Innovation China UK
Colaboration Development Fund
Project Summaries
The ICUK Collaboration Development Fund was a £3 million fund, awarded to ICUK by HEFCE, and designed to support staff exchange, feasibility studies, proof of concept and joint commercial research and development projects between UK and Chinese Universities. Through this dedicated fund, ICUK has become a champion of progressing research from universities to markets in both China and the UK. A total of 72 projects were awarded funding in the following two categories:

**Partnership Grant**

The purpose of the Partnership Grant was to support the UK and Chinese Higher Education Institutes in initiating research and development collaboration and facilitating joint innovation and knowledge transfer. 39 projects were awarded Partnership Grants, of which 12 went on to successfully apply for ICUK Proof of Concept funding.

**Proof of Concept award**

33 projects were awarded ICUK Proof-of-Concept funding, the purpose of which was to support technologies or business ideas from the research community to be further developed to the stage that a commercial company or a private investor would become engaged in the commercialisation of a new product or service. It effectively reduces the risks involved in early-stage technology development. Examples of the use of Proof-of-Concept (PoC) Funding included: developing and evaluating commercial prototypes; strengthening Intellectual Property Rights; and conducting market research on customer preferences.

**Introduction**

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Healthcare and Biomedicine
NOTTS01 Development of a purified phytochemical extract from the Chinese fungus, Ganoderma Lucidum for use in prostate cancer chemoprevention

**Partners:** Prof. Sue Watson & Professor Ken Muir, University of Nottingham  
Prof. Prof De-An Guo, Chinese Academy of Sciences

**Amount of Award:** PoC £86,501

**OBJECTIVE**

The major aim of the project was to further develop a uniquely-isolated triterpene extract from GL, in which pre-clinical efficacy had been confirmed, for clinical use in prostate cancer chemoprevention where current approaches remain untested or are associated with side-effects.

This project further developed the manufacturing process for the triterpene extract to support completion of the pre-clinical phase and to define the programme of studies to complete the safety pharmacology. It was also established to strengthen/exemplify current intellectual property (IP) including new applications and technology advances and establish the regulatory and clinical strategies for submission of clinical trial authorisation (CTA) in the UK.

**OUTCOME**

Triterpene was shown to possess potent biological active compounds. Patent 0800134.9 was filed in 2008 (University of Nottingham).

A 2nd patent is being written by the University of Nottingham Research Technology Transfer team together with Professor Guo after which a paper will be submitted to Cancer Research (Impact Factor: 7.6).

**BENEFITS OF COLLABORATION**

Through collaboration with the Shanghai Institute of Materia Medica, the applicants have identified a novel mixed triterpene extract with pre-clinical efficacy in both the pre-malignant and cancerous prostate which has formed the basis of a patent application. Ganoderic acids (GAs) have been confirmed as the active components having both anti-proliferative/invasive properties and impacting on epithelial mesenchymal transition (EMT), a fundamental process in metastasis, results which have lead to the preparation of a 2nd patent application.
**NOTTS21 Enhancing the formulation of S111, a novel drug for depression**

*Partners: Prof Terry Parker, University of Nottingham  
Prof Wei-guo Jia, Shanghai Innovative Research Centre of Traditional Chinese Medicine (SIRC)*

**Amount of Award:** PoC £87,324

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**OBJECTIVE**

Depression is one of the most disturbing and widespread of all chronic mental disorders: it is a worldwide problem effecting people from all cultural backgrounds. There are currently a number of anti-depression therapies on the market including the most commonly known drug, Prozac. The side-effects associated with current medications are numerous and include dizziness, blurred vision, sedation, weight increase, changes in sleep patterns and restlessness. The side effects could be so severe that they prevent patients from continuing to use the medication, resulting in failures of the treatment. Further, the efficacy of current antidepressants has been seriously challenged.

Therefore there is an urgent need for a commercially available alternative anti-depression compound that shows limited side-effects, has a clear mechanistic route and restricted drug-drug interaction. It is believed that S111 fulfils all these criteria.

The aim of this project is to improve and increase the successful commercialisation and clinical adoption of a synthetic metabolite of the Chinese herb ginseng (S111). This has been shown in animal models to be an affective treatment for clinical depression and has led to an approved IND clinical trial for anti depression from the SFDA in China.

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**OUTCOME**

The results have proved sufficiently novel and exciting to warrant continued support and this will be forthcoming from UON Departmental funds and support from SIRC. Two papers are in preparation and a grant application to the Wellcome trust is in the draft stage. It is believed that this compound has a significant future as an antidepressant and may possess important side effects that could prove even more significant than its original intended purpose.

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**BENEFITS OF COLLABORATION**

This is an established China-UK collaboration where the members share a complimentary skills base in TCM drug formulation and pre-clinical neuroscience. The Chinese partner provided access to expert herbal technologies and the novel anti-depression compound; the UK partner provided novel in vitro models of the Blood-Brain Barrier to evaluate the efficacy of the uptake of the compound into the brain.
SOTON03 Development of software for monitoring the control of blood flow in the brain

Partners: Dr. David Simpson, ISVR, University of Southampton  
Prof. Jia Liu, Shenzhen Institute of Advanced Technology

Amount of Award: PoC £90,000

OBJECTIVE

The objective of the project team was to develop software to analyse patient data in order to assess control of blood flow control, impairment of which has been linked to a number of serious neurological complications, including stroke, and the consequences of head-trauma and premature birth of neonates. This required them to test, compare and optimize various published methods and identify the most appropriate technique to include in commercial software. The outcome from these tests could potentially have led to a new software package to be bundled with ultrasound equipment manufactured by a Chinese collaborating company or sold separately for use with other equipment. Such a device would help in diagnosing impaired autoregulation in patients, assist their medical treatment, and could contribute to reducing serious neurological complications.

OUTCOME

Comparison of the different methods clearly identified approaches that are most promising for future implementation in clinical diagnostic systems, and clear differences between groups with normal and impaired function were observed. The results yielded some surprises in terms of the methods that best distinguished between normal and impaired blood flow control: some of the simplest methods and some of the new and most sophisticated showed surprisingly similar performance, with some of the more established conventional techniques performing rather poorly. However, all methods showed large inter- and intra-subject variability, even in healthy subjects, which does not currently allow them to be recommended for routine clinical application and for commercial systems for hospital use. Thus, none of the methods investigated demonstrated a sufficiently high level of performance to be taken forward into a successful commercial product. However, some promising approaches have been identified, though further research work will be required.

