Institution: University of East London

Unit of Assessment: UoA15

a. Overview

The *School of Architecture, Computing and Engineering* (ACE) was established in 2011, to provide an organisational foundation to better support our research plans; recognising Engineering research as a mainstream activity and strengthening our academic core to support our research strategy. UEL Engineering has a long-standing strength in knowledge transfer and industrial consultancy (see REF3a), which is now paralleled in our strong academic outputs and environment. Our submission is drawn from two research groups: *The Communications, Control and Electric Power Group* (CCEP) and *The Design, Materials, Engineering & Manufacturing Group (DMEM)***.** The submission contains 5 clusters of expertise in: (1) **Sustainable Design & Manufacturing;** (2) **Earthquake Engineering & Signal Processing**; (3) **Structural, Geotechnical and Coastal Engineering***;* (4) **Materials and Mechanical Engineering***;* and (5) **Circuits & Systems for Communication Technologies**. Our submission comprises 8 staff (7.8 FTE). This includes one professor (**Abdalla**), and 3 ECRs (**Qureshi, Ahangar-Asr, Jahromi**), reflecting a growing and vital research environment. This work has received recent funding from FP7 Euro 1.71 million) and EPSRC-Ford industry case award (£92,161). Linking with colleagues from UOA16 this forms part of the UEL research theme of *Sustainability*.

b. Research strategy

Enacting the six key objectives of the UEL Research Strategy, our primary focus over the last five years has been the development of our research environment and building capacity. Our strategy towards submission for REF2014 has been to develop a high quality core of research work building on our existing and established industrial and knowledge transfer base, to develop new groups and where necessary to recruit new specific expertise. We have pursued 5 strategic aims.

i) to attract new high quality research staff and develop early career researchers
ii) to enhance our research culture
iii) to develop high quality research groups
iv) to produce high quality outputs
v) to build our academic collaborations, networks and reputation

i) We recruited a high quality researcher as Dean of ACE (**Abdalla**) and recently appointed three academic staff at ECR level to build our future capacity (**Jahromi, Ahangar-Asr, and Qureshi**), adding particularly to our strengths in the Structural, Construction and Geotechnical Engineering cluster. This development has been supported by internal investment in promising researcher funds (£20,000+ from central UEL funds for **Jayaratne** & Ciupala) and funding for conference and overseas visits (£20K). We have also started to build a significant PGR cohort, which will continue to grow into the next period (see future strategy).

ii) We have made significant progress in developing a sustainable research culture within the School that can support our research vision and further develop our research activities. We have a number of research activities established on the School calendar and have hosted a number of visiting researchers and academics. The School organises research seminars with speakers from academia and industry. Speakers have included: Charles Johnson (Atkins), Ken Shuttleworth (Director of Make Architect and the designer of the Gherkin in London), and Paula Walsh (Technical Director of Arup). At least 10 seminars are organised per academic year. These seminars are highly interactive and provide a good opportunity for both students and staff to discuss research and for students to present their work in a wide audience (see section c).

iii) Our groups have made advances around five main areas of high quality research:

Sustainable Design & Manufacturing (**Abdalla,** Arunchalam, Adnan): We have been conducting research which is industry driven and currently leading an FP7 data centre project in partnership with 12 organisations from across Europe including University of Leeds, DCA, and TuDelft University. **Abdalla** has been working with the research team at Cranfield on the enhancement of product information collaboration and access in the aerospace industry in partnership with Airbus operation systems. We have been developing an integrated design framework for mass customisation in consumer electronics industry. Abdalla is collaborating with Ford Motor on developing a symbiotic simulation system for enhancing the performance of Ford engine

production. We have also been developing an integrated design system for sustainable consumer electronics products such as white goods. In addition, we have developed flexible manufacturing systems in advanced production systems dealing with the problem of scheduling of jobs and automated storage & retrieval system using non-traditional optimisation techniques such as adaptive genetic algorithms, artificial neural networks and fuzzy logic.

