Faculty of Engineering, Science and the Built Environment

DEPARTMENT OF ENGINEERING SYSTEMS

RESEARCH REPORT

2004 - 2007

April 2007

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1. Introduction

In the past year alone, the Department of Engineering Systems has been awarded £1.5M in research grants and the total value of its existing grants is over £3M. These figures demonstrate the vitality and success of the Department's research in the face of unrelentingly competition in both the UK and international academic environments. The work is a combination of fundamental and applied research but an underlying characteristic is that it is aimed at applying research knowledge to achieve practically useful outcomes. Many of the projects will therefore be seen to be undertaken in collaboration with industrial companies or public bodies. Another common feature is that the research is very relevant to the teaching in the Department and this allows it to be channelled into undergraduate and postgraduate teaching programmes through lectures, visiting lecturers from industry, case studies and projects. A particularly pleasing result of this research activity, moreover, is that it enthuses and brings us together as an interacting and lively group of academics.

During the last year, the Department has been reorganized into two main research groupings: Environmental Engineering and Materials & Manufacturing. This was stimulated partly by the coming UK Research Assessment Exercise but also by a desire to focus the research within the Department. Within these groupings the Department Engineering Systems currently supports research programmes in the following broad areas:

- **Acoustics**
- **Refrigeration and Cooling Systems**
- **Energy Studies and Thermal Systems**
- **Materials Science and Manufacturing**
- **Soil Mechanics**

Research funding is obtained largely from industry, the Engineering and Physical Sciences Research Council, the Department of Trade and Industry, Knowledge Transfer Programmes and the European Commission. Our collaborators range from large multinational manufacturing companies and local SMEs to educational establishments in the UK and overseas.

This report summarizes the research being carried out in the Department. Each project is briefly described together with the supervisors, researchers, collaborators, sponsors and monetary value.

Tim Dwyer

Head of Department
Engineering Systems

2. Current Research Projects

2.1 Acoustics

Project Title **Development of a Speech Intelligibility Test for Children**

Description The project aims to develop a new speech intelligibility test for use by young children who may not yet be proficient in reading and writing. There is a need for such a test as current recommendations on speech intelligibility, including those for schools, are based on previous work with adults. It is unlikely that children's requirements are the same as those of adults. The test being developed involves children listening to a set of words and marking each word they hear on a set of pictures which includes the word and similar sounding words or 'foils'. Similar tests have been developed previously in the US but are not suitable, because of the words used and the quality of the pictures, for use by modern children in the UK. When the test has been fully validated it will be made available as a research tool and also for use in assessing the acoustics of classrooms and other areas.

Researchers Anne Carey

Supervisors Prof B Shield and Prof J Dockrell (External)

Funding EPSRC

Project Title **Acoustic Design Guidelines and Teacher Strategies for Optimising Learning Conditions in Classrooms for Hearing and Hearing Impaired Children**

Description This is a multidisciplinary project being carried out in collaboration with Professor Julie Dockrell of the Institute of Education, London University. The project involves acoustic and noise surveys of occupied and unoccupied primary school classrooms, questionnaire surveys of teachers and children, cognitive testing of pupils in different acoustic conditions, evaluation of the use of sound field systems in primary school classrooms, measurements of teachers' voice levels, evaluation of acoustic treatments of classrooms and development of a new word test for use in speech intelligibility testing with young children. Comparison of the objective acoustic data with questionnaire responses, cognitive test results and speech intelligibility testing will provide valuable information regarding ideal acoustic conditions for teaching and learning for hearing and hearing-impaired children. Results of the project will be made available to the Department for Education and Skills, as a contribution to the current debate on the new legislation in England and Wales regarding acoustic design of schools.

Researchers Anne Carey and Anastasis Efentakis

Supervisors Prof B Shield, in collaboration with the Institute of Education, Arup Acoustics and Voice Care Network

Funding EPSRC

Budget £160,000

Project Title **Acoustics of Open Plan Classrooms**

Description Open plan classrooms became popular in the 1960s for educational reasons but many teachers found them difficult to work in because of noise and visual disturbance, and in general they ceased to be used for teaching. However, in the current new generation of school buildings open plan spaces are increasingly appearing in both secondary and primary schools, often in the guise of 'resource areas' which are also used for teaching. There is now a legal requirement in England and Wales, as part of the Building Regulations, to provide conditions for good speech intelligibility in open plan spaces. This project will include acoustic and noise surveys of open plan spaces in primary and secondary schools, together with questionnaire surveys of teachers and children, to determine whether it is possible to achieve acoustic conditions appropriate to learning in such spaces. In addition to objective and subjective surveys a new acoustic model specifically for use with open plan classrooms will be developed, to enable acoustic treatments and other modifications to open plan classrooms to be evaluated. The project will provide data which may lead to a review of the legislation.

Researchers Emma Greenland (nee Tate-Harte)

Supervisors Prof B Shield and Dr S Dance

Funding PhD programme, EPSRC and LSBU scholarship

Budget £18,000

Project Title **Improvement of Speech Intelligibility in Enclosed Spaces using Sound Amplification Systems**

Description Previous acoustic research projects have found that sound amplification systems have been poorly designed in the learning environment. The project has two aims: development of a low noise measurement system, so as not to disturb the learning environment; and secondly, to produce easily understood design guides for sound amplification systems in rooms. The results will be applicable to a range of types of room where information has to be disseminated, such as auditoria, schools and underground stations.

Researchers Christos Nestoras

Supervisors Dr S Dance and Prof B Shield

Funding PhD programme/LSBU scholarship

Budget £50,000

Project Title **Development of a Measurement and Prediction System to Deliver New World-Class Speech Intelligibility Systems in Complex Underground Environments**

Description The key challenges in this project concern the development of novel measurement and prediction methods in the context of a 'live environment'. Previous measurement systems are based on isolating the room, no background noise, and using an array of temporary cables to carry the measurement signal to the loudspeaker and a return cable for the microphone. This closed loop system is entirely unsuitable for stations, so

it will be necessary to test an open loop measurement system using the cabling already installed as part of the Public Address System.

The mathematical model(s) should be capable of predicting the critical regulatory parameters for the Public Address System in all areas of the underground stations. These spaces are unusual as they tend to be very long, very reflective and use many directional sound sources.

Novel solutions using audio equipment will be investigated to improve the clarity of the communication. This approach must be taken as it would result in minimum inconvenience to the underground system, whilst meeting the new intelligibility standards within the constraints of the LUL designs.

Researchers Louis Gomez

Supervisors Dr S Dance and Prof B. Shield

Funding DTI /KTP programme with Telent

Budget £187,000

Project Title **Design and Development of Culturally Acceptable Products and Techniques for the Mitigation of Noise Exposure for Classical Musicians**

Description The key challenges in this project concern four specific areas: education of musicians, individual audiometric assessment; personal noise exposure; and solutions to reduce the risk of excessive exposure.

Normally, Health and Safety courses are run for employees where the noise is an unwanted side effect of a process, which can be mitigated easily with better equipment, different procedures or hearing protection. However, for musicians the noise is all important. This poses a different set of questions which need to be addressed according to current and new regulations. Education is a practical means of rising awareness of the problem, so that the practitioner can self regulate.

Assessment and analysis of hearing loss will establish the baseline for the scope of the potential problem in student classical musicians. In addition, personal noise exposure of various musicians will be measured.

Current practical solutions are based around hearing protection are not liked, and hence not used by classical musicians. Thus, a non-intrusive noise mitigation device is envisaged.

Researchers Georgia Zepidou

Supervisors Dr S Dance and Prof B Shield

Funding AHRC / KTP programme with Sound Research Laboratories

Budget £187,000

2.2 Refrigeration and Cooling Systems

Project Title **Methods of Measuring, Quantifying and Improving Energy Efficiency of Building Fabrics**

Description The fabric of a building is a major factor in determining the comfort of people living and working in that building. It is also one of the most important factors to consider when determining the overall energy efficiency of the building. Designers use facts and figures from books and guides to set the parameters for the building and determine the size of the heating systems etc based on these calculations. There is at present no regulation stating that this must be checked in the as built condition and no method of reliably and repeatably measuring the energy emitted by a building in normal operation. This project aims to do this by combining air tightness test, thermography and U value tests results to give a better more accurate result that the industry can use and trust.

Researchers Ben Cheeseman

Supervisors Prof G Maidment and Dr M Mavroulidou

Funding DTI/KTP programme with BSRIA

Budget £100, 000

Project Title **Effect of Thermo-Cycling on the Behaviour of Energy Pile Foundations**

Description Geothermal energy has emerged as a promising energy source in recent years and has received serious attention from developers and potential users. It has been implemented for the cooling and heating systems of buildings using its foundations (piles or retaining walls).

The real effects that take place between the soil ground and the thermo structures when this technology is used have constantly concerned the construction industry. The main aim of this project is to determine the effects of high cyclical temperature fluctuations on the stability and mechanical properties of geothermal foundation interactive systems using experimental and computational methods.

Researchers Reinaldo Florez

Supervisors Mr K Smith, Prof G Maidment and Prof M Gunn

Funding Self-funded

Project Title **Modelling and Verification of Latent Heat Storage using Energy Piles, using TRNSYS Software, and an Experimental Calorimeter Rig**

Description There has been a great deal of work done in exploiting the latent heat of materials such as water, to enhance and improve the performance of building refrigeration systems. These typically involve the construction of an isolated storage facility, such as a buried tank, which may be frozen over the previous night, to be used as a refrigeration cold sink during the following day.

The abundance of ground water suggests that such a similar latent heat store application could be devised by freezing the water content of the soil

around an energy pile. Concerns about soil deformation following successive freeze-thaw cycles, mandate that this exercise only be carried out with non-load-bearing piles.

The goal of this investigation is to develop and verify the modelling tools required for analysing such a latent heat storage system, and evaluate the benefits using an experimental calorimeter rig.

Researchers Saiid Bagherzadeh-Akbari

Supervisors Prof G Maidment, K Smith and Prof J Missenden

Funding EPSRC

Budget £50,000

Project Title **Refrigeration Systems Modelling for Fault Detection and Diagnosis**

Description The project is concerned with investigating and developing, software for the refrigeration systems to monitor Systems' transients by dynamic modelling to be used later in commercial food storage systems. The goals are to improve and enhance the refrigeration systems operation and reduce System's faults by have real-time performance monitoring.