BENEFITS OF COLLABORATION

The project has revived the collaboration between Dr. Jia Liu and Dr. David Simpson and joint work on autoregulation has been resumed. Joint and separate publications have resulted as a direct consequence of this project, and further publications are being prepared. The mix of skills and the synergy between the teams have generated new enthusiasm for further collaboration, and we are currently investigating possible sources of funding to support this work.
SOTON12 On the use of Brain-Computer Interfacing in rehabilitation

Partners: Dr Christopher J. James, Institute of Sound and Vibration Research, University of Southampton
Prof Shangkai Gao, Institute of Neural Engineering, Tsinghua University

Amount of Award: PG £8,500

OBJECTIVE

The central objective was to establish a link between two laboratories that are producing high quality research on the use of BCI for communication and rehabilitation. Both labs have strengths in differing areas of the vast field of BCI and if successful the partnership grant would help bring both labs together to identify areas within the development of BCI that will benefit from our mutual strengths. Of particular interest is to explore the possibility of applying algorithms developed within the UK to BCI paradigms and hardware in use in China.

OUTCOME

The partnership project was successful in building an important link between an established BCI lab in Tsinghua University and our BCI lab in Southampton. A research visit took place in May 2009 as planned which was very fruitful. Areas of strength within the Southampton BCI group lie in the use of novel algorithms for making the BCI process faster and in reducing the need for large numbers of recording channels. Strengths within the Tsinghua group lie within their accessibility to small, low cost EEG amplifiers, and the introduction of novel BCI algorithms.

The areas that both labs felt could be further explored include:
1. The application of joint research funding for a joint BCI paradigm based project.
2. The Tsinghua team to look at making low cost hardware available for practical use.
3. The Southampton team to collaborate on algorithm development, coupled with Tsinghua equipment to optimise both groups’ outputs.
4. The possibility that trials are run in the UK on jointly developed systems.
5. Continued joint development of novel BCI paradigms.

BENEFITS OF COLLABORATION

This joint work will contribute to bringing the goal of a successful commercial BCI system much closer. The next steps involve both teams in obtaining further funding for bilateral visits. Both teams are looking for appropriate funding schemes to apply for.
QMUL03 Microsomal vaccine for Hepatitis virus infection

**Partners:** Prof. Ping Wang, Queen Mary, University of London
Prof. Jimin Zhang, Fudan University

**Amount of Award:** PoC £89,883

**OBJECTIVE**

The aim of the project is to investigate the efficacy of the vaccine to induce anti-HJC responses in infected patient samples in China. This will provide key proof-of-concept data to facilitate human clinical trials. Prof. Ping Wang’s research at QM has demonstrated that patients with chronic HCV and HBV have a substantial number of viral or cancer specific lymphocytes, but these lymphocytes develop a tolerance and do not respond to the virus and cancer despite sustained antigen presence. A new form of vaccine has been developed aiming to reverse the tolerant state of viral or cancer specific T lymphocytes.

**OUTCOME**

The research group adapted the technology to treat the Hepatitis B virus which is a less serious disease but is more prevalent than the Hepatitis C virus in China and there is currently no cure for chronic infection. In-vitro experiments using blood samples of around two hundred Hepatitis B patients were carried out, of which the results so far have been very promising. Currently, discussions have been initiated with a leading contract research organisation in China which is interested in investing in clinical trials.

Following the positive results from the trials with Chinese Hepatitis B patients, the researchers at Queen Mary are keen to pursue a pre-clinical development programme for a vaccine for the Hepatitis C virus.

**BENEFITS OF COLLABORATION**

The collaboration is very successful. The two sides are actively working together to progress to the clinical trial stage and ultimately commercialise the technology in China.
QMUL05 Establishment of a technical platform for development of new biomarkers and therapeutics for cancer treatment in China

Partners:  Prof. Nick Lemoine, Institute of Cancer, Barts and The London School of Medicine, Queen Mary University of London  
Prof. Ziming Dong, School of Basic Medical Sciences, Zhengzhou University

Amount of Award:  PG £15,000

OBJECTIVE

Queen Mary University of London and Zhengzhou University signed an agreement for the establishment of the Sino-British Research Centre for Molecular Oncology in 2006. Following the requirements of the Chinese SFDA, we have to carry out various preclinical assays before our new findings go to clinical trials in China. To this end, several key techniques in the field of adenovirus-based therapy have to be set up in the centre. With this PG funding, we will establish the following key techniques in the centre to conduct the required assays conforming to the requirements of the SFDA: 1) Large scale production of Adenovirus and vaccinia virus vectors; 2) Viral titration; 3) Ex vivo Primary tissue culture and viral infection; 4) GLP-standard Real-time PCR for detection of adenovirus vector.

OUTCOME

A Chinese senior scientific officer came to the Institute of Cancer, QMUL, for three months training, during which time she mastered all techniques listed in the proposal, such as Bucket viral production using CF-10, viral purification, viral titration by TCID50, MTS assay to detect cytotoxicity of oncolytic virus and PCR to detect viral early gene and late gene. She also learnt several other key techniques in the field of cancer viral and genetic therapy. After her return to China last September, she has worked with other staff at Henan University to duplicate the major techniques that she learnt at QMUL. Ms Gao has since set up a standard protocol for viral production and titration and trained other staff members in its use. They can now produce high-quality and large-scale the oncolytic adenovirus and the vaccinia virus used in developing effective cancer treatment. This has built a strong basis for QMUL to translate our new therapeutic reagent into clinical practice in China. The Sino-British Research Centre for Molecular Oncology was recently awarded six million RMB by local government.

BENEFITS OF COLLABORATION

The UK PI felt that technical platform provided by the PG grant was extremely valuable it helped the project move to the next stage.
QMUL12 Development and evaluation of novel Spidrex conduits for long gap peripheral nerve repair

**Partners:** Prof. John Priestly, Queen Mary, University of London  
Prof. Wenlong Ding, Jiao Tong University School of Medicine

**Amount of Award:**  
PG £7,500  
PoC £89,733

**OBJECTIVE**

The overall aim of the work is to develop novel biomaterial implants that can be used to replace autologous grafts for peripheral nerve repair. The Specific aim of this ICUK project is to develop second generation conduits that are suitable for bridging small and medium-sized (3-4 cm) nerve gaps in patients, to test the conduits in a rodent peripheral nerve injury model (rat 1.0-1.5 cm gap), to evaluate the same conduits in small and medium-sized (3-4 cm) gaps in experimental nerve injury in dogs.