Earthquake Engineering and Signal Processing; (**Chanerley** & Ciupala). Since 2008 this area has been developing new wavelet transform methods, recovering the low frequency fling from seismic events by removing the baseline error. We have demonstrated that this error is actually locatable in time (Chanerley and Alexander, 2010), (**Chanerley** et al, 2013). The error is an acceleration transient caused by ground torsions and rotations. These novel results have been made possible by collaborating with many colleagues at the Universities of Bristol, Iceland, New Zealand. Furthermore we have presented a 3D approach in conjunction with genetic algorithms to investigate the effect of earthquake force inclination on minimum stability factor of safety and the shape & direction of the corresponding failure force which can be integrated in software building constructional design package to provide earthquake resistant capability.

Structural, Geotechnical and Coastal Engineering (Jayaratne, Qureshi, Ahangar-Asr, Jahromi, Abbas & Ciupala)**:** Since 2008, this group has actively engaged with industry and academia to produce high quality publications. We have published and presented major research findings on nonlinear finite element analysis, response prediction of structural responses of concrete beams, partially-damaged RC beams & columns, constitutive modelling of complicated mechanical/hydro-mechanical/thermo-mechanical/chemo-mechanical behaviour of saturated and unsaturated soils, soil-water characteristic in unsaturated soils, intelligent finite element modelling of geo-materials, landslide analysis/stability of soil and rock slopes under static and seismic loadings, compaction and permeability characteristics of soils, mechanical behaviour of rubber concrete. In addition, we have developed novel nonlinear computational models for advanced multi-physics and multi-scale coupled modelling of mechanical systems with particular emphasis on non-linear soil structure interaction and fluid-solid interaction. These has already been applied to various current and cutting edge problems such as response prediction and damage assessment of building structures subjected to deep excavations, tunnelling, modelling of elevated water tanks etc. At present, we have close collaboration with Mott Macdonald Bridge Division and University of Warwick on research themes of sustainable lightweight structures including all FRP (Fibre reinforced polymer) structures. We have also been involved in preparing design recommendations to Eurocode 4 for steel-concrete composite beams as reflected in our joint publications with University of Bradford and Lancaster University.

Materials and Mechanical Engineering (Saidpour, Stewart, **Abdalla**): We have conducted research, which has transformed dramatically the design and construction of two joint replacement prostheses, namely hip and wrist. The need for this development is that prosthesis loosening remains a problem for young people who need a long term, reliable fixation of hip replacements. We solved this problem by moving away from the traditional cemented metal material. A novel, low elastic modular component for total hip replacement has been developed using a composite of polyetheretherketone and carbon fibre. This novel design, and material, was implanted by a US firm, Osteotec Ltd (Gareth Thomas), and Professor John Stanley, Wrightington Upper Limb Unit. This work was led by Saidpour, who secured a professorship at Birmingham City in June 2013.

Circuits & Systems for Communication Technologies (**Lota,** Yeo, Hosny, Bailey): We developed approaches to quantify stability of single-bit and multi-bit higher order Delta-Sigma based analog-to-digital (ADC) and digital-to analog converters (DACs) for communication systems. Presently we are collaborating with the Sensors, Systems and Circuits Group in the department of Electronic and Electrical Engineering at University College London for design and development of BiCMOS/CMOS based radio-frequency (RF) ADCs for multi-standard wireless front-end applications. The collaborative research with **UCL** has resulted in the system-level development of a RF ADC capable of multi-standard operation for TETRA and Long Term Evolution (LTE). We have contributed to the standardization efforts of the **European Telecommunication Standards Institute** (ETSI) for software defined radio (SDR) and cognitive radio/networks. We have

contributed to microwave research particularly in high-temperature superconducting micro strip bandpass filter design and quasi-elliptic microstrip bandpass filter using tap coupled open-loop resonators and the novel microstrip dual-bandpass filters using dual-mode square patch resonators. The group have also developed a set of novel compensating current evaluation algorithms for power active filters based on orthogonal transformation strategy. These algorithms were implemented by a Slovakian firm in conjunction with University of Zilina (Prof Dobrucky) to improve the quality of their active power filters for locomotives and defence industries.

