain. The Third International Symposium On Electrical and Electronics Engineering (ISEEE) 16-18 September 2010, Galaţi, Romania

Dr Macdonald: Member of the Scientific Committee of the International Conference Series on Thin Walled Structures (2004, 2008, 2011 and 2014), Member of the Scientific Committee of the International Symposium Series on Stability of Structures (2006, 2009, 2012 and 2015)

Example Keynote / Plenary Lectures:

Prof Jian: International Symposium on Environmental Science and Technology, Dalian, China, 4-7June 2013, 2nd International Symposium on Aqua Science, Water Resource and Low Carbon Energy, Dec. 7-10, 2009 (Sanya, Hainan, China)

Dr Sinanovic: ICTF conference in Poznan, Poland in May 2013, invited lecture at GREENET Workshop in Barcelona in July 2011.

Dr Popoola: The Rank Prize Funds Symposium on Solid State Lighting, Windermere 12th to 15th September, 2011. Title: 'High Data Rate Wireless Communications using White LED', EPSRC Communications and Networking workshop in Photonic Communications, Oxford University, 28th/29th September, 2011. Title: 'OFDM based Visible Light Communications: Lab. Demonstrator Design and Challenges'.

Prof Zhou: International Conference on Smart Grid and Clean Energy, 2013

Prof Pugh: The Institute of Measurement and Control Annual Lecture, 2011, at the Royal Society in London. The title of the lecture was 'The Challenge of Measuring Particulate Solids' Mass Flow Rate'.