**OUTCOME**

Success was achieved in improving the biocompatibility of the Spidrex conduit by introducing pro-regenerative factors and improving the degumming process.

Agreement with Shanghai Jiaotong University School of Medicine is due to be finalised, in which the ownership of all joint IPs from this project will be assigned to QMI which will in turn grant Neurotex the right to commercially exploit it. In return, QMI will give 50% of the additional share arisen from the project to Jiaotong University.

The experiment will be carried out on dogs by the Chinese collaborator in the next 12 months.

The funding on the Chinese side will run until end of 2011, so the collaboration will continue beyond the ICUK deadline of July 2010.

**BENEFITS OF COLLABORATION**

This is a new collaboration set up with the support of ICUK. ICUK awarded a PG grant initially. At the end of November 2009, Prof. Wenlong Ding and his senior researcher, Dr. Wenjin Wang, visited Prof. Priestley’s group and attended a key planning meeting, which were very productive.
QMUL10 Development of novel metal compounds for Alzheimer’s disease therapy

Partners:  
Dr. Adina Michael-Titus, Institute of Cell and Molecular Science, Barts and the London School of Medicine and Dentistry  
Dr. Yan Zhang, Associate Professor, College of Life Sciences, Peking University

Amount of Award:  PG £7,000

OBJECTIVE

The two objectives were of this project were:
To draw up a detailed project plan for the PoC application through extensive communication including a visit to Peking University by the UK PI, Dr. Adina Michael-Titus; and to have an up-to-date IP review and market review in preparation for the PoC application.

OUTCOME

The first objective has been successfully completed as demonstrated by the PoC proposal. A brief IP review was also carried out, the emphasis of which has been on the current IP provision in China. The TTO at QMUL is satisfied that there is no real concern over its IP arrangement; since existing QMUL patents are in PCT stage, the colleague can apply for protection in China when these enter the national stage in less than 12 months time.

The market review was initially designed to update a market research report commissioned 18 months ago by QMUL. It was realised after talking to the market consultant Dr Michael F O’Neill of Eolas Biosciences Ltd who has over 20 years experience in the Pharmaceutical industry, that we would be better off by using his experiences in the industry to help design the work plan of the PoC proposal to maximise the value of the PoC project output. The market need for effective Alzheimer’s therapy is overwhelming, and this has not changed in the last 18 months.

BENEFITS OF COLLABORATION

As the result of the PG project, the two groups (QMUL and Peking University) are now jointly applying for funding to further the development of the project.
QMUL14 Smart On-Body Wireless Sensor Networks for Healthcare Applications

Partners:  Dr. Akram Alomainy, Queen Mary, University of London
Dr. Rui Zhang, Fudan University

Amount of Award:  PG £14,820

OBJECTIVE

The aim of the project was to develop a first prototype of the cognitive-based smart antenna system for applications in healthcare on-body wireless networks and to access and evaluate the hurdles in commercializing this technology and to put forward the prototype design specification for a subsequent ICUK Proof-of-Concept award.

OUTCOME

All of the stated objectives were met and a PoC application has been submitted.

BENEFITS OF COLLABORATION

The funding allowed a connection to be forged with Fudan university.
KCL01 Comprehensive traditional Chinese medicine compounds database

Partners: Prof Peter Hylands, King’s College London
Prof Weiliang Zhu, Shanghai Institute of Materia Medica

Amount of Award: UK: PoC £88,000
China: Asia Hub e-Drug Discovery grant: RMB 90,000

OBJECTIVE

To transform currently available TCM information and the database from its current state, where only a specialist can interpret the information, to a database that is accessible, user friendly and has the functionality required by industry or academic end users. The Prototype TCM database will include the existing chemical structure databases and phytochemical activity profiles with:
1. expanded data sets to include data on constituents from other Chinese herbs,
2. integrated chemical and known or putative biological activity data which are embedded within a single resource, and
3. A graphical user interface (GUI) to enable greater ease of use, in particular by non-specialists.

OUTCOME

Pilot version of the TCM database: All proposed tasks were completed and a standalone fully functional pilot version of the database has been developed and rigorously tested in-house, and an Internet-accessed version has also been tested using a demonstration copy of the ChemDBSoft WebServer software provided by TimTec. External beta-testing of the standalone and web versions of the database has been precluded because of commercialisation considerations.

Interaction with Companies: Intensive discussion has been held with a US company regarding licensing of the technology. The company would like to licence the database and integrate it into the company’s other online databases. Evaluation of the prototype database in the Company has been completed with satisfactory results. Negotiation on the terms of the licensing arrangement has been principally agreed.

BENEFITS OF COLLABORATION

This collaboration made possible the development of a prototype TCM database that uniquely combines the academic knowledge of TCM compounds from SIMM with an understanding of the needs of Western users from the King’s researchers. The King’s–SIMM partnership enabled the management of key technical risks and allowed the team to address the barriers to market entry by using the project to define the characteristics that a TCM database tool will require.
KCL03 Development of anti-fibrotic drugs from Chinese herbs

Partners: Dr Qihe Xu, King’s College London  
Prof. Xinmiao Liang, Dalian Institute of Chemical Physics

Amount of Award: PoC £30,000  
National Natural Sciences Foundation of China: RMB 1 million

OBJECTIVE

The project aim at using extensive experience in fibrosis study and innovative in vitro fibrosis models developed at King’s and the strong TCM expertise at Dalian Institute of Chemical Physics to develop high-throughput screening of inflammation-independent anti-fibrotic activities of TCM herbs and to discover and develop novel chemical entities of anti-fibrotic efficacy from TCM herbs, develop activity-guided fractionation and purification technology of novel anti-fibrotic herbs, and to explore the potential of the NCEs potential for development of new antifibrosis therapy to address this unmet medical demand.

OUTCOME

The project has selected 20 target TCM herbs and their extracts for in vitro antifibrotic screened studies. Among which 5 TCM herbs have been found to show reproducible anti-fibrotic activities. In particular, one herb, SLH, showed very high antifibrosis activity and low cytotoxicity which is a desirable chemical profile for new drug development. The joint team are currently looking into further funding opportunities to continue their investigation on these novel anti-fibrotic compounds and extracts discovered during this project, particularly on the mechanisms of the anti-fibrotic effect of SLH and efficacy, as well as develop a activity-guided fractionation and isolation technology to isolate and identify the chemical nature of the anti-fibrotic herbal compounds from SLH.