iii) Our focus has been to increase the quality of our outputs and this is reflected in this submission where we include outputs in eminent journals including: International Journal of the Institute of Electrical & Electronics Engineers (IEEE), Journal of the Institution of Engineering & Technology, Journal of Manufacturing Engineering, Bulletin of the Seismological Society of America, International journal of Design Engineering, Advances in Structural Engineering etc.

iv) Our research networks highlight our international reputation and vital environment with active research collaborations in the UK and abroad. Example, **Abdalla** is collaborating with 12 organisations from across Europe on an FP7 (euro 1.71 million) project**.** He has been working with Cranfield University on the enhancement of product information collaboration and access in the aerospace industry. He is also developing a symbiotic simulation system in collaboration with Ford. **Chanerley** is working on seismic data in collaboration with academic colleagues in the UK (Bristol University), New Zealand (CUSP Company), Iceland (EERC, University of Iceland) and recently in the USA (Stanford University); **Lota** is a visiting Research Fellow at UCL. **Jayaratne** works on coastal engineering and disaster management against natural hazards jointly with Waseda University, Japan and University of Tokyo.

Future strategy

Our strategy is focused on consolidating our existing success and expanding our research base in order to be recognised internationally for the quality and impact of our research. We aim to:

i) Increase our research income to sustain our work
ii) Continue developing our existing ECR and mid-career staff to an international standard
iii) Appoint more senior staff at professorship level to support the Engineering Research Centre, which we aim to establish in 2014 and develop staff to leadership positions
iv) Develop further our international networks and links
v) Build further our interdisciplinary work and impact building on our strengths in Architecture and Sustainability submitted in UoA16 & Computer Science and Informatics UoA11
vi) Develop further our PGR culture and support

i) We recently gained EU funding and have a number of ECRS in good position to obtain early career funding. Over the next period we will be developing funding applications in the areas of energy efficiency low carbon footprint systems, smart assisted living for the visually impaired, and augmented reality in design and manufacturing. In the next period we will look to obtain a minimum of 10 grants of £250k+.
ii) Key to our future sustainability is active mentoring and support for 'Early Career' and mid-career researchers. UEL research strategy places developing each generation of researchers as one of its primary objectives and has actively funded promising researchers: for example the University awarded promising research grants (£10K each) to **Jayaratne** and Ciupala in 2009-2010, and **Abbas** for attending conferences in 2013. It is our intention to continue implementing the Concordat to support the career development of researchers via appointments of post-doctorate research fellows, for example through **Abdalla's** recent successful FP7 PEDCA bid, which will result in the appointment of one research fellow and two research assistants. **Abdalla** is developing a partnership with Ford Motor Company to develop a symbiotic simulation system for the production line of Ford Engines. A recycling of waste heat for energy reduction for smart cities with Leeds and other EU organisations.
iii) Areas in which we will be seeking to consolidate and build our capacity are energy efficiency and low carbon footprint for Data Centres (**Abdalla**), innovative digital solutions to support verifications and validations of automotive/aerospace products, Smart Assisted Living for the Visually Impaired (**Abdalla**), power line communications and smart grid (**Lota**), novel efficient