Researchers Tarek El Shafey

Supervisors Prof G Maidment

Funding Scholarship and Bursary

Budget £50,000

Project Title **Development of Cooling Strategies for Underground Railways**

Description The underground railway networks are complex, multidimensional thermal environments. Currently more information is required on the dynamic environmental performance of these systems in order to identify energy management opportunities that will benefit system performance and thermal comfort. This project is concerned with the development and implementation of cooling strategies to underground railways. The project involves Thermal Modelling and Optimisation and Experimental Development

Critical to the investigation and selection of optimum whole life cost systems is the development of appropriate thermal models. Initially the project will review and compare existing thermal models against life cycle cost criteria to establish which model is preferable and what additional subroutines will be required. The model will be used to carry out parametric analysis to understand impacts of operational decisions but also to explore new cooling strategies and their implications. This work will investigate system performance over time on the London Underground. The project will develop generic empirical performance correlations to enable key variables to be developed and thermal performance of the underground to be characterised and better predicted.

Researchers Dr Yew Ting and Dr J Thompson

Supervisors Prof G Maidment and Prof J Missenden

Funding	DTI, KTP Programme with Parsons Brinkerhoff
Budget	£200, 000

Project Title	**Improving Energy Efficiency In Refrigeration in the Food Chain**
Description	The project is concerned with investigating and optimising energy efficiency in the food chain.
Researchers	Prof I W Eames
Supervisors	Prof G Maidment and Prof J Missenden
Funding	DEFRA
Budget	£250, 000

Project Title	**Development of a Miniature Refrigeration System for Electronics Cooling**
Description	This application is for collaborative research on an area of cooling of great industrial and social significance by three teams with expertise in heat transfer, system simulation and component design. The lead team will be based at Newcastle University with the support teams at Oxford and London South Bank Universities If the performance of electronic chips follow current trends and double every 18 months (Moore's Law), then it will soon not be possible to effectively cool them using conventional passive cooling and an alternative technique/devices must be found. This proposal is concerned with developing such a device. In particular it is concerned with a theoretical analysis and experimental evaluation of a miniature vapour compression refrigeration cycle optimised for the cooling of future electronic systems. The proposed work will consist of three distinct but interrelated activities that will be conducted at three centres by personnel with recognised skills, expertise, resources and experience to undertake this work. The proposed work is innovative in that it will examine issues associated with miniature refrigeration systems that have not been studied hitherto. It is intended to explore design criteria related to system stability and develop design codes to assist designers and manufacturers of such systems. The heat transfer performance of phase change in porous materials and the technology transfer associated with the compressor development all contribute to making this a very innovative project. The groups already have experience of working together and arrangements will be put in place to facilitate the exchange of ideas and expertise on a larger scale. The integrated approach will provide significant advantages compared to three unlinked projects and produce a significant step forward in electronic cooling technology.
Researchers	To Be Appointed
Supervisors	Prof G Maidment and Prof I W Eames
Funding	EPSRC
Budget	£233,000

Project Title	**Sustainable Integrated Modeling in Retail Applications**
Description	The project investigates the integration novel heating and cooling schemes

within the supermarket environment to reduce the carbon footprint. The models developed are based upon the second law analysis and will specifically enable optimization of integrated heating and cooling technology over true life conditions. It will consider solutions involving natural refrigerants integrated with trigeneration and energy storage.

Researchers Andy Campbell

Supervisors Prof G Maidment and Prof J Missenden

Funding Tesco Stores Ltd

Budget £10,000

Project Title **Low Energy Hotels**

Description The European Union is facing a critical situation regarding energy supply and dependency on imported fuels in the coming years. All studies show an increase in the energy supply uncertainty. For the hotel sector especially in Southern Europe this situation represents a major risk to the industry and actions are urgently needed to reduce the energy consumption and lower the dependency on imported fuels in this sector.

The project will provide a novel approach to demonstrate a new generation of energy conscious and sustainable hotel facilities. The structure of the project provides two phases of energy solutions representing increasingly high levels of ambitions. The first phase actions will seek to reduce energy consumption by implementing existing good practice, e.g. insulation measures, efficient boilers, glazing replacement, shading etc, and as well as focusing on integration of renewable energy in the building envelope, e.g. solar water heating, photovoltaics and solar assisted cooling. The second phase will introduce innovative solutions by utilising new principles based on nano-technology, heat-pipes and advanced controls to efficiently cool the facilities with only a very small consumption of primary energy.

Researchers To Be Appointed

Supervisors Prof G Maidment

Funding EU sixth framework

Budget 250,000 Euros

Project Title **CO2 in Refrigeration Applications**

Description The project investigates the use of the natural refrigerant CO2 in refrigeration applications. The project is experimentally based and investigates new configurations of cycle that enable entropy losses to be minimised.

Researchers Khalid Majaz

Supervisors Prof J Missenden and Prof G Maidment

Funding Self funded

Project Title **Sustainable Low Carbon Heating and Cooling Solutions for Retail Applications**

Description Refrigeration is vital to the delivery of food to the world's population yet it consumes half of the energy used in the retail sector. It also adds to emissions of carbon dioxide and other pollutants. Legislation over the past two decades has changed the options available to the designer but without giving optimum alternatives. There is therefore a pressing need to develop improved technologies to achieve cooling and this is accepted by industry, government and retailers.

Up until recently the design of supermarket systems has been based primarily on first cost decisions with little consideration of the performance over the lifecycle and its resultant costs and carbon emissions. However, the issues of global warming, depletion of non renewable resources, large scale increases in energy cost and long term reductions in interest rates has changed the market place rapidly. There is a need to develop and implement innovative low carbon solutions and to also consider whole life costs carefully. The aim of this project is to develop a novel low cost, low carbon solution and test its performance, developing novel system characteristics to enable optimum design and performance.

Researchers Ina Colombo

Supervisors Prof G Maidment and Prof J Missenden

Funding EPSRC

Budget £80,000

Project Title **An Autonomous Solar-Powered Jet-Pump Refrigerator**

Description The project scope is the research, design, manufacture and testing of a novel solar-powered jet-pump refrigeration system. The project forms the basis of a Knowledge Transfer Partnership (KTP) between Industrial Design Consultancy Ltd and LSBU. Although solar-powered refrigerators are already available on the market, they make use of photovoltaic cells and hence cost in the region of £3,000. By using solar-thermal energy and novel jet-pump technology, the project aims to deliver an autonomous refrigeration system that will cost in the region of £300. The initial application of the system would be as a vaccine storage solution in the developing world.

Researchers Ryan Fenton

Supervisors Prof G Maidment and Prof I W Eames

Funding DTI/KTP programme with IDC Ltd

Budget £100,000

Project Title **Development of a Whole System Performance Measure for Refrigeration Systems**

Description The project is concerned with the development of a whole system efficiency index, (SEI), for commercial and industrial refrigeration systems. Theoretical models of refrigeration systems have been developed. The models assume correct best design practices in the section and matching of components. From these models a range of efficiency classifications

have been specified, ranging from A to E, against which the performance of actual refrigeration systems is compared. A copy of the calculator software can be obtained from the Institute of refrigeration at: www.ior.org.uk.

Researchers Prof I W Eames

Supervisors Prof G Maidment

Funding Carbon Trust and Institute of Refrigeration

Budget £20,000

Project Title **A Novel Low Energy Pumpless Absorption Refrigeration Cycle**

Description The project is concerned with investigating, developing, manufacturing and testing a novel 'pumpless' single-effect vapour absorption system that can be powered by low-grade heat and then be used in buildings' cooling and food storage systems. The goals are to design and manufacture an environmentally friendly refrigeration and air conditioning system with higher coefficient of performance values in the order of 0.6 to 0.7 making it more efficient and compact than the diffusion absorption refrigeration cycles currently in existence.

Researchers Alex Paurine

Supervisors Prof G Maidment, Prof I W Eames Prof J F Missenden and Prof A R Day

Funding EPSRC

Budget £50,000

Project Title **Geothermal Source Energy (GSE) for Building**

Description The objective of current research is to investigate the integration of GSE with Heat Pumps for building cooling and heating and to boost the business in Fulcrum Consulting in the UK.

Researchers Dr F Wang

Supervisors Prof G Maidment and Prof J F Missenden

Funding DTI/KTP programme with Falcon Consultancy

Budget £100,000

Project Title **Sustainable Groundwater Cooling System**

Description Rising water tables in industrial centres, e.g. of London and Merseyside are causing deterioration of infrastructure for underground buildings, constructions and railway networks. In some instances this has resulted in the closure of rail lines for over one month, in order to carry out remedial works. At the same time, rising comfort expectations show public transport in a worsening light, in view of the high temperatures and humidities experienced. Conventional air-conditioning as applied in some countries is both very capital and energy intensive and consequently comfort cooling of this kind will not be implemented.

The subject of this project is an innovative integrated concept that will both reduce the water table and improve underground thermal conditions for

railway passengers. This idea has been proposed by the supervisory team and uses the cold groundwater to provide 'free' sustainable cooling for the underground network. This project involves an interdisciplinary engineering investigation into the above using hydrogeological, thermofluid and thermal comfort disciplines.

Researchers Felix Ampofo

Supervisors Prof G Maidment and Prof J Missenden

Funding London Underground Limited

Budget £400,000

Project Title **Transient Heat Transfer and Sustainable Cooling of Underground Railways**

Description This research project investigates the potential for using thermal storage within the earth's structure to cool underground railway tunnels. The project will involve computer modelling of the situation and this model will be validated against real life data and work on an experimental rig. The project will mainly focus on the infinite sink effect of the earth and look at ways of harnessing this cooling potential particularly when working under the surface in areas of substantial heat production.

Researchers Joylyon Thompson

Supervisors Prof G Maidment, Prof J Missenden and Dr F Ampofo

Funding EPSRC

Budget £50,000

Project Title **A Novel Low Carbon Superconductive Food Display Cabinet**

Description The purpose of this project is to investigate a novel superconductive cooling technique for food systems. This study will pioneer the research of a generic concept, offering improved temperature control throughout the food chain and leading to large energy savings as well as much improved food safety.