BENEFITS OF COLLABORATION

This project enables the two research teams and organisations to establish a strong research partnership and with complimentary skill sets and strength, which made possible of the discovery of the 5 potential new leads from TCM for antifibrosis therapeutics development. The research project also opened up new route for the antifibrotic drug discovery and development and has attracted great industry interests.
KCL04 Analytical approaches to the quality control of compound danshen dripping pill, a traditional Chinese medicine

Partners: Prof Peter Hylands, King’s College London 
Prof Yongpin Yu, Zhejiang University

Amount of Award: PG: £15,000

OBJECTIVE

The aim of the project is to evaluate the feasibility of using non-separation based analytical technology as novel approach to obtain reliable robust data that can be used to support applications for regulatory approval of a TCM (in this case, CDDP) to the authorities in the European Union in order to address the critical obstacle for the lack of suitable GLP/GMP complianted methodologies for QA/QC of TCMs to satisfy the stringent regulatory requirement established in western countries for granting marketing licences.

OUTCOME

The project has achieved three key objectives (i) evaluated the technological merits of the conventional analytical methods (HPLC) and novel non-separation approach (NMR) for TCM QA and QC analysis using Danshen Drpping Pill as testing example. (ii) Assessed the commercial needs and route to market of the proposed novel approaches, and (iii) established a strong partnership between King’s and Zhejiang University.

BENEFITS OF COLLABORATION

The project enables the establishment of a close interaction between King’s College London and the College of Pharmaceutical Sciences, Zhejiang University and opened up a new channel for the two teams to collaborate in this emerging research area. The complimentary expertise of the joint teams enables management of key technical risks, and barriers to market entry by using the project to define outputs so that analytical procedures to be developed will be fit for purpose – i.e., appropriate to the needs of the western regulatory environment.
KCL06 Development of novel antibiotic compounds with potential in therapy, cosmetics and wound healing

Partners: Professor Robert C Hider, King’s College London
Professor Yongping Yu, Zhejiang University

Amount of Award: PG £15,000

OBJECTIVE

The aim of the project is mainly two fold: (1) To continue to develop meaningful collaboration links between the staff of the Pharmaceutical Science Research Division, King’s College London and the College of Pharmaceutical Sciences, Zhejiang University. (2) To initiate and carry out preliminary evaluations on a collaborative research project on the development of a new generation of antibiotic drugs between the two centers, taking advantage of the expertise in both centers. The project itself has considerable relevance to both the Medicine and Cosmetic Industries in the UK and in China.

OUTCOME

The outcomes of the project are generally three fold (i) established research collaboration in this key research area, (ii) evaluated the marketing and commercial relevance of the proposed novel anti-microbial therapeutics and the commercialization route, (iii) evaluated the technological feasibility of the proposed technology and novel anti-microbial mechanism and identified a set of novel compounds of anti-microbial activities via in vitro screening selection of the chemical libraries. The project findings have attracted significant interest from several pharmaceutical discovery companies and led to a further 3 years of company sponsorship for the group to further the research investigations on discovery of a potential new generation of anti-microbial agents using this new mechanism for therapeutics development.

BENEFITS OF COLLABORATION

The value of the project comes from allowing the strengthening of the partnership between King’s College London and the College of Pharmaceutical Sciences, Zhejiang University by promoting close interaction of the scientists from both universities, sharing knowledge and expertise, and by carrying out joint project activities. It also facilitates the bringing together of significant and complimentary know-how of the Zhejiang and KCL applicants in the fields of synthetic organic chemistry, medicinal chemistry and physical chemistry. This will enable the minimization and management of key technical risks associated with the project.
KCL10  Time-resolved fluorescent imaging to measure micro-viscosity in living cells

Partners:  Dr Klaus Suhling, King’s College London
         Dr Junle Qu, Shenzhen University

Amount of Award:  PG £15,000

OBJECTIVE

Viscosity is one of the key parameters affecting the diffusion of molecules and proteins. In biosystems, changes in viscosity have been linked to disease and malfunction at the cellular level. The aims of this project include (1) to establish a strong research collaborations between King’s College London and Shenzhen University, and (ii) to evaluate the feasibility of the use of two recently developed time-resolved fluorescence imaging techniques which allow mapping the viscosity in living cells as a novel technology capable of satisfying the market need for a commercial microviscosity measurement technology platform. This approach only requires microliter sample volumes and has great potential to help drug discovery and drug delivery studies, cancer treatment and cell signaling research.

OUTCOME

The project has achieved all the milestones and deliverables set out in the proposal. An effective research partnership has been established between the two teams. The feasibility of the two microviscometry technologies were thoroughly investigated, the performance of the TR-FLIM and TR-FAIM were investigated and they showed good potential for being further developed into a suitable commercial technology platform for biosystem microviscosity measurement applications. The market need and relevant commercialisation feasibility of the technology was also studied and verified. It was found that the technology is particularly suited to being developed as a novel high throughput drug discovery assay platform technology.

The research team are committed to continuing collaboration with each other and are looking into further funding opportunities to progress their investigations.

BENEFITS OF COLLABORATION

The added value for the collaboration is that it enabled the bringing together of the expertise in high performance fluorescence instrumentation in Shenzhen university and biophysics expertise at King’s college, which made it possible for a successful feasibility of this technology to be carried out and to deliver the project deliverables. It opened a new channel for King’s and Shenzhen to collaborate in research and benefit from each others complimentary strengths and know how and achieve greater research impact.
KCL16 Development of an expert system for optimized cell culture growth and protein production

**Partners:** Dr Roberto A Steiner, King’s College London  
Dr. Hailin Yang, Jiangnan University

**Amount of Award:** PG £9,000

**OBJECTIVE**

This project aims to (i) establish a research partnership between King’s College London and Jiangnan University, (ii) to develop an expert system able to fully supervise the cell growth process in fermentors/bioreactors. The expert system will be capable of automatic control, management and optimisation of the process of biomass production, (iii) assess the market need and commercialization feasibility of the technology.