machines designs, signal processing and earthquake engineering (**Jayaratne**), design of very high frequency wave guides, Tsunami disaster mitigation, fibre reinforced concrete structures (**Ali**), reconfigurable radio systems, sustainable designs. To support this we will be looking through specific investment and natural refreshing of staff to appoint more senior leaders in these areas.
iv) We will continue to encourage exchange of staff between institutions including inviting research staff from other high calibre institutions to spend their secondment period in our research laboratories. For example, **Lota** is currently a Visiting Research Fellow at UCL, **Abdalla** is a Visiting Research Professor at Cranfield, **Jayaratne** is a Visiting Research Fellow at Waseda University – Japan, we had an eminent Professor from South Korea from Seoul National University of Science and Technology, Professor Joongho Song, who spent his sabbatical six month (2009-2010) in our research laboratories, working on active power filters applied in AC Railway Systems. We also have international Visiting Professors from Slovakia and Poland in the field of control of electric drives (**Lota**, Bailey/Hosny) (Professor Jan Vittek and Professor Teresa Orlowska-Kawalska).
v) It is a key goal of UEL actively to seek synergetic interdisciplinary research collaborations among other research groups and centres between and within Schools; In 2011 UEL formed the new School of Architecture, Computing and Engineering to bring closer still these areas and in the next REF cycle we will be working closely with the Sustainability Research Institute (SRI) (**Abdalla, Abbas, Quershi, Jayaratne**, Ciupala) and Computing Research staff to develop research in green roofs (**Abbas, Abdalla**, Ciupala), power line communication (Hosny, **Lota**) and in Earthquake Engineering (**Chanerle**y), including the design and construction of a 6-degree-of-freedom seismometer for use in the field.
vi) Postgraduate researchers (MPhil/PhD) benefit from working within a dynamic research environment alongside more senior staff in their research disciplines. This research culture generates a vital and vibrant research community and strengthens links with industry and informs high quality teaching and develops a portfolio of innovative spinoffs. The University has a well established graduate School to support and nourish postgraduate researchers by fostering a stimulating environment and including postgraduate researchers within the research community. Supporting mechanisms for postgraduate researchers are provided via research skills training courses for graduates pursuing research degrees, public defence at the stage of research registration, during the annual reviews and before the final submission of theses for feedback on their progress and encouraging PG researchers to participate in international conferences.

c. People, including:

i. Staffing Strategy and Staff Development

Our staffing strategy for research active staff has been informed by the seven principles of the Concordat to support career development of Researchers. Research ability and fit to existing clusters, and research record and or potential are important factors for our recruitment selection process. It has been our policy since 2008 to ensure that all new academic appointments must be research active in one of our key research groups. We have clear research group structure that supports staff and PGR students. Our goal is that every member of academic staff should be clearly located within a research area and the School norm is that research groups provide the context for mentoring staff and setting staff research output goals and monitoring them. Development funds, research intern funds, and sabbaticals are available to support all research active staff in their primary research and in preparing research proposals, attending conferences, research skills training and in wider professional development (several staff have attended the consultancy training course provided by the University's Research and Development Support (ReDS) team. Research-active members of staff are given lighter teaching and administrative duties, with research activities explicitly included in the school's academic work allocation model. The University provides vitality research staffing mechanisms for the unit via encouraging ECR and mid-career researchers as described in section (b). This includes applying for internal research funding (promising research funds as described in sections (b) and (d)), sabbaticals and secondments to industry (Ciupala) and participation in open competitive personal research fellowships as a source of external research funding.
Career Development and Support: The University Staff Development and Review (SDR) scheme with its annual reviews for all staff includes personalised identification of research goals and training needs. New research active staff members are provided with opportunities, from early on, to participate in PhD supervision team in conjunction with more experienced staff. UEL has

recently gained the HR Excellence in Research Award, and offers a range of development courses across staff careers, based on UK Concordat development and integrity principles. PGR supervisors receive regular update training. ECRs are eligible to apply for the University Early Career Researcher Accelerator Fund, awards up to £10K for each proposal and staff from this unit have been successful in securing this award, e.g. the University awarded research grants, £10K each, to **Jayaratne** and Ciupala in 2009-2010. We implement the Concordat and support the career development of researchers. **Abdalla's** recent successful FP7 PEDCA bid will result in the appointment of one research fellow and two research assistants who will be developed in the next period. Internal School and University Funding opportunities, including the Research Development Fund, The Alumni Start-up research grants, and the Undergraduate Research Internships Scheme are available to support all research active staff. Funds are also made available by the School to support staff presenting at peer-reviewed conferences (e.g. **Jayaratne, Lota, Ali**), and for engaging in external research activities and or preparing research proposals. In 2001 UEL initiated sabbatical scheme to support development opportunities for individuals across the University by advancing their pursuit of research activity. Staff on fixed term research contracts are supported to apply for full time academic posts while staff on full time posts are eligible to progress their research career through the University's annual promotion round for SL, PL, Readers and Professorship.