The supermarket is a large user of energy, consuming as much as 15,000 GWh of the UK's total consumption. Of this 50% is consumed by refrigeration equipment, which provides cooling for retail cabinets used for chilled and frozen foods. The purpose of these cabinets is both to display the food products attractively and to maintain food at temperatures below that required by food hygiene legislation. These cabinets use convective cooling to cool the food, however, due to the low air velocities heat transfer rates are very low. Consequently, the air stream entering the cabinets needs to be cooled to low temperatures to compensate for the poor convective heat transfer. Achieving low air temperatures results in a large energy penalty, through increased cabinet loads, lower refrigeration system efficiency and the necessity for energy intensive defrost systems.

A creative and novel concept able to provide significantly higher food-cooling rates is the subject of this proposal. The concept uses superconductive cooling in addition to convective cooling to significantly increase heat transfer rates to the food enabling the cabinet to operate

more efficiently and therefore at much higher temperatures. Preliminary research carried out by the applicants has shown that with this system lower food temperatures can be achieved with significantly higher air supply temperatures. A 4K increase in air supply temperature is possible, which will give energy savings and CO2 reductions of approximately 50% compared to traditional food display methods. Also, lower food temperatures will improve food quality and safety.

The superconductive food cooling technique is potentially an attractive commercial product, which could be supplied to new and retrofit cabinets. We estimate large potential CO2 savings of 1.9 million tonnes per year could be achieved following this research and proof of concept study.

Researchers Dr F Wang

Supervisors Prof G Maidment and Prof J Missenden

Funding Carbon Trust

Budget £73,000

Project Title **Flow Boiling of R134a Refrigerant-Oil Mixtures**

Description The present project is concerned with flow boiling for R134a and oil mixtures. The purpose of this research is to present a comprehensive study for boiling in a horizontal tube and to investigate the mechanisms of flow boiling heat transfer and the flow patterns encountered along the tube. The effect of oil on the flow patterns and heat transfer characteristics will be examined. An experiment facility has been design and constructed to allow both accurate measurement of the heat transfer rates and pressure drop and also visual observation of the flow characteristics. The parameters that will be examined include: heat flux (0-500 kW/m^2) mass flux (50-700 kg/m^2 s) evaporating temperature (-10 – 20 ^oC), quality (0-1) and oil concentration (0-10%). Two different oils will be examined (Castrol SW32 and Emkarate RL100S) to verify the effect of oil on the heat transfer rates.

Researchers Ibrahim Dabboussi

Supervisors Prof J F Missenden and Prof G Maidment

Funding PhD programme, Self-funded

Project Title **MSc Building Services Engineering (Flexible provision)**

Description This project is the development and production of the multimedia e-learning materials for the MSc Building Services Engineering (Flexible provision) Course. London South Bank University is the largest provider of undergraduate, post-graduate and CPD courses in the UK building services sector. The development of this package will allow a greater range of people to access the skills that the University has to offer whilst maintaining the high quality of education and training provision.

Researchers Eurling T Dwyer

Supervisors Eurling T Dwyer

Funding EPSRC

Budget £240,000

2.3 Energy Studies

Project Title **The Development of an Energy Auditing Methodology (KTP with SEA/RENUE)**

Description The Energy Performance of Buildings Directive is being effected in the UK through changes to the Building Regulations Part L (April 2006) and the Energy Performance of Buildings Regulations (April 2007). The latter requires all buildings over 1000 m^2 to have energy certificates, with certain public buildings having to display similar information in a prominent place. The generation of these certificates is new, and will need to be accompanied by recommendations for improvements to the building to reduce carbon emissions.
This will generate an increase in energy auditing of buildings. SEA/RENUE aim to improve their capacity for such audits by developing novel data capture techniques to simplify the energy certification and reporting process. New electronic data collection, transfer and analysis techniques will be developed, together with a new service that meets the needs of the EPBR.

Researchers Julie Allen

Supervisors Prof A R Day and Mr P Jones

Funding KTP

Budget £75,000

Project Title **The use of Advanced Meter Reading for Energy Waste Detection (KTP with TEAM (EAA Ltd))**

Description TEAM (EAA Ltd) are a leading energy services bureau, with a large number of public and private sector clients. There is a growth in the use of half hourly metering for electricity, gas and water consumption. This provides very detailed data on the energy use patterns in buildings, but often in such large quantities that it is impossible to make best use of the information.
This project seeks to find ways to collect and process the information to provide automatic fault detection, and performance evaluation. This advanced meter reading capability will allow the company to provide additional services, and through reporting apparent waste to the clients be able to make significant reductions in UK carbon emissions.
The project has developed two new analysis techniques that allows half hourly data to be quickly and effectively used. In the long run this will provide new energy characterisations and performance criteria.

Researchers Selvakumar Samiyappan

Supervisors Prof A R Day and Dr P Xiao

Funding KTP

Budget £70,000

Project Title **Continuous Commissioning to Improve Building Performance (KTP with ABS Ltd)**

Description The aim of this project is to develop a package to carry out continuous

commissioning for facility managers, middle and top level managers, and energy consultants who want to maximise the buildings energy efficiency and comfort.

Benefits from continuous commissioning are improved building performance and increased profits for companies through:

- Reduced operating cost
- Reduced environmental impact
- Leading to greater employee reward and motivation
- Improved reputation with customers, government and public

Researchers Sarath Wijesinghe

Supervisors Mr P Jones and Prof A R Day

Funding KTP

Budget £75,000

Project Title **Decision Support Tools for Low Carbon Building Design (KTP with ECSC Ltd)**

Description The aim of the KTP Programme is to develop the company to become the principal source of knowledge and expertise for combined heat and power (CHP) installations, and the use of renewable energy sources in new buildings compliant with building regulations.

The use of renewable energy sources in the development and construction of new buildings provides significant opportunities for reduction in energy use and harmful emissions. However there is a lack of clear guidance and supporting economic/technical models, which can be used by developers and planners, e.g. local authorities and property developers, in assessing the extent to which differing renewable energy sources, e.g. solar cells, CHP and ground source heat pumps, can be used from a technically feasible and economic perspective while ensuring compliance with EU/UK building regulations.

Completion June 2008

Researchers Aidan Dunsdon
Princess Ogumka

Supervisors Mr P Jones and Prof A R Day

Funding KTP

Budget £150,000

Project Title **On-line Building Energy Log Books (KTP with Zutec Ltd)**

Description This collaboration between LSBU and ZuTec (UK) Ltd is aimed at delivering an online software package that will increase the usefulness of Building Log Books to the owners and operators of commercial buildings. Key aspects for attention are minimising energy use whilst increasing occupier comfort and productivity.

The development of Building Log Books is a reaction to the ever-increasing complexity of commercial buildings. The effective management

and use of building information is at the core of this project. An online Log Book package enables building owners and operators to access information that is "live", rather than merely accurate at the time it was filed. This ease of access will result in: enhanced energy efficiency decisions; increased usability & accessibility; improved benchmarking; better operation of buildings; lower carbon emissions & running costs; reduced operational risks.

There is also significant scope for the integration of building controls and utility metering analysis with the Log Book package.

Researchers Rob Liddiard

Supervisors Mr P Jones and Prof A R Day

Funding KTP

Budget £75,000

Project Title **Monitoring Roof Mounted Wind Turbines in an Urban Environment**

Description Urban wind is seen as a potential renewable energy source, with a significant amount of space available on buildings to site small scale wind turbines. There is increasing interest in this small scale, particularly as London planning requirements ask for 10% renewable energy in all new developments. In addition there has been a growth in sales of these devices in the domestic sector. However, there is almost no reliable performance data on turbine output against actual site potential. This is undermining confidence in the technology and severely restricting its uptake.

This project will monitor the energy output two wind turbines – one horizontal and one vertical axis machine – over the course of a year at a site in central London. This monitoring will be carried out together with full wind regime and acoustic monitoring to provide the most comprehensive data set on urban wind potential.

Future developments include re-siting the turbines after the first year at a permanent home on the LSBU campus as a research and teaching facility. This will enhance the value of the research by providing the results for two different locations.

Researchers Chris Parcell

Supervisors Prof A R Day

Funding Southwark Council and LSBU

Budget £75,000

Project Title **Review of the Energy Requirements of the London Plan**

Description A review commissioned by the Greater London Authority on the effectiveness of the London Plan. The first stage of the review was completed in June 2006, and a second phase commissioned in April 2007. The review aims to identify whether developers are meeting the requirement to meet10% of the on-site energy demands from renewable energy sources, and which technologies are being used to achieve this.

	The analysis includes the quantity of technologies specified together with the effectiveness of the planning process to deliver real carbon savings.
Researchers	Felix Emanuel, Anagha Athalekar, Princess Ogumka
Supervisors	Prof A R Day and Mr P Jones
Funding	Greater London Authority
Budget	£60,000

Project Title	**Photovoltaic Thermal Collector- Optimization**
Description	Photovoltaic cells are devices that convert solar radiation into electricity, quietly with no moving parts and are friendly to the environment. The main disadvantage of these photovoltaic cells is that they are relatively expensive and their electrical efficiency is still low (5-15%). Although such PV/T systems have been studied both experimentally and theoretically, no work on optimisation in terms of material cost of the absorber plate (thermal unit) of PV/T collectors seems to have been reported. Realising that the ratio of the additional cost of the thermal unit per PV module cost should be the lowest possible, the purpose of this work is to optimize the absorber plate material content of a PV/T collector. The performance of such optimized PV/T collector will then be simulated. Finally, an optimized PV/T prototype will be constructed and its performance will be tested. The simulated and experimental results will be compared and validated.
Researchers	Petros Charalambous
Supervisors	Prof G Maidment, Mrs K Yiakoumeti and Dr S Kalogirou (External)
Funding	Self funded

Project Title	**Development of a CHP Feasibility Model with Sustainable Energy Action Ltd**
Description	The project will carry out market research and technical analysis of the different CHP systems available and existing feasibility CHP models, develop a detailed database with all the factors that affect the economics of CHP and a flexible model for conducting CHP feasibility studies. The project will test the model using existing and proposed installations, refined the model into an expert system, undertake feasibility and implementation of a real CHP installation and evaluate the potential for novel applications using different fuel types. Finally the project will produce operation documentation and train SEA personnel and consultants.
Researchers	Luis Hinojosa
Supervisors	Prof A R Day and Prof G Maidment
Funding	KTP
Budget	£75,000

Project Title	**The Development of Project Management System for Sustainable Urban Developments (KTP)**
Description	The research involves the analysis of the key technology components

which comprise a sustainable urban development, e.g. renewables, CHP plant, wastewater recycling and waste disposal; the assessment of the financial viability, costs, safety and environmental benefits of the available technologies detailed above; the identification of the key risk factors associated with each of the technologies. The project will develop a range of strategic models for different types of sustainable developments e.g. a residential site for 600 homes, a residential site for 6,000 homes, and a mixed commercial/residential site and will produce, based on the above models, technical documentation including energy and utility definition, typical site drawings, costs and schedules, in order to support full scale project development and execution, complete documentation and training for staff, to embed the technology into the company.