**OUTCOME**

The project has fully achieved its goal and delivered all the deliverables and milestones set out in the proposal. A joint research team was established between the two organisations with complimentary expertise in protein biophysics and food science and fermentation. A comprehensive market research study was undertaken and the feasibility commercialising the technology were investigated. The technology feasibility was also assessed by the joint team and a PoC research proposal was developed in order to acquire further funding to move the technology investigation into prototype development.

**BENEFITS OF COLLABORATION**

The two partners have the complementary skills necessary to validate and translate the current technology into a commercial product and bring benefits to the scientific community. The collaboration of these two research groups offers the best opportunity to develop this system into a commercially viable technology. It allows the Chinese originators of the original technology to collaborate with the researchers in the UK who have the skills and contacts to develop a convincing cell culture and protein production system. Allowing these two research groups to interact enables the exchange of ideas and expertise and gives the most realistic chance to commercially evaluate and to further develop the technology. The combination of skills and expertise is the real added value of this ICUK project. It is unlikely that this expert system for protein fermentation process technology could be developed if either of these groups were to work alone.
KCL18 Establishment of a novel immunological assay to distinguish patients with autoimmune hepatitis from those induced by hepatitis B virus infection

**Partners:** Dr Yun Ma, Professor Diego Vergani, King’s College London  
Professor Huifeng Wang, Professor Jinhua Hu, Chinese Military General Hospital for Infectious Diseases

**Amount of Award:** PG £14,700

**OBJECTIVE**

The major objectives of the project include: 1) To establish and strengthen the research partnership and collaborations between the King’s College London and the Military Hospital for Infectious Diseases; 2) To assess the feasibility of developing a highly sensitive and specific non-isotopic assay, ELISA, via the measurement of anti-SLA antibodies for the unmet diagnosis needs of autoimmune hepatitis; 3) To explore the potential of commercializing this assay; 4) To develop a joint strategy to obtain further development funding.

**OUTCOME**

The project has achieved all the goals set out in the project plan. A research partnership was established between the two partners and collaborations strengthened. Preliminary experimental investigation into the technology feasibility of developing a high sensitivity bioassay using a unique cDNA encoding SLA to express in yeast provided a correctly-folded protein, and obtained positive results. Furthermore a comprehensive market research study was also conducted and the major issues of commercialisation of the technology were verified. The project also resulted in a translational research proposal which was submitted to MRC in the UK for funding to carry out further detailed technology development.

**BENEFITS OF COLLABORATION**

The collaboration resulted in significant benefits to both project partners. King’s team, strong on conducting basic and clinical research defining the mechanisms of various liver diseases, especially autoimmune liver diseases, has been able to expand into translational research aimed at designing an immunoregulatory cell based therapy through the collaboration with the Chinese partner in project. King’s also benefit from the knowledge exchange activities in this project, particularly via the expertise of the visiting Chinese Research Fellows in cDNA cloning and protein expression techniques. The Chinese partner strengthened their clinical research and clinical assay skills in this disease area, and gained greater insight into the disease mechanism and knowledge of conducting basic research through this joint project collaboration.
RVC02 Identification and mechanistic studies of novel antibacterials from Traditional Chinese Medicines (TCM) using anti-sense mRNA sensitized whole cell screening.

**Partners:** Dr Liam Good, the Royal Veterinary College
Prof. Boli Zhang, the Tianjin University of Traditional Chinese Medicine

**Amount of Award:**
- PG £14,360
- PoC £88,050
- Chinese match fund: RMB 505,000

**OBJECTIVE**
New antibacterials are needed to combat multi-drug resistance and improve therapy. Traditional Chinese Medicines appear to contain novel antibacterial substances, which could be further developed as medicines if their activities can be better understood. In this project we have selected medicines that have robust antibacterial activity and planned to test their mechanism(s) of action using in-house methods for whole-cell mechanism of action studies. The assays are based on anti-sense sensitized strains, where putative target genes are silenced at the RNA level using expressed RNA. The project uses a powerful genetics tools to study inhibitor mechanism of action.

The TUTCM facility successfully prepared the extracts for initial screening and these have been transferred to RVC. Also, at RVC we completed the initial screening of these extracts and returned information about potency to TUTCM.

**OUTCOME**
Among the 11 pure compounds the compounds from "H1-1" (Berberine) show high activity and other extracts in the same series show promising activity. Also, we have continued our analyses of the TCM berberine and we are pleased to report that we have gathered new information about the mechanism of action of the drug. The recent results with H1-4 pure extract may provide a basis for a further research and possibly a commercial product. One research paper on the mechanism of action of berberine (H1-1) has now been submitted for publication.

**BENEFITS OF COLLABORATION**
The UK laboratories have benefited greatly by acquiring access to the TCM extracts from TUTCM. Also, we are benefiting from their capacity to fractionate the samples and help us to follow-on from the initial indications of antimicrobial activity. We have also initiated an on-going collaboration with other academic groups in Shanghai Jiaotong University who have similar interests in TCM mechanism studies.
RVC03 Identification of genetic markers associated with fertility and longevity traits in dairy cows

Partners: Prof DC Wathes, Royal Veterinary College  
Prof Shujun Zhang, Huazhong Agricultural University

Amount of Award: PG £14,500  
PoC £90,000  
Chinese match fund: RMB 1,000,000

OBJECTIVE

The objects of this project were
1. to obtain the phenotypic and management data on economically important traits (fertility, milk production, longevity) from a population of Chinese Holstein dairy cows
2. to obtain DNA from cows in the same population for analysis using Illumina BovineSNP50 DNA BeadChips (containing 54K informative single nucleotide polymorphisms (SNPs))
3. to identify SNPs associated with relevant traits in both British and Chinese dairy cow populations.

OUTCOME

Objectives 1 and 2 have been achieved. We now have to identify quantitative trait loci, evaluate the genetic merit of individual cows, and perform comparative studies between UK and Chinese populations of Holsteins. This aspect of the project will now proceed promptly without incurring any further costs. We anticipate completion by 31 Dec 2010. The phenotypic data and DNA samples used in this project were obtained from purebred Chinese Holstein cows owned by two Dairy Companies in China. Both of them are willing to contribute in the next stage of this project. From UK side, the National Milk Records (NMR) attended the workshop in Wuhan and is very keen to work with RVC in terms of commercialisation.