***Equality and diversity*:** We are committed to quality and diversity, from the recruitment process to everyday support provided to our diverse staff. We have made significant number of appointments of staff originate from at least 10 different countries. Our staff benefited from flexible working hours and paternity leave and the University is fully committed to the Athena Swan initiative.

ii. Research students

Research students are essential to our research culture and vitality. Funding for their research work is obtained via either industry sponsorship, EPSRC/Case Awards or in some cases they are self-financing. These candidates transmit the research culture to the undergraduate students, therefore contributing to a teaching-research interaction through acting as instructors in practical sessions, research seminars or in informal interaction. Our research students join the research group within which they pursue their research. Each student is allocated, at the time of enrolment, a supervisory team, which consists of at least two members of staff with research knowledge and expertise related to the student's research project. Student progress is monitored well-established events, including annual reviews and minuted supervisory meetings, and a list of important milestones such as registration and MPhil Transfer. All PhD students have access to all University facilities, including a 24/7 library, and a dedicated research student room with networked computers and printing facilities. During the period of assessment, 14 students have been awarded PhD degrees related to the University, two students (Pederson, Da Silva: group CCEP, Electric Power & Control) have completing their PhD in conjunction with Delphi Diesel and Control Technique Dynamics (CTD) and one PhD student with Delphi Diesel has successfully completed his PhD (Abdi Fallahi) in "Robust Control of Powertrain Drives" (group CCEP, Electric Power & Control). The latter candidate is currently employed as a consultant engineer with Emerson, USA. Both research groups are involved in the expanding area of energy efficiency and sustainability. Several new PhD candidates have taken up research study in energy efficiency, green roofs, green wheels, and novel solid state topologies for wind generators. (Lemon, Owczarek, Nash, Mahmud, Latifi: group DMEM, Structural, Geotechnical and Coastal Engineering). **Lota** is seeking industrial sponsorship from Salex ES for a PhD study in designing active CMOS RF bandpass filters. There is also one PhD candidate researching into using existing power line infrastructure for broadband communication. **Abdalla** has also secured an Industrial Case Award with Ford. We have been proactive in supporting our PhD researchers by to further their research career either through support for external research, jobs in industry and academic posts.

Research student seminars take place frequently (at least once per month), in which PhD students present their research works. PhD research seminars are attended by staff, PhD students; and also a number of our MSc students. We also have a School Research showcase, where staff and PhD students present their works to ACE staff and students and also to external collaborators (both from industry such as Canary Wharf Group and academia), and students present at the UEL annual research conference. The groups arrange and have their own meetings. We also have an Undergraduate Research Internship scheme (supported by central UEL funding), This UEL-wide

scheme funds undergraduate students to work on a 10 week research project

d. Income, infrastructure and facilities

Income: the unit has attracted EPSRC Case Awards in conjunction with industrial establishments such as, Control Technique Dynamics (CTD) and Ford Motor Company. The School has been collaborating with Ford on research projects for many years such as the Eurofleetman Programme; with our MSc students completing their dissertations at the company, then the high-flyers moving to PhD sponsorships within the company (3 students) with the most recent on 'Innovative Symbiotic Simulation of the Manufacturing System' at the Ford company, **Abdalla** (£92K). Also at CTD, students pursuing research in the areas of innovative permanent synchronous magnet machine designs. **Abdalla** has recently secured an EP7 (euro 1.71million) grant to establish a pan European Data Centre in conjunction with 12 national and international industrial firms and academic institutions. Future research funding strategies focus on applying annually for at least one EPSRC, EU, and TSB-KTB research grants (section b). Examples of current projects and those in development are listed below:

EPSRC: 2009-2012: EPSRC Case Award in Conjunction with Control Technique Dynamics (£60,000); 2013-2016: EPSRC Case-award jointly with Ford Motors (£92K) to develop a symbiotic simulation of Ford Engine Manufacturing Systems. **Abdalla** is the Principal Investigator.