Researchers Vacant

Supervisors Prof A R Day, Prof G Maidment and Energy and Power Ltd

Funding KTP

Budget £75,000

Project Title **Understanding Household Energy Demand in Developing Countries: A System Dynamics Approach**

Description The project will evaluate the domestic energy situation in Nigeria, with particular attention on rural communities without access to stable energy supplies. In order to understand how best to service the development of these communities, it is essential to understand their energy needs and those factors that influence the choice of energy supply. Econometric studies are unable to examine the detail or interactions of the operating parameters and System Dynamics modelling will be examined as an alternative method for determining energy development strategies.

Researchers Oluremi Kayode

Supervisors Prof A R Day

Funding PhD programme/self funded

Project Title **Creation of Methods to Accelerate Improvement of the Built Environment's Carbon Performance**

Description The aims of this project are to:

- Develop a single metric for the evaluation of building carbon performance improvement options.
- Form a methodology for optimising building energy systems with respect to both carbon and investment yield.
- Identify the most sensitive modelling parameters (future energy costs, capital plant costs, value of carbon).
- Use a practical implementation of the methodology (a calculation engine) for a variety of engineering projects.
- Evaluate the impact on the Engineering consultancy pioneering the method.
- Characterise and categorise national built environment market segments to identify the 'path of least resistance' for achieving national carbon emission reduction targets with minimal economic imposition.

- Identify relationships between carbon performance and human utility and comfort of buildings.

Researchers Julian Sanders

Supervisors Prof A R Day

Funding PhD programme/Employer- funded

Budget £30,000

Project Title **Automatic Benchmarking and Classification of Buildings**

Description The aims of this project are to produce energy management tools for the automatic classification and benchmarking of buildings. To use half hourly collected data from buildings of electricity, gas, and water to classify the type of building and then to apply calculated benchmarks to the data to determine the efficiency of the building. The benefit of the tools will be to reduce the effort required to identify waste and specify energy saving measures to rectify problems.

The system will use a combination of techniques such as building energy signatures, benchmarking/classification and pattern recognition to evaluate building energy usage and efficiency.

Researchers Selvakumar Samiyappan

Supervisors Prof A R Day and Dr P Xiao

Funding PhD programme/employer funded

Budget £15,000

Project Title **An Evaluation of Fuel Poverty Alleviation Measures in Social Housing**

Description This project will undertake a physical study of 9,500 dwellings within a housing association. The study will assess the stock's energy rating both before and after the measures in energy efficiency have been undertaken. These measures will either include insulation (both wall and loft), heating systems and controls and glazing singly or part of a package, along with energy advice and benefit checks. The aim of this study is to compare the measures undertaken to assess which are the most effective both in reducing energy consumption against capital costs. It will then be possible to compare the measures taken against the NHER software results and predictions for fuel use and affordable warmth. A tenant satisfaction survey is to be carried out afterwards this will also confirm that the occupier is no longer fuel poor and has access to affordable warmth. The measure of success of this research study will be numbers of people taken out of fuel poverty and into affordable warmth. Although the link between the energy consumption of the dwelling and fuel poverty has been established, there are no studies purely involving social housing where more than 70% of the occupants are on some form of benefit.

Researchers Robert Peto

Supervisors Prof A R Day

Funding PhD programme/employer- funded

Project Title **The Evaluation of Cooling Degree-Days and their Applicability to Building Energy Analysis**

Description This project is part of an on-going programme of research that is examining all aspects of energy estimation and monitoring and targeting techniques for heating and cooling in buildings. High quality, high resolution data supplied by WSA is being analysed to assess the extent to which energy signatures and energy performance lines can be used in building energy diagnostics. Outputs from this work include improved interpretations of performance lines, which can correctly identify the base (balance) temperature of a building.

Researchers Prof A R Day

Collaborators Welsh School of Architecture, Building Research Establishment

Funding Project value lies in the data supplied by partners, which is estimated at £100,000.

Project Title **Development of a Dynamic Model to Simulate Boiler Controls**

Description The project is developing a dynamic model to simulate a variety of boiler control configurations. Different control settings and configurations give different firing patterns, which in turn impact on energy consumption. This is likely to be closely linked to the thermal behaviour of the building and system. This is a highly complex problem that requires carefully planned modelling and experimental methodology. A purpose designed boiler rig will be constructed that will enable real time investigation into the characteristics of different control strategies; this will be used to validate the model. The rig will need to be constructed in such a way as to emulate different building and system response strategies. Once validated the model will be used to analyse the behaviour of a variety of control strategies and, determine the best option for a given boiler arrangement. The outputs of this project will be a validated theoretical exposition of how boiler-firing patterns affect energy consumption, together with generic guidance of the positioning & setting up criteria for boiler control devices.

Start Date: September 2001

Researchers Xenofontas Damianos

Supervisors Prof A R Day and M Ratcliffe (external)

Funding PhD programme/self-funded

Project Title **The economic and Practical Implementation of Off-Grid Rural Electrification**

Description This project examines the practicalities of, and barriers to, implementation of renewable energy systems in developing countries. The focus is non-grid connected communities in Sri Lanka, which have provided data and case studies for the project. Systems dynamics modelling is used to assess the potential growth rates of renewables for a given range of constraints and opportunities. The results of this project are aimed at improving the direction of subsidy funding for renewable energy projects.

Researchers Jeyatharshini Bovan

Supervisors Prof A R Day, Prof T G Karayiannis and Prof I M Dharmadasa

Funding LSBU/PhD scholarship

Project Title **Decision Support Systems for Sustainable Energy Planning in a Developing Economy**

Description National energy planning strategies have been based on a wide variety of modelling techniques, including econometric, input/output and linear programming. System Dynamics modelling offers the potential to model the dynamic interactions of the energy system to explore different scenarios. This project aims to develop a new energy policy planning paradigm, which provides the software tools for a new planning methodology.

Researchers Titus Olaniyi

Supervisors Prof A R Day, Prof T G Karayiannis, M Kennedy and Prof R O Fagbenle

Funding EPSRC

Project Title **Modelling and Experiment on a Low-Pressure Solar Desalination Plant**

Description The availability of fresh water is imperative for the development of every country and in many places around the world this valuable resource is limited. The solution to this problem is one of the most challenging ones facing engineers and scientists. One way forward is the use of desalination plants. However, the cost of conventional desalination plants is beyond the reach of many developing countries. Furthermore fresh water may be needed in some remote locations. An innovative solar energy driven desalination system working at low pressure is currently examined. The novelty of the process lies in the reduction of the pressure due to the height of the evaporator which is 10m, allowing a much reduced grade of energy required to operate the cycle. In a real plant, solar energy can be utilised, thus eliminating the need for conventional and costly thermal energy input. A mathematical model was first produced which described the thermodynamic process and the desalination cycle. This was used to predict the performance of the plant. It was also used to evaluate the effect of parameters such as water flow rate, temperature, heater output (simulating the solar collector) and the rate of gas release in the chamber and its effect on pressure and thus performance. A prototype plant is now completed in our laboratories. This will be used to verify the viability of the proposed method and also validate the model. The model can then be used in various locations around the word with different insolation values.

Researchers Abdul Lalzad

Supervisors Prof T G Karayiannis, Prof I W Eames and Prof G Maidment

Funding PhD programme, Council for assisting Refugee Academics: £16K

Project Title **The Potential for Photovoltaics in the UAE in the 21st Century**

Description Investigation into the potential for Photovoltaics in the UAE and the practical application of ‘on’ and ‘off’ grid systems for the 21st century. The

global photovoltaic industry is growing at over 20% per annum. The main driver is the concern over global warming caused by fossil fuel based carbon dioxide emissions. In the United Arab Emirates (UAE) there has been an awakening by the government for the need to look at alternatives to their oil/gas based energy supply. This research investigates the potential for Photovoltaic in the UAE and the practical application of 'on' and 'off' grid systems for the 21st century.

Researchers Tamim Alhaj

Supervisors Dr A Parsa and Dr L Salam

Funding PhD programme/self-funded

2.4 Materials Science and Manufacturing

Project Title **Improvement in the Machining Processing of Aero-Engine Components used in the Joint striker Fighter (JSF) Project**

Description High speed machining using latest cutting tool materials and machining techniques under medium pressure coolant supply. This project explores the suitability of various cutting tool materials for economic machining of titanium alloys at high- speed conditions and also to dispel the myth that titanium alloys cannot be machined at high-speed conditions due to the possibility of ignition. Improvement in the machining processes will be determined in terms of tool life, minimum surface abuse and effective chip segmentation achieved with the high pressure coolant supply.

Researchers Dr J Bonney

Supervisors Prof E Ezugwu

Funding Rolls-Royce plc

Budget £35,000

Project Title **General Applications Features (GAF) Phase of the JSF Project**

Description Production of prototype machined component (GAF) using newly developed machining technology at high-pressure coolant supply. This project will simulate the machining of a typical machined component with similar features as specified in the JSF. This project will establish machining conditions that will ensure that the machined components will satisfy Rolls-Royce CME 5043 standard and also improve machining productivity. Coolant supply pressures up to 110 bar tend to generate lower reactive forces that will guarantee the integrity of the machined components.