BENEFITS OF COLLABORATION

The collaboration between the RVC and HZAU has been very successful, a formal memorandum of a joint laboratory on “Animal Breeding and Disease Control Technology” was signed in April 2010 and a MOA for general collaboration was signed in January 2010. The initial ICUK collaboration has led to significant new funding for both partners, including a BBSRC China Partnering Award, value £36K; two summer studentships from Genesis-Faraday and the Wellcome Trust (each valued at £2500); a further ICUK network grant in 2009 provided £15,000 to assist with the costs of running the 2009 International conference in Wuhan. A further 1,000,000 RMB in Chinese match funding was awarded to the Chinese team to further develop the project.
RVC04 Development of a blood based test screen for transmissible spongiform encephalopathy

**Partners:** Dr Mourad Tayebi, the Royal Veterinary College
Prof Deming Zhao, the China Agricultural University

**Amount of Award:**
- PG £14,700
- PoC £88,926
- **Chinese match fund:** RMB 1,000,000

**OBJECTIVE**

The aim of the project was to establish methods and protocols needed to develop a blood-based test screen for prion diseases. Anti-prion monoclonal antibodies were developed and characterized using specific prion strains as set out in the objectives and methods and assays of sufficient sensitivity were developed using infected tissues from Chinese sheep flocks.

**OUTCOME**

Following isolation of prion strains from Chinese sheep flocks, monoclonal antibodies have been raised in mice and characterized using prion proteins. We have initially optimized the immunization protocols. This was then followed by producing monoclonal antibodies in the PrP Knock-out mice.

A panel of monoclonal antibodies were successfully produced with our partners in China and were subsequently characterised for their binding capacity to recognise prions. Antibodies were screened on ELISA and Western blotting with prion proteins and for total mouse IgG and IgM. These antibodies will be used to pursue the remaining objectives of the project.

The antibodies raised were used for assay optimization using scrapie-infected samples. The experiments have allowed us to determine parameters (time-points, detection limit etc) that will be translated and used for the blood-based assay commissioned by the European Commission. While awaiting approval for samples to be provided by the EC, this objective was expanded to include various sheep breeds but also assessing different prion strains in sheep and mice. Crucially, this objective has allowed us to validate a Sandwich ELISA Assay that relies on the use of two antibodies for immunocapture and immunodetection.

A report on the optimization studies performed by our laboratory has been submitted to the European Commission in order to secure ‘validation’ s samples to enter to validate our test screen by the EC.

**BENEFITS OF COLLABORATION**

A spin out of RVC has now been created and formalised. PrioCam Limited (www.priocam.co.uk) has appointed a CEO (Mike Simmonds) and a CSO (Dr Mourad Tayebi). Rounds of investment talks have been held with Roche and Pharmidex limited.
RVC05 Development of novel antimicrobial drug products based on pharmacokinetic and pharmacodynamic interactions

Partners: Prof Peter Lees, Royal Veterinary College, London University
Prof Jianyong Li, Lanzhou Institute of Animal Science and Veterinary Pharmaceuticals

Amount of Award: PG £14,700

OBJECTIVE

The aim of the project is to exchange knowledge and expertise between the UK and China partners on the pharmacokinetics (PK) and pharmacodynamics (PD) of drugs of the antimicrobial and anti-inflammatory drug classes. Our intention was that this will lead to development of one or more novel commercial products for use in farm animal medicine. Using the principles of PK-PD modelling, the dosages of the drugs in the combination products will be optimized to ensure maximum bacterial kill and minimum opportunities for the emergence of antimicrobial resistance.

Drugs of the non-steroidal anti-inflammatory (NSAID) and antimicrobial drug classes are used extensively to treat infectious diseases such as calf and piglet pneumonia. NSAIDs reduce body temperature and suppress acute inflammation in the lungs. Antimicrobial drugs kill (bactericidal action) or inhibit the division (bacteriostatic action) of bacterial cells, thereby achieving clinical cure of disease. The potential, thus far unrealized, is to combine a drug of each category in a single product, in which the dosing schedule will be selected on the basis of utilizing additive and synergistic interactions of each constituent. This will provide the basis for increasing clinical and bacteriological cure rates, thereby minimizing the emergence of resistance.

OUTCOME

All of the stated objectives were met and the funding is now being sought to further the development of the project

BENEFITS OF COLLABORATION

The ICUK Partnership grant supported the new established collaboration between the two institutes. Both sides are very happy to work together and committed to the promising project. Although it has not been awarded PoC funding, they are very positively looking for alternative resources to carry on this project, which they believe has great commercial potential.
RVC08 Development of traditional Chinese veterinary medicine products to improve embryo development and success rate of embryo transplantation

**Partners:** Dr Ali Fouladi-Nashta, Royal Veterinary College, University of London  
Prof. Zuoting Yan, Lanzhou institute of animal science & Veterinary Pharmaceutics Science

**Amount of Award:** PG £13,400

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**OBJECTIVE**

Low fertility is a pervasive problem; affecting both farm animal species and humans. It is caused by embryo death before or soon after implantation and establishment of pregnancy. The death of an embryo or fetus and abortion results in decrease of reproductive performance and severe economic loss in animal production husbandry. In dairy cattle, the rate of embryo death between days 0 to 7 after mating is about 30%. This rate increases to 40% in the periods between day 8 to 17 when the embryo is in the uterus and prepares for attachment to the uterine wall.

While many factors may cause embryonic death, our investigations show that TCMs with the function of invigorating the kidney for anti-abortion can improve the success rate of embryo implantation after transfer of embryos produced by in vitro fertilization (IVF) in humans. However, effect of TCMs on fertilization and embryonic development is still unknown. This project will use the knowledge from humans to assess the effects of TCMs in increasing pregnancy and reducing embryo death or abortion in dairy cows.

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**OUTCOME**

The partnership grant project has successfully finished and a good relationship between the collaborators has been formed. They are currently looking for other funding resources to carry on this project.