EU: 2013: PEDCA (Pan European Data Centre Academy) - euro1.71 million – Principal Investigator is **Abdalla**, the project is in partnership with Twente Institute for Wireless and Mobile Communications, University of Leeds, London & Partners LBG, TECHNISCHE University Delft, Data Centre Alliance Ltd, Wusys GMBH, Wysus, Cerious Green LtD, WFG (Germany), SMK 9Netherland), GrIT, and AIMES Grid Company.

Projects in development for 2014-2019: An EPSRC (Abdalla) proposal (£3.2 million) jointly with Universities of Leeds, Manchester and Bath, which focus on developing a fully integrated holistic system for energy efficient Data Centres. FP7 (Abdalla) proposal (euro 2.5 million) entitled "Smart Assisted Living for the Visually Impaired"–SALVI is to be submitted to the forthcoming Horizon 2020 in partnership with Universite Pierre et Marie Curie, Kaunas University of Technology, HARPO Ltd, MFKK Invention and Research Centre, and Smart Tech ltd.

KTP: 2013**: Abdalla** is developing a TSB-KTP (£112,000) in partnership with Ecolution Ltd. The project will investigate the development of an energy management programme with an e-portal interface for social housing providers and tenants, enabling positive behavioural change whilst improving the company's turnover, profit-margin and reputation.

Vital to our research are the specialist facilities provided in partnership with a world-wide network of industrial research collaborators; namely civil and earthquake engineering centres in the UK (Bristol and Iceland Universities), Christchurch (New Zealand), Delphi Diesel (US) and Control Technique Dynamics (Division of Emerson, USA). We are in the process of developing an Engineering Research Excellence Centre and funds are being requested for further expansion of our research laboratories. Our in-house physical resources in the Geotechnics laboratory include standard and modern: pneumatic shear box, odometer and triaxial testing equipment as well as the more traditional equipment that allows research to be more effectively undertaken. We currently have 3 triaxial, 3 shear boxes and 4 odometers, 2 CBR testing machines and 2 compactors which are the main sets of equipment, The Geotechnics laboratory is open plan which adjoins the materials laboratory and the heavy structures laboratory although they have discreet sections within the one plan area. The materials area is equipped with all the necessary testing equipment. The module testing structure laboratory at UEL also houses a model-shaking table that allows the model simulation testing of various structures. Research in river and coastal engineering is supported by a well equipped hydraulics laboratory which houses a large 300 mm wide flume, 100mm wide flume and a flatbed (Ahlborn) tank in which sediment erosion is being investigated. The effect of wave impact is being looked at in the 300mm wide flume. Research is not only undertaken by the staff included in the submission but also by undergraduate and post graduate students on their final projects and dissertations under the supervision of the academic staff and industrial visiting lecturers. At both undergraduate and postgraduate level teaching is informed and research undertaken that is industry led. The dedicated facilities for Electrical and Electronic Engineering are: Telecommunications Laboratory; Electronic Computer Aided Design Suite (from a £90k SRIF bid); Power Electronics and Control Laboratory and a Workshop. These facilities provide a good resource base to support research candidates. Examples of accessible software packages available via the computer network include Matlab, Orcad, Microsoft. In addition,

Docklands Campus is wireless-field enabled to enable access to the University network.