Researchers Rosemar Da Silva and Dr J Bonney

Supervisors Prof E Ezugwu

Funding Rolls-Royce plc

Budget £40,380

Project Title	**Development of Machining Technology for the JSF Affordability Project**
Description	Optimisation of machining performance when machining Titanium alloy under high pressure coolant supply. This project will optimise cutting conditions that will ensure higher material removal rates and at the same time guarantee the integrity of machined components in a manufacturing environment. Step change in cutting speed in excess of 25% of current industrial practice for titanium alloy machining will be considered as this will be implemented to ensure machined components for the JSF project can be produced economically.
Researchers	Rosemar Da Silva and Dr J Bonney
Supervisors	Prof E Ezugwu
Funding	Rolls-Royce plc
Budget	£40,022

Project Title	**High Speed Turning of Aerospace Superalloys with Various Cutting Tool Materials**
Description	Various cutting tool materials such as nano and micron-grained size ceramic tools, coated and uncoated carbide tool materials, will be evaluated in terms of tool life, failure modes and wear mechanism(s) as well as forces generated when machining at high speed (up to 300 m/min) conditions under roughing (or bulk removal) and finish machining operations. This will provide relevant and reliable machining data for aerospace alloys.
Researchers	Dr W F Sales
Supervisors	Prof E Ezugwu
Funding	Rolls-Royce plc
Budget	£42,000

Project Title	**Specification for the Development of Production High Pressure Coolant Turning Tooling for the JSF Lift Fan**
Description	Implementation and refinement of production tooling for optimum delivery of coolant under high pressures. This project involves the testing and modification of different high pressure tooling for grooving and profile turning. The key objectives of this project are to: increase insert life by 5 fold when turning Blisks (bladed disks), reduce consumable tooling costs; achieve a balance between speed increase and tool life; evaluate alternative machine tool platforms (e.g. Mill/Turn capability). The developed tools should ensure that: the high pressure jet is delivered as close as possible to the tool tip as this will guarantee efficient cooling; all tooling developed should guarantee chip segmentation especially for roughing applications were most titanium alloys will be roughed out on most of the components such as disk and the lift fan; there is an assortment of HPC tooling developed to meet the varying carbide geometries required in rough turning a Blisk; this technology can be introduced onto the machine tool with minimal impact on production output.

Researchers	Dr D Fadare
Supervisors	Prof E Ezugwu
Funding	Rolls-Royce plc
Budget	£48,000

Project Title	**High Pressure Coolant Supply Technology in Finish Turning of Ti-6Al-4V Alloy with Various Cutting Tools**
Description	This research project is to primarily achieve a step increase in the machining of a commercially available titanium-base, Ti-6Al-4V, alloy using recently developed cutting tool materials including Carbides, Polycrystalline Diamond, Cubic Boron Nitride, micron and nano-grain size ceramic tools under 7, 10 and 20.3 MPa coolant pressures. Tool wear rates, cutting forces, surface integrity, micro and macro-geometric tolerances have been monitored. All the collected data are being analysed using statistical techniques. Analysis of the machining trials so far suggest that longer tool life can be achieved when machining with uncoated cemented carbide and PCD cutting tools under higher coolant pressure of 20.3 MPa compared to conventional coolant flow. This research project also seeks to achieve a step improvement in machining productivity when processing aero-engine components without compromising their surface integrity.
Researchers	Rosemar Da Silva
Supervisors	Prof E Ezugwu and Prof A R Machado (UFU Brazil)
Funding	PhD Programme/CNPq Brazil

Project Title	**Directional Coolant Flow in High Speed Machining of Titanium 6246 Alloy**
Description	Directional high pressure cooling system enables the coolant to flow under pressure through fine channel in the tool holder and exits through a nozzle located very close to the tool cutting edge. This ensures better cooling and lubrication at the cutting interfaces than conventional coolant flow when machining superalloys. As high pressure cooling application methods also affect surface integrity due to removal of hard inclusions from machined surfaces. Surfaces that conform to high integrity standards required directional cooling applied under low pressure conditions. This project aims to establish that there is benefit in using directional coolant technology at low coolant pressures up to 10 bar for rough face turning of the novel grade titanium 6246 alloy. This will benefit Rolls-Royce production plants that utilize machines that have a low pressure coolant delivery system for the manufacture of disc products.
Researchers	Ezedimbu Ugwoha and Dr J Bonney
Supervisors	Prof E Ezugwu
Funding	Rolls-Royce plc
Budget	£20,000

Project Title **Turning of Sintered Nickel Base Alloy (RR1000)**

Description RR1000 is a sintered nickel base alloy recently developed nickel base alloy by Rolls-Royce plc for high pressure turbine and compressor disc applications. Due to its chemical composition and specific processing route using powder metallurgy, RR1000 is characterised by high strength, toughness and hardness which are maintained at increased temperature, making the material extremely difficult to machine. Other serious challenge posed is the generation of surface "pick up" during machining. This problem is best solved by credible research and development work to generate appropriate data and also to develop new manufacturing methods that will ensure significant improvement in productivity, including savings on insert usage, shorter production time, ease of chip transportation and disposal, etc. The first stage of this project is benchmark machining trials followed by back-to-back machining trials. This will help to identify tool manufacturers with suitable cutting tool materials for machining RR1000.

Researchers Dr J. Bonney

Supervisors Prof E Ezugwu

Funding Rolls-Royce plc

Budget £10,000

Project Title **"Pick up" Generation when Turning Sintered Nickel Base Alloy (RR1000)**

Description Principal causes of surface alterations during machining are high temperatures or high temperature gradients developed during machining operation and plastic deformation. Temperature reduction in machining is essential to guarantee acceptable components and at the same time enhance machining productivity. Typical surface damage produced by machining process includes micro-cracks, micro-pits, tearing (pickup), plastic deformation of feed marks, re-deposited materials etc. Machined components for aerospace applications are subjected to rigorous surface analysis to detect surface damages which will be detrimental to the highly expensive machined components produced. Sintered nickel base alloy (RR1 000) is no exception to these conditions and is usually machined at low speed conditions but the resulting surface is usually dogged by "pick ups" which does not conform to the surface integrity requirement of critical aero-engine components. On the basis of this manufacturing problem, face turning of sintered nickel-base alloy (RR1 000) disc material were carried out under production conditions in order to understand the phenomenon of pick up generation on machined components during production and also to identify an envelope of suitable cutting conditions for machining sintered nickel base alloys without generating surface pick up.

Researchers Dr J Bonney

Supervisors Prof E Ezugwu

Funding Rolls-Royce plc

Budget £10,000

Project Title **Evaluation of Parameter Envelop of Hole Making and Milling of**

RR1000 Nickel Disk Material

Description The primary focus of this programme of work is the evaluation of machining conditions and determination of a machining parameter window (cutting tool characteristics, machining parameters, manufacturing route) within the specific machine tool framework against a specified geometrical, dimensional and surface integrity sensitive feature of RR1000 disc holes. The secondary outcome based on the data & possible future work will focus on delivering high process efficiency measured through reduced manufacturing times and cost, against surface roughness, surface integrity and geometrical and dimensional accuracy, of a specified disc hole feature.

Researchers Ezedimbu Ugwoha and Dr J Bonney

Supervisors Prof E Ezugwu

Funding Rolls-Royce plc

Budget £20,000

Project Title **High-Performance Polymer Coatings**

Description The project will develop a radically different process from those currently available for applying polymer coatings and novel thermoset materials. The project will meet an industrial need for an environmentally compatible technology to apply heavy-duty polymer coatings on engineering structures. The resulting technology will be capable of coating large components in-house or outside on-site, being solvent-free, operating at high productivities and producing much higher quality coatings. LSBU will be involved in new materials development, deposition process design, computer modelling and coating characterisation and property evaluation.

Researchers To be appointed

Supervisors Dr Y Bao and Prof D T Gawne

Funding DTI Link Programme

Budget £202,907

Project Title **Polymer Nanocomposite Coatings**

Description The project will extend the very recent advances in bulk nanocomposites to produce a new class of polymer coating hitherto unobtainable and with properties far superior to those of existing coatings. The research will develop new synthesis methods for powders in which the nano-phase interacts with the polymer matrix on a molecular scale. A new spray-coating technique based on processing powder particles in a thermo-kinetic window will be designed based on low-temperature high-velocity gas jets produced by cooled combustion. Near-infrared radiation simultaneous with spray-deposition will be developed for thermoset nanocomposite coatings. The coatings will be evaluated in the context of potential industrial applications.

Researchers Dr Z Qiu

Supervisors Dr Y Bao and Prof D T Gawne

Funding European Commission Framework 5 Programme

Budget £273,880

Project Title **Deposition of Glass-Based Coatings**

Description The project will develop a new integrated process based on modified plasma spraying and combustion flame spraying coupled with infrared crystallisation to deposit high-performance glass-based coatings on industrial components /structures. It is aimed at overcoming the weakness of the available processes and widening the application of the glass coatings. In particular, the new process has the potential to coat temperature-sensitive materials and structures. The spray-deposition process also opens up the possibility of nanostructured coatings, since its rapid thermal cycle preserves the structure of the sol-gel-derived powders and enhances subsequent crystallisation. LSBU is the coordinator of the project, which consists of nine partner organisations and a total cost of 1.8 million euro. LSBU will be involved in developing sol-gel process for new glass compositions, deposition process for glass-based coatings, computer modelling for materials database and process simulation and laboratory-based properties evaluation of the coatings.

Researchers Dr J Gao

Supervisors Prof D T Gawne and Dr Y Bao

Funding European Commission Framework 6 Programme

Budget £253,940

Project Title **Thermoset Coatings by Thermal Spray Deposition and Infrared Radiation Curing**

Description The deposition of thermoset coatings is much more difficult than that of thermoplastics since the thermoset particles have to melt but not crosslink in the flame and then the splats must cure before the end of the spray-deposition process without degradation. The project uses thermal spraying techniques combined with simultaneous IR radiation curing to deposit thermoset coatings. This involves fitting the slow curing kinetics of thermosets into the short time frame of a rapid spray-deposition process. Computational modelling and validation, coating characterisation and evaluation are important means for the research.

Researchers Peter Hu Xu

Supervisors Dr Y Bao and Prof D T Gawne

Funding PhD programme/LSBU Scholarship

Project Title **Process Simulation and Experimental Validation of Plasma Spraying**

Description The temperature and velocity profiles of plasma jet affect greatly the quality of the plasma spray deposited coatings. These profiles are determined by nozzle structures and process parameters. The project develops a computational model to simulate the temperature and velocity profiles of the jet as functions of process conditions and nozzle prototypes. The experimental measurements will be carried out to validate the computational model.

Researchers Wenliang Guo

Supervisors Prof D T Gawne and Dr Y Bao

Funding PhD programme/LSBU Scholarship

Project Title **Glass Coatings by Thermal Spray Deposition**

Description Glasses are a unique and versatile class of materials, whose properties are greatly under-exploited in coatings due to the limitations of existing materials and available processes. The research will develop glass-based coatings on steel substrate. This will involve developing feedstock powders, deposition techniques and quality control methods.

Researchers Fwaz Said Alhasso

Supervisors Dr Y Bao and Prof D T Gawne

Funding PhD programme/self-funded

Project Title **Flexible Automated Coating Process**

Description Physical vapour deposition (PVD) is a prime candidate to replace existing electroplating processes, which are serious sources of environmental pollution. However, PVD is expensive and is not affordable by many SMEs in the electroplating sector. This project is aimed at developing a flexible and low-cost PVD process that produces engineering coatings with acceptable properties.

Researchers To Be Announced

Supervisors Prof D T Gawne and Dr Y Bao

Funding European Commission

Budget £1,490,000 (total) - £225,000 (LSBU share).

Project Title **Biomechanics: Whole Body Vibrations**

Description Experimental investigations of whole-body vibration (WBV) of different frequency and amplitude on muscle activation level during static and dynamic squat exercises. Biomechanical (postural) conditions during the exercise are kept constant for all conditions and subjects, and controlled by using a 2D electrogoniometer attached laterally to the knee: static squat to 20deg knee flexion; dynamic squat between~20-40deg. Muscle activity is quantified by using surface electromyography (EMG). Bipolar EMG electrodes are attached to the surface of two leg muscles and continuous records taken throughout the experiment. The general aim of this project is to establish and to investigate the dependence of muscle activation level during whole-body vibration on the biomechanical properties of the human leg.

Researchers

Supervisors Dr V G A Goss, Dr D Cook and Dr K Mileva.

Funding Pilot study to prepare for EPSRC funding

Project Title **Deep Sea Cable-Buoy Dynamics**

Description This research proposal concerns the mechanics of self-deployable cable-

buoy systems which have a single mooring line i.e., "single point" and are sub-surface i.e., they lie below these and are unaffected by surface waves. The research is inspired by a strong interest in both the practical and theoretical aspects of these systems with a particular focus on the problem of cable tangling. This problem is known to arise in these systems but is not well understood. Self-deployable cable buoy system are used for monitoring of the environment.

Researchers

Supervisors Dr V G A Goss and Prof I Sillitoe (CISM)

Funding Research proposal being prepared for EPSRC funding (First Grant Scheme)

Project Title **Analysis of Second Mode Configurations of Rods**

Description Mathematical and experimental investigation into the large deflections of second mode configurations of a bent rod with welded ends. This work is complemented by experiments on nitinol wire, which has superelatic properties. The mathematics involves using elliptic functions to solve a system of nonlinear ordinary differential equations. So far analytical results have been obtained which describe the bent confiiguration and fit well with experimental data. These are new results. The next phase is to investigate the interaction between the first and second mode configurations, which manifests itself through a seconday bifucation. The critical parameter appears to be misalignment of the ends of the rod.

Researchers

Supervisors Dr V G A Goss

Funding Self-funded

2.5 Soil Mechanics

Project Title **The Response of an Unsaturated Silt to Earthquake Loading**

Description This project attempts to combine ideas from two separate areas at the forefront of soil mechanics research: the mechanical behaviour of unsaturated soils and the response of soils to earthquake engineering. Recent work on unsaturated soils has concentrated on the mechanical response of clays. A recently completed research project at South Bank University developed new apparatus for observing stress-strain response and made new measurements of the stiffness of an unsaturated silt. The current project will use this apparatus to measure the response of unsaturated silt to the cyclic loading which soils experience during earthquakes. The data obtained will be used to evaluate the success (or otherwise) of recently developed stress-strain theories (e.g. the Zienkiewicz-Pastor soil model), which have been proposed to represent soil response in earthquakes.

Researchers Kovit Tarangsi

Supervisors Prof M Gunn

Funding Self-funded

Project Title **Permeability of Saturated and Unsaturated Soil-Measurement and Modelling**

Description The permeabilities of saturated and unsaturated soils (relevant to design calculations in geotechnical engineering) are notoriously difficult to determine. Recently Professor Vaughan (in his 1994 Rankine lecture) has pointed out that the observed profiles of measured pore pressure in the range of slope and dam problems can be only explained by permeability being a function of effective stress level in saturated soil. (The dependence on effective stress level is usually ignored in design). Similarly, the permeability of unsaturated soil is known to vary by several orders of magnitude depending on factors such as suction. Many different functional relationships have been proposed in the literature to model these variations in permeability. The current research will determine experimentally how permeabilities of both saturated and unsaturated soils vary with the factors described above (including the effect of net stress in unsaturated soils for which there is currently no reported data). The best functional relationships for representing this data will be determined and implemented in a finite element program. This program will then be used to assess the importance of representing permeability variation in common design situations.

Researchers Alan Kao

Supervisors Prof M Gunn

Funding Self-funded

Project Title **Earthquake Resistant Design of Iranian Buildings with Emphasis on SSI**

Description Since Iran is situated close to the boundary of tectonic plates, where seismic excitations occur, earthquakes have been the main cause of much damage and a heavy death toll. Most of this loss of life has been caused by the collapse of housing of various types. Factors relating to earthquakes are often ignored (at worst) or grossly simplified (at best) during their design. Modern codes of practice for earthquake design allow the use of Soil-Structure Interaction (SSI) analysis in design but this is usually regarded as too complex and is rarely carried out. A SSI analysis describes the response of both the structure and the underlying soils in a single, coupled, calculation. In this project full SSI analysis will be carried out on a range of typical Iranian dwellings constructed from different structural materials. The results will be compared with those from some of the simpler methods advocated in the Iranian earthquake code. The objective of the research is to suggest engineering methods for the strengthening of the existing buildings and for the design of the ones to be built. In addition, modification of the current Iranian Code may be suggested.

Researchers Hadi Sabouhi

Supervisors Prof M Gunn

Funding Self-funded

Project Title **Soil-Structure Analysis of Gravity Earth Retaining Structures of the London Underground**

Description Recent studies of historic gravity retaining walls of the railway network suggested that many of the provisions of the current code of practice for retaining walls are not appropriate for an assessment of these historic walls. This result is unsatisfactory, not least because many such walls continue to exist without showing signs of failure. This raises the question (if the current code of practice is inadequate), precisely how should these structures be assessed? This is the fundamental question which this research programme seeks to answer, using state of the art soil mechanics theories. The objectives of the research are:

1. Perform literature search on possible methods of construction and materials of typical earth retaining structures on the underground railway system in London
2. Determine current properties for the ground adjacent to earth retaining structures. This involves a certain amount of testing (insitu and/or laboratory) and, in particular, the determination of pore water pressures and/or suctions in the ground.
3. Determine soil properties appropriate for the assessment of the stability and the possible movement of the earth retaining structures (for FoS or reliability of structure) when they are subject to maintenance operations on the railway/ adjacent construction activity
4. Investigate the modelling of the unsaturated /compacted nature of the ground behind walls. This involves further programming within the geotechnical software CRISP
5. Perform numerical modelling for the soil soil-structure analysis of typical gravity retaining walls using the information obtained in 1, 2, 3 and 4.

Researchers Robert Sheppard

Supervisors Dr M Mavroulidou, Prof M J Gunn and R Bailey (Metronet Alliance)

Funding EPSRC –Metronet Alliance (CASE for New Academics)

Budget £80,000

Project Title **Hydro-Mechanical Properties of Lime-Stabilised Shrinkable UK Clays**

Description Some clays of high plasticity show large volumetric changes in response to seasonal cycles of wetting and drying. Such clays are called shrinkable or expansive clays. In the UK, a range of shrinkable clays can be found in South and East England, the main geological strata being the Lower Lias, Oxford Clay, Kimmeridge Clay, Gault Clay, London Clay and some of the Lambeth Clays. Due to their presence, seasonal variations in moisture content can cause annual surface movements as high as 50mm.This can cause significant distress and damage to civil engineering structures founded on them. Problems related to shrinkable clays in the UK result in millions of pounds of damage to homes every year as several millions of homes are affected. This also led to a rapid increase in insurance claims for 'subsidence damage' to low-rise buildings, principally housing (Farrow &Simon, 2004). Maintenance and repair cost of the affected infrastructure (pavement, railway tracks etc) can also be very high and may incur severe

traffic delays.

To improve the engineering properties of the shrinkable soil and prevent damage to structures, stabilisation using chemical additives, and in particular lime, has been extensively used in many overseas countries. The technique is particularly attractive, as it allows the improvement and use of the soil in-situ. For this reason, it is often a more economic (in terms of both time and money) and environmentally-friendly alternative to the conventional methods, which involve removal and disposal of the unsuitable soil to landfills and its replacement with imported quarried aggregate material.

In the UK the technique has been introduced with a relative delay and has not been used to its full potential. With the scope of an increased use of the technique in a wider range of projects and applications, the need has emerged for predictive numerical tools able to describe the behaviour of lime-treated soils for a variety of problems. Such tools are not available at the moment for this type of soil.

The aim of this research is to develop such a predictive tool based on new experimental data on lime-treated UK clay soils. Specifically the strength of the material in drained conditions, the stiffness (including investigation of the yielding characteristics), the permeability and water retention characteristics will be measured. An additional novelty of the research is that both saturated and unsaturated soil conditions will be considered. This will be achieved mainly through triaxial testing, including suction-controlled testing. To account for seasonal effects, the impact of factors such as suction and cycles of drying-wetting on soil response will be investigated. Unlike most previous studies, the proposed research will interpret the results using constitutive modelling. In particular, the suitability of recently proposed constitutive models for unsaturated and structured untreated soils will be assessed. The suggested constitutive model for the lime-treated soils under saturated and unsaturated conditions will be implemented into a Finite Element (F.E.) computer program. This will provide engineers with better analytical tools for modelling the behaviour of lime-treated soils in a variety of applications.

The research is timely due to the increase in environmental and economic pressure to upgrade material by stabilisation of in situ soil, as an alternative to its export to landfill and replacement by imported granular fill. This saves construction time and money (including landfill taxes) and reduces emissions from vehicles. Moreover, with extreme weather conditions becoming more common due to climate change, engineering problems due to cyclic shrinkage/expansion of soils are expected to rise in the years to come.

Researchers Research Student and Research Associate (To Be Appointed)

Supervisors Dr M Mavroulidou and Prof M J Gunn

Funding EPSRC (First grant scheme)

Budget £248,000

3. Tables

3.1 Current Research Grants

Investigators	Project Title	Total Budget	LSBU Share	Funding Body	Start Date	End Date
Prof B Shield	Acoustic Design Guidelines and Teacher Strategies for Optimising Learning Conditions in Classrooms for Hearing and Hearing Impaired Children	£320,000	£160,000	EPSRC	January 2002	January 2005
Prof B Shield and Dr S Dance	Acoustics of Open Plan Classrooms	£18,000	£18,000	PhD Programme/EPSRC and LSBU Scholarship		
Dr S Dance and Prof B Shield	Improvement of Speech Intelligibility in Enclosed Spaces using Sound Amplification Systems	£50,000	£50,000	PhD Programme/LSBU Scholarship		
Dr S Dance and Prof B Shield	Development of a Measurement and Prediction System to Deliver New World-Class Speech Intelligibility Systems in Complex Underground Environments	£187,000	£187,000	DTI/KTP Programme with Telent		
Dr S Dance and Prof B Shield	Design and Development of Culturally Acceptable Products and Techniques for the Mitigation of Noise Exposure for Classical Musicians	£187,000	£187,000	AHRC/KTP Programme with Sound Research Laboratories		
Prof G Maidment and Dr M Mavrildoulou	Methods of Measuring, Quantifying and Improving Energy Efficiency of Building Fabrics	£100,000	£100,000	DTI/KTP programme with BSRIA	October 2006	July 2009
Prof G Maidment	Refrigeration Systems Modelling for Fault Detection and Diagnosis	£50,000	£50,000	Scholarship and bursary	August 2006	August 2009
Prof G Maidment and Prof J Missenden	Development of Cooling Strategies for Underground Railways	£200,000	£200,000	DTI/KTP programme with Parsons Brinkerhoff	January 2007	January 2010
Prof G Maidment and Prof J Missenden	Improving Energy Efficiency in Refrigeration in the Food Chain	£250,000	£250, 000	DEFRA	June 2006	June 2009

Prof G Maidment and Prof I W Eames	Development of a Miniature Refrigeration System for Electronics Cooling	£233,000	£233,000	EPSRC	May 2007	May 2010
Prof G Maidment and Prof J Missenden	Sustainable Integrated Modelling in Retail Appliances	£10,000	£10,000	Tesco Stores Ltd	January 2005	January 2010
Prof G Maidment	Low Energy Hotels	€250,000	€250,000	EU sixth framework	June 2007	June 2010
Prof J Missenden and Prof G Maidment	Sustainable Low Carbon Heating and Cooling Solutions for Retail Applications	£80,000	£80,000	EPSRC		
Prof G Maidment and Prof I W Eames	An Autonomous Solar-Powered Jet-Pump Refrigerator	£100,000	£100,000	DTI/KTP programme with IDC Ltd	August 2006	July 2009
Prof I W Eames and Prof Maidment	Development of a Whole System Performance Measure for Refrigeration Systems	£20,000	£20,000	Carbon Trust and Institute of Refrigeration	March 2006	January 2007
Prof G Maidment, Prof I W Eames Prof J F Missenden and Prof A R Day	A Novel Low Energy Pumpless Absorption Refrigeration Cycle	£50,000	£50,000	EPSRC	July 2005	July 2008
Prof G Maidment and Prof J Missenden	Geothermal Source Energy (GSE) for Building	£100,000	£100,000	DTI/KTP programme with Fulcrum Consultancy	August 2005	August 2008
Prof G Maidment and Prof J Missenden	Sustainable Groundwater Cooling System	£400,000	£400,000	London Underground Limited	April 2002	April 2008
Prof G Maidment, Prof J Missenden and Dr F Ampofo	Transient Heat Transfer and Sustainable Cooling of Underground Railways	£50,000	£50,000	EPSRC	August 2003	August 2006
Prof G Maidment and Prof J Missenden	A Novel Low Carbon Superconductive Food Display Cabinet	£73,000	£73,000	Carbon Trust	July 2002	February 2007
Eurling T Dwyer	MSc Building Services Engineering (Flexible Provision)	£240,000	£240,000	EPSRC	April 2001	April 2006
Prof A R Day and Mr P Jones	The Development of an Energy Auditing Methodology (KTP with SEA/RENUE)	£75,000	£75,000	KTP		
Prof a R Day and Dr P Xiao	The Use of Advanced Meter Reading for Energy Waste	£70,000	£70,000	KTP		

	Detection (KTP with TEAM (EAA Ltd))					
Mr P Jones and Prof A R Day	Continuous Commissioning to Improve Building Performance (KTP with ABS Ltd)	£75,000	£75,000	KTP		
Mr P Jones Prof A R Day	Decision Support Tools for Low Carbon Building Design (KTP with ECSC Ltd)	£150,000	£150,000	KTP		
Mr P Jones Prof A R Day	On-line Building Energy Log Books (KTP with Zutec Ltd)	£75,000	£75,000	KTP		
Prof A R Day	Monitoring Roof Mounted Wind Turbines in an Urban Environment	£75,000	£75,000	Southwark Council and LSBU		
Prof A R Day and Mr P Jones	Review of the Energy Requirements of the London Plan	£60,000	£60,000	Greater London Authority		
Prof A R Day and Prof G Maidment	Development of a CHP Feasibility Model (with Sustainable Energy Action Ltd)	£110,000	£75,000	KTP	November 2003	October 2005
Prof A R Day, Prof G Maidment and Energy and Power Ltd	The Development of Project Management System for Sustainable Urban Developments (KTP)	£75,000	£75,000	KTP		
Prof A R Day	Creation of Methods to Accelerate Improvement of the Built Environment's Carbon Performance	£30,000	£30,000	PhD programme/employer funded		
Prof A R Day and Dr P Xiao	Automatic Benchmarking and Classification of Buildings	£15,000	£15,000	PhD programme/employer funded		
Prof E Ezugwu	Improvement in the Machining Processing of Aero-Engine Components used in the Joint Striker Fighter (JSF) Project	£35,000	£35,000	Rolls-Royce Plc	December 2003	November 2004
Prof E Ezugwu	General Applications Features (GAF) Phase of the JSF Project	£40,380	£40,380	Rolls-Royce Plc		
Prof E Ezugwu	Development of Machining Technology for the JSF Affordability Project	£40,022	£40,022	Rolls-Royce Plc		
Prof E Ezugwu	High Speed Turning of	£42,000	£42,000	Rolls-Royce Plc		

	Aerospace Superalloys with Various Cutting Tool Materials					
Prof E Ezugwu	Specification for the Development of Production	£48,000	£48,000	Rolls-Royce Plc	March 2000	February 2005
Prof E Ezugwu	Directional Coolant Flow in High Speed Machining of Titanium 6246 Alloy	£20,000	£20,000	Rolls-Royce Plc		
Prof E Ezugwu	Turning of Sintered Nickel Base Alloy (RR1000)	£10,000	£10,000	Rolls-Royce Plc		
Prof E Ezugwu	“Pick up” Generation when turning Sintered Nickel Base Alloy (RR100)	£10,000	£10,000	Rolls-Royce Plc		
Prof E Ezugwu	Evaluation of Parameter Envelop of Hole Making and Milling of R1000 Nickel Disk Material	£20,000	£20,000	Rolls-Royce Plc		
Dr Y Bao and Prof D T Gawne	High-Performance Polymer Coatings	£744,186	£202,907	DTI Link Programme	February 2004	April 2008
Dr Y Bao and Prof D T Gawne	Polymer Nanocomposite Coatings	£1,341,700	£273,880	European Commission Framework 5	November 2002	September 2006
Prof D T Gawne and Dr Y Bao	Deposition of Glass-Based Coatings	£1,229,920	£253,940	European Commission Framework 6	January 2004	November 2007
Prof D T Gawne and Dr Y Bao	Flexible Automated Coating Process	£1,490,000	£225,000	European Commission Framework 6	March 2007	February 2010
Dr M Mavroulidou	Soil-Structure Analysis of Gravity Earth Retaining Structures of the London Underground	£80,000	£80,000	EPSRC CASE for New Academics	November 2006	30 April 2010
Dr M Mavroulidou	Hydro-Mechanical Properties of Lime-Stabilised Shrinkable UK Clays	£248,000	£248,000	EPSRC (First Grant Scheme)	August 2007	14 August 2010

3.2 Research Students

Student Name	Project Title	Supervisors	MPhil/PhD	FT/PT	Funding	Start Date
Ibrahim Abdulmalik		Prof E Ezugwu	PhD/MPhil			
Tamin Al Haj	Future of the United Arab Emirates' (UAE) Energy Requirements and the Possible Role of Photovoltaics in the 21st Century.	Dr A Parsa and Dr L Salam	PhD	FT	Overseas	March 2003
Fwaz Alhasso	Thermal-Spray Deposition of Glass-based Coatings.	Dr Y Bao and Prof D Gawne	PhD	PT	Self-funded	January 2004
Rizgar Amin		Dr A Parsa and P Regan	PhD	PT	Self-funded	October 2001
Ali-Reza Anisi		Prof J Missenden	PhD			
Saiid Bagherzadeh-Akbari	Modelling and Verification of Latent Heat Storage using Energy Piles, using TRNSYS Software, and an Experimental Calorimeter Rig	Prof G Maidment, Mr K Smith and Prof J Missenden	PhD	FT	EPSRC	December 2007
Andy Campbell	Sustainable Integrated Modelling in Retail Applications	Prof G Maidment, Prof J Missenden and Eurling T Dwyer	PhD	PT	Tesco Stores Ltd	June 2005
Anne Carey	Optimisation of Acoustic Conditions for Teaching and Learning in a Primary School Environment	Prof B Shield and Prof J Dockrell (External)	PhD	PT	EPSRC	November 2002
Petros Charalambous	Photo-Voltaic Thermal Collectors	Prof G Maidment, Mrs K Yiakoumeti and Dr S Kalogirou (External)	PhD	PT	Self funded o/s (Cyprus). EU from May 2004	March 2004
Lejun Chen	Flow Patterns in Upward Two-phase Flow in Small Diameter Tubes	Prod T G Karayiannis and Y S Tian (Aspentech)	PhD	FT	EPSRC & LSBU Scholarship	October 2003
Dermot Cotter	To improve the heat transfer performance of an ammonia air cooler	Prof J Missenden and Prof G Maidment	PhD	PT	Employer funded	February 2002
Xenofontas Damianos	Development of a dynamic model to simulate boiler controls	Prof A R Day	PhD	FT	Self-funded	2001
Rosemar Da Silva	High Pressure Coolant Supply Technology in Finish Turning of Ti-6A1-4V Alloy with Various Cutting Tools	Prof E Ezugwu and Prof A R Machado (External)	PhD	FT	CNPq Brazil	July 2002
Ibrahim Dabbousi	Flow boiling of R134a refrigerant-oil mixture	Prof J Missenden and Prof G Maidment	PhD	PT	Self-funded	April 2000

Tarek El Shafey	Refrigeration Systems Modelling for Fault Detection and Diagnosis	Prof G Maidment	PhD	FT	Scholarship and bursary	September 2006
Reinaldo Jerez Florez	Investigation into Thermo Pile Applications	Mr K Smith, Prof G Maidment and Prof M Gunn	PhD		Self Funded	
Alula Ghermazion						
Emma Greenland (nee Tate Harte)	Acoustics of Open Plan Classrooms	Prof B Shield, Prof J Dockrell and Dr S Dance	PhD	PT	LSBU Scholarship/EPSRC Research Scholar	December 2003
Wenliang Guo	Process Simulation and Experimental Validation of Plasma Spraying	Prof D Gawne and Dr Y Bao	PhD	FT	LSBU Scholarship	October 2001
Xiaorong Huo	Experimental study of flow boiling heat transfer in small to micro diameter tubes	Prof T Karayiannis, Y Tian and V Wadekar (Aspentech)	PhD	FT	ORS award, London	1998
Jahan Issapour	The Animation and Simulation of Human Facial Masks Using Animatronics with Art Methodology	Prof J Missenden and D Brown	PhD	PT	Self-funded	June 2002
Jeyatharshini Jeyabalsingam	The economic and practical implementation of off-grid rural electrification	Prof A R Day, Prof T Karayiannis and Prof I M Dharmadasa	PhD	PT	LSBU Scholarship	1999
Alan Kao	Permeability of Saturated and Unsaturated Soil-Measurement and Modelling	Prof M Gunn	PhD	FT	Self-funded	January 2004
Oluremi Kayode	Understanding Household Energy Demand in Developing Countries: A system Dynamics Approach	Prof A R Day, D Williams and V Daly (External)	PhD	PT	Self-funded	September 2003
Abdul Khaleq Lalzad	Modelling and experiment on a low-pressure solar desalination plant	Prof T G Karayiannis, Prof I W Eames and Prof G Maidment	PhD	PT	Council for assisting Refugee	July 2000
Khalid Majaz	CO2 in Refrigeration Applications	Prof J Missenden and Prof G Maidment	PhD	FT	EPSRC	December 2007
Christos Nestroras	Improvement of Speech Intelligibility in Enclosed Spaces using Sound Amplification Systems	Dr S Dance and Prof B Shield	PhD	FT	LSBU Research Scholar	November 2005
Titus Olanyi	Decision Support Systems for Sustainable Energy Planning in a Developing Economy	Prof A Day, Prof T Karayiannis and M Kennedy	PhD	PT	EPSRC	1998
Alex Paurine	An Investigation of a Novel Low Energy Pumpless Absorption Refrigeration Cycle	Prof G Maidment, Prof J Missenden, Prof A R Day and Prof I W Eames	PhD	FT	EPSRC	July 2005
Robert Peto	An Evaluation of the Measures to Alleviate Fuel Poverty in Social Housing	Prof A Day and M Shaw (External)	PhD	PT	Employer funded	May 2004
Hadi Sabouhi	Earthquake Resistant Design of Iranian Buildings with Emphasis on SSI	Prof M Gunn	PhD	PT	Self-funded	January 2004

Julian Sanders	Creation Methods to Accelerate Improvement of the Built Environment's Carbon Performance	Prof A R Day	PhD		PhD programme/Employer funded	
Abdul Shabazz Nelson	A novel Case Based Reasoning System for Selecting Grinding Parameters for Superalloys	Prof E Ezugwu and P Burred	PhD	PT	LSBU & Rolls-Royce	September 1998
Rob Sheppard	Soil-Structure Analysis of Gravity Earth Retaining Structures of the London Underground	Dr M Mavroulidou, Prof M J Gunn and R Bailey (Metronet Alliance)	PhD	FT	EPSRC – Metronet Alliance (CASE for New Academics)	November 2006
A Syed	Optimal Solar Cooling Systems	Prof G Maidment and Prof J Missenden	PhD	FT	LSBU Scholarship	October 2000
Kovit Tarangsi	The Response of an Unsaturated Silt to Earthquake Loading	Prof M Gunn	PhD	FT	Self-funded	January 2004
Joylyon Thompson	Transient heat transfer in underground	Prof G Maidment / and Prof T Karayiannis	PhD	FT	EPSRC	July 2003
Ezedimbu Ugwoha	Influence of High-Pressure Coolant Application on Component Forces, Cutting Temperature and Machined Surfaces of Aero-Engine Alloys	Prof E Ezugwu and Dr J Bonney	PhD	FT		March 2006
Peter Hu Xu	Thermoset coatings by thermal spray deposition and infrared radiation curing	Dr Y Bao and Prof D T Gawne	PhD	FT	LSBU Scholarship	January 2001
Xu Zhao	Numerical Study of Moving Boundary Problems: Application in Arteries and Coriolis Mass Flowmeters	Prof T G Karayiannis and Prof M W Collins	PhD	PT	ORS Award, Micro Motion	April 2000

3.3 KTP Associates, Research Fellows and Visiting Academics

Researchers	Supervisors	Project Title (where appropriate)	Funding	Start Date	End Date
KTP Associates					
Julie Allen	Prof A R Day and Mr P Jones	The Development of an Energy Auditing Methodology (KTP with SEA/RENUE)	KTP		
Ben Cheeseman	Prof G Maidment and Dr M Mavrildoulou	Methods of Measuring and Improving Energy Efficiency of Build fabrics	KTP		
Aidan Dunsdon	Mr P Jones and Prof A R Day	Decision Support Tools for Low Carbon Building Design (KTP with ECSC Ltd)	KTP	April 2005	March 2007
Ryan Fenton	Prof G Maidment and Prof J Missenden	An Autonomous Solar-Powered Jet-Pump Refrigerator	KTP		
Louis Gomez	Dr S Dance and Prof B Shield	Development of a Measurement and Prediction System to Deliver New World-Class Speech Intelligibility Systems in Complex Underground Environments	KTP	February 2007	
Luis Hinojosa	Prof A R Day and Prof G Maidment	Development of a CHP Feasibility Model with Sustainable Energy Action Ltd	KTP	2003	
Robert Liddiard	Mr Phil Jones and Prof A R Day	Development of On-line Building Log Books - Zutec Ltd	KTP	July 2006	July 2008
Andrew Mott	Prof A R Day and Prof G Maidment	Sustainable Development Engineer with Energy and Power Ltd	KTP	2004	
Princess Ogumka	Mr P Jones and Prof A R Day	Decision Support Tools for Low Carbon Building Design (KTP with ECSC Ltd)	KTP	June 2006	July 2008
Selvakumar Samiyappan	Prof A R Day and Dr P Xiao	The use of Advanced Meter Reading for Energy Waste Detection (KTP with TEAM (EAA Ltd))	KTP	May 2005	April 2007
Dr Fuqiao Wang	Prof G Maidment and Prof J F Missenden	1. Geothermal Source Energy (GSE) for Building 2. A Novel Low Carbon Superconductive Food Display Cabinet	KTP	March 2004	
Sarath Wijesinghe	Mr P Jones and Prof A R Day	Continuous Commissioning to Improve Building Performance (KTP with ABS Ltd)	KTP	April 2006	April 2008
Georgia Zepidou	Dr S Dance and Prof B Shield	Design and Development of Culturally Acceptable Products and Techniques for the Mitigation of Noise Exposure for Classical Musicians	KTP	July 2007	
Research Fellows					
Dr Felix Ampofo	Prof G Maidment and	Sustainable Groundwater Cooling	London Underground	April 2002	

	Dr J Missenden		Limited		
Dr John Bonney	Prof E Ezugwu and Dr A Ajmal	Improvement in the Machining Processing of Components Produced in the Joint Strike Fighter (JSF) Project	Rolls-Royce plc	December 2003	February 2005
Rosemar Da Silva	Prof E Ezugwu	Development of Machining Technology for the JSF Affordability Project	Rolls-Royce plc	Sept. 2002	March 2003
Dr D Fadare	Prof E Ezugwu	Specification for the Development of Production High Pressure Coolant Turning Tooling for the JSF Lift Fan	Rolls-Royce plc		
Dr Jiming Gao	Prof D T Gawne and Dr Y Bao	High-Performance Glass-Based Coatings	European Commission	January 2004	December 2006
Dr Zhuhai Lin	Prof M Gunn				
Dr Zheng Xiang Qiu	Prof D T Gawne and Dr Y Bao	Polymer Nanocomposite Coatings	European Commission	November 2002	October 2005
Dr Wisely Sales	Prof E Ezugwu	High Speed Turning of Aerospace Superalloys with Various Cutting Tool Materials	Rolls-Royce Plc		
Dr Donglin Zhao	Prof T G Karayiannis	A Fundamental Investigation of the Mechanism of the Critical Heat Flux Including the Effect of an Electric Field	EPSRC	November 2003	October 2006

Visiting Academics

Prof Barrie Brickle Visiting Professor					
Prof Michael Collins Visiting Professor					
Prof Ian Eames Visiting Professor					
Prof Michael Farrell Visiting Fellow					
Soteris Kaligerou Visiting Research Fellow	Prof G Maidment				
Tassos Karayiannis Visiting Professor					
Martin Ratcliffe Visiting Research Fellow	Prof A R Day				
Prof Robert Tozer Visiting Professor					
Dr Mohammad Ullah Visiting Research Fellow					