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**BENEFITS OF COLLABORATION**

Royal Veterinary College London and Lanzhou Institute are partnering to develop Traditional Chinese Veterinary Medicine (TCM) products which improve fertility by improvement in survival rate by control and prevention of embryonic death in dairy cows. This will lead to increase in birth rate of embryos as well as maximizing reproductive performance and improving economy in the British and Chinese dairy industries.
Environment and Energy
NOTTS09 Development of commercial genetic markers for rice for nitrogen-use efficiency

Partners:  Professor Wu Ping, Zhejiang University

Amount of Award:  PG £14,980 / PoC £69,997

OBJECTIVE

Plant breeding during the 20th-century achieved substantial increases in crop yields using large quantities of inorganic fertilizer. However, this approach is unsustainable because of diminishing returns both economically and environmentally. Unused fertilizer can leach into the environment where it induces algal blooms, contaminates drinking water and depletes aquatic oxygen. Furthermore, fertilizer prices have almost tripled in last 3 years in China. As such, there are environmental and economic incentives for breeding programmes targeted towards low Nitrogen (N) conditions: increasing the ability of crops to assimilate N is crucial to both yield increase and environmental protection.

The project applies University of Nottingham (UoN)’s existing techniques that identified the basic genetic model of wheat to rice experimental data from Zhejiang University (ZJU) to allow the rapid completion of a genetic map of rice. This genetic map will then be used to identify key genetic markers associated with NUE in rice. The project is the first of its kind and should be able to offer significant advantages for breeding of crops with a higher NUE.

OUTCOME

Methods and techniques we used in this project have been used for a BBSRC funding application in April and we are now waiting for the outcome. A manuscript about the ANNs has been submitted. We will contact the institutes and industry for commercial use after further testing in field. We are going to apply a patent for the markers.

BENEFITS OF COLLABORATION

The UoN School of Biosciences (SB) includes the largest group of crop scientists in any UK university, an internationally renowned Plant Sciences division, and the Nottingham Arabidopsis Stock Centre. ZJU possesses a large rice variety resource centre which was very useful for the project. During the collaboration we were able to apply the techniques developed by UoN to data from ZJU’s Chinese rice varieties, combined with ZJU’s extensive knowledge of rice physiology, to rapidly develop commercial genetic markers for NUE.
**NOTTS10 An innovative combined solar/wind compound parabolic concentrator (CSW-CPC)**

**Partners:** Professor Hulin Huang, Nanjing University of Aeronautics and Astronautics Professor Hongfei Zheng, Beijing Institute of Technology Prof. George Zheng Chen, The University of Nottingham, UK Dr. Xianbo Jin, Wuhan University, China

**Amount of Award:** PG£15,000

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**OBJECTIVE**

Solar and wind energy are two of the main renewable energy sources. Concentration of solar energy onto a smaller area may reduce the cost of the solar energy receiver (e.g., PV module) and achieve higher efficiency. During cloudy weather and long nights solar energy is limited, yet during these times it is often windy: an advantage would be to use the same concentrator to utilise sunlight when sunny and wind when windy. This project aims to develop a combined concentrator for electricity generation and lighting. The size of the enclosed wind turbine in the system is reduced to be suitable for the built environment. The design may provide a solar concentration ratio of 10-100 and wind power concentration ratio of ~3. Sunlight may be focused onto a small concentrating PV module or into optical fibres for lighting.

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**OUTCOME**

A Computerized Fluid Dynamics simulation was conducted to study wind concentration/augmentation of solar concentrators of various sizes and tests on a plastic model concentrator showed good agreement between the simulation and measurement. A prototype system was designed, constructed and is being tested. Performance of the prototype was estimated for 20 cities worldwide, concluding that the proposed system is very suitable for changeable weather found in the UK, northern Europe and coastal cities such as Tianjin, Shanghai and Guangzhou. A Market study of the proposed system was conducted, which found that there is real interest in the proposed solar/wind concentrator. Demand for renewable microgeneration technology is large as the Code for Sustainable Homes calls for all new homes to be zero carbon by 2016. Two joint papers have been published in the international journal of low carbon technology and Two patent applications in China have been made.

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**BENEFITS OF COLLABORATION**

The project has brought individual expertise together in synergy on this joint project. Collaboration with Chinese academics has provided an opportunity for UK to draw on help and expertise regarding commercialization in China.
NOTTS12 An image matcher for an FPGA based embedded system for next generation Mars exploration

Partners: Dr Yiqun Zhu/Dr. Barrie Hayes-Gill/Dr. Matt Clark/Dr. Ian Stockford, The University of Nottingham
Professor Zhiguo Jiang, Beihang University

Amount of Award: PG £14,980

OBJECTIVE

Entry Descent and Landing (EDL) Systems used in previous rover missions have been unable to identify unexpected hazards on a planetary surface, which is believed to be the cause of several mission failures. This project assesses the feasibility of providing an EDL system with the intelligence, in the form of an image matcher, to identify hazards on a planetary surface enabling it to modify its descent path and change to another, safer, landing site. An image matcher works by comparing a ‘live’ image (of a surface) to existing, pre-recorded images. If the image matches, then the EDL system knows that it is safe to land. If something unexpected appears in the picture then it can assess whether this poses a problem and instruct the EDL system to modify its descent path to a safer landing site.

OUTCOME

The simulation models have been built based on the limited Mars terrain images available. A SIFT-based Mars terrain image-matching algorithm has been proposed and developed. The SIFT-based image-matching algorithm has been optimised for hardware architecture and then implemented on Xilinx M507 FPGA development board, which has confirmed that a real-time image matching speed can be achieved with minimum hardware usage. The team received funding from a Chinese company to investigate and develop a prototype of the SIFT (Scale Invariant Feature Transform)-based low cost and high performance video stabilizer on an FPGA (Field Programmable Gate Array) device.

BENEFITS OF COLLABORATION

The collaboration has brought our experiences in different disciplines together: this is critical to the project, because the Chinese partner has both an excellent track-record in image processing, and a strong link with China Academy of Space Technology, which is responsible for all deep space exploration in China. Also, the University of Nottingham has a very strong track-record on FPGA based embedded system design which is indispensable to this project, coupled with experience with custom image sensor design.
**NOTTS14 Solar-thermochromic composite films of ionic liquids and polymers for smart windows**

**Partners:** Prof. George Zheng Chen, The University of Nottingham, UK  
Dr. Xianbo Jin, Wuhan University, China

**Amount of Award:** PG £14,900

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**OBJECTIVE**

In summer, air conditioning accounts for the largest part of energy consumption in the built environment, the main cause of which is sunlight because after entering buildings or vehicles through windows, light dissipates most of its energy as heat. Smart windows built from solar-thermochromic materials can partially prevent light from entering the built environment. These materials work automatically in response to temperature changes, and hence do not need a control system.  
The two applicants have developed novel polymer-ionic liquid composite films that change colour, e.g. white to light blue, in response to temperature changes between room temperature and 80°C that can be readily achieved under sunlight.  
This project aims to develop novel and affordable solar-thermochromic polymer-ionic liquid composite materials on the basis of proven sciences from previous collaborative research. Such materials have the potential to enable the solar-thermochromic material based smart window technology that can significantly reduce the energy consumption for air conditioning in the built environment.

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**OUTCOME**

Following market engagement activity significant interest was generated from two leading global film production companies. This interest was used to shape a Venture Capital proposal that is aimed at developing commercial proof of concept for the thermochromic films. This application was successful and the team are now shaping up to collaborate with the largest global films company towards benchmarking the technology against currently available films. This activity will complete during 2011 and the intention is to secure a license for use of thermochromic films on windows before the team begin to explore wider opportunities for the technology.

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**BENEFITS OF COLLABORATION**

The award allowed both teams to strengthen their research collaboration, which was initially set up 8 years ago. It also allowed the team to Identify commercial partners and bring a commercial film product closer to market.
NOTTS18 Development and sub-pilot demonstration of an innovative carbon capture adsorbant technology based on a hydrothermal process

**Partners:** Dr Chenggong Sun, Prof. Colin Snape and Dr Trevor Drage, University of Nottingham  
Prof. Kaxi Li, Institute of Coal Chemistry, Chinese Academy of Sciences

**Amount of Award:**  
*PG £14,980  
PoC £69,997*

**OBJECTIVE**

To develop and demonstrate at sub-pilot scale an innovative solid adsorbent technology. The results already obtained from a recent ICUK partnership project have led to superior materials with reversible CO2 capture capacities of up 3 times that of leading sorbents. The costs of these materials are comparable or lower than existing technologies – most of which are not commercially available. Using the unique production technology expertise of the Chinese partners combined with the extensive sorbent development know-how of the UK partner this further collaboration takes the outcomes of the partnership grant forwards towards demonstration at a sub-pilot scale, with the ultimate goal of commercial implementation in operational power plants.

**OUTCOME**

The project has identified candidate materials with the highest CO2 uptakes to date for carbons in post-combustion capture, as well as other performance criteria that make these materials especially suitable to be developed further for post combustion capture. The project has led to a potential patent application and once patent protection is in place, options to develop the adsorbent technology for post-combustion capture in conjunction with Chinese industrial partners will be pursued. We have already received strong interest from a couple of UK companies who could be potential licensees of the technology. We aim to have achieved an Option agreement during 2010.

**BENEFITS OF COLLABORATION**

Strong expertise and complementary skills which were brought together by both partners have increased the speed of the development and deployment of novel CO2 capture/storage technologies. A combination of the existing links between individual UK and Chinese partners with industry can undoubtedly speed up the potential commercialisation of the technology being developed.
**SOTON04 Overcoming the barriers of commercializing biomass fast pyrolysis**

*Partners: Dr. Sai GU, University of Southampton  
Dr. Shurong Wang, Zhejiang University*

**Amount of Award:** PoC £70,000

**OBJECTIVE**

Fast Pyrolysis is a novel technology used to convert widely available biomass into liquid biofuels and high value products. Unlike the technology used to create 1st generation biofuels, Fast Pyrolysis does not consume food crops. Although Fast Pyrolysis technologies already exist, this technology has an advantage as it can deliver much higher yields. The UK Principal Investigator has made rapid progress towards completing the design of a Fast Pyrolysis system ready for scaled-up installation and a laboratory prototype has now been built and is currently being tested in Southampton.

**OUTCOME**

The quality of the bio-oils currently produced is suitable for use as heating oil although the long term aim is to upgrade for use in transportation. It is estimated that with a RMB 100M investment for a pyrolysis plant, it is possible to repay the investment in 5-10 years by selling the oil.

The construction of a fast pyrolysis plant in China using the additional MoST funding will take the project to a level where VC funding in China can be accessed.

This company will seek to establish a joint venture with a manufacturing company to take the proof of concept plant towards a finalised commercial operating system that will then either be sold or leased going forward.

On the UK side, there is a significant window of opportunity arising out of a projected 100% increase in landfill tax by 2014 and the consequent need for companies to find innovative ways to deal with waste. The research team at the University of Southampton is working with a UK company to identify a potentially high value waste stream for use as an input for an optimised Fast Pyrolysis plant and to seek investor support.

**BENEFITS OF COLLABORATION**

The ICUK project has significantly improved the profile of fast pyrolysis research in the UK. The PI won the first EPSRC grant specifically for fast pyrolysis. Now Southampton is collaborating with Aston University to support the Carbon Trust Pyrolysis Challenge consortia to develop scaled-up plants and biofuel upgrading technologies, where over a dozen of UK companies are involved. Southampton is now an associated member of UK SUPERGEN Bioenergy consortium which is to develop new generation biofuel technologies for the UK industry. Funding gained on the Chinese size has enabled the work to commence on a scaled-up plant.
SOTON05 Portable biosensors based on Lab-on-a-Chip technology for environmental pollution monitoring

Partners:  Dr. Xunli Zhang, School of Engineering Sciences, University of Southampton
Dr. Ningyi Zhou, Wuhan Institute of Virology, Chinese Academy of Sciences

Amount of Award:  PG £14,800

OBJECTIVE
To set up a feasibility study integrating each partners’ cross-disciplinary expertise in engineering and environmental microbiology to develop a new type of portable detection system based on Lab-on-a-Chip bioreactor technology for fast and reliable measurements of aromatic organic compounds in surface water and soil.

OUTCOME
A market research survey was commissioned which concluded that the proposed technology was a very strong candidate to fulfil major technological needs of the relevant end-user industries and that there was a good chance of commercial success.
A range of enzymes were constructed and/or engineered which could potentially be used for catalyzing and degradation of the targeted organic compounds. This work was carried out mainly in Wuhan.
Using the enzyme selected and the detection method identified, a preliminary study on the feasibility of the technology principle was carried out using a flow cell system and it was established that the absorbance at a given optical wavelength was proportional to the corresponding organic compound.

BENEFITS OF COLLABORATION
The project provided an opportunity for the two partners from different disciplines to work together in order to assess the feasibility of the portable detection system and to enable the identification of the scale of scientific/technical development required for this follow-on phase, the size of the commercial opportunity and the likely commercial exploitation route.
SOTON06  A feasibility study of capacity building