e. Collaboration or contribution to the discipline or research base

The School research groups have maintained strong and lasting external research collaborations during the REF census period as well as developing new links with key influential research organisations. **Abdalla** is the coordinator and PI of a Pan-European Data Centre FP7 project in collaboration with partners from the UK (University of Leeds, Data Centre Aliance, London & Partners, AIMES Ltd), Germany (Johann Wolfgang-Goethe University Frankfurt, Wusys Gmbh, and WFG Frankfurt Gmbh), and Netherland (Technische University Delft-TUDelft, Twente Institute for Wireless and Mobile Communications, and Cerios). **Abdalla** is a visiting research professor at Cranfield University co-supervising a project which aims to develop a cost modelling system for lean product and supported by SITECH Sp. So Polkowice, Poland. He is engaged in a knowledge transfer TSB project with Ecolution. He is also collaborating with Ford Motor Company on developing a symbiotic simulation system for the engine production. **Lota** (CCEP) is collaborating on research on reconfigurable RF ADCs for a combined Tetra-2/LTE receiver and the design of active CMOS RF bandpass filters for up to 17 GHz, 500 MHz and 270 Mbps with Professor Andreas Demosthenous, University college London. He is also collaborating with Professor Izzet Kale, University of Westminster, to quantify the stability of delta-sigma based ADCs and DACs with non-linear analysis for single and multi-bit quantizers. He is also collaborating with UCL research team. **Jayaratne** is collaborating with Dr Alison Raby, University of Plymouth, UK (Wave impact and overtopping research), Professor Tomoya Shibayama, Waseda University, Japan (Sediment transport and tsunami research) and Dr Miguel Esteban, University of Tokyo, Japan (Tsunami research). **Ahangar-Asr** has been conducting collaborative research works with Professor Akbar Javadi, University of Exeter, Professor David Toll, University of Durham, Professor Nasser Khalili, University of New South Wales, Professor Farimah Masrouri and Dr Olivier Cuisinier, University of Lorraine (Nancy), Professor Youliang Chen, University of Shanghai for Science and Technology, Professor Toufigh, University of Kerman, investigating ithe complex behaviour of saturated and unsaturated soils and also intelligent finite element modelling of geo-materials and geo-structures. Yeo (CCEP) is working with Prof. Lancaster (University of Birmingham) on high temperature superconductor microwave filters and Dr White (University of Birmingham) on Archaeological surveying RF/microwave techniques. An exemplar of interdisciplinary research earthquake engineering **Chanerley** (CCEP) is collaborating with Bristol University (Dr N Alexander), Iceland University, (Professor R Sigbjornsson, Dr B Halldorson) and a spin-off (CUSP Company) from the University of Canterbury, New Zealand under the direction of Dr John Berrill). Moreover, recently we have been collaborating with Professor Jack Baker's research group (Lynne Burks) at Stanford University in obtaining the low-frequency fling pulses for the particular research. He is also collaborating with the Earthquake Engineering Research Centre (EERC) at the University of Iceland analysing the ICEARRAY data from the 2008 earthquake and also with the CUSP company (New Zealand) established from Canterbury University (Christchurch, New Zealand) analysing the 2010 seismic event which caused much destruction in Christchurch.

Broader contributions to the discipline: this include membership of professional bodies and networks, journal editorships, peer reviewing etc. **Abdalla** is a Member of the Editorial Board for the Int. J. of Design Engineering, Accreditation Board for the Data Centre Alliance, visiting research Professor at Cranfield University, EPSRC Peer Review College, FRSA, FIMechE, Principal Fellow of the Higher Education Academy, and external examiner for Brunel, Birmingham, Westminster, and Dublin City Universities. **Jayaratne** is an elected member of Waseda-YNU Advanced Coastal Environment and Management Research Group - Japan, a visiting researcher to Complex Disaster Research Institute of Waseda University, a Fellow of Higher Education Academy, awarded travel grants from Great Britain Sasakawa Foundation £3,200 (2013) and £1,600 (2012), Royal Academy of Engineering £400 (2008) and £500 (2010). **Qureshi** has worked with Mott MacDonald Bridge Engineering Group and Access Design & Engineering on his research on Fibre Reinforced Polymer (FRP) bridges. He received the second runner up prize in the young researcher's conference 2010 organised by the Institution of Structural Engineers. Ciupala is Evaluator of EU research proposals, Brussels; RFCS evaluation, TGS8, November 2012, an EU Marie Curie Research fellow. **Jahromi** was awarded the 2010 Unwin Prize in Civil Engineering, Imperial College London for his PhD research work. **Ahangar-Asr** was awarded the best PhD student prize in 2009 for his research project at College of Engineering at University of Exeter and was also among top effective researchers at University of Exeter in 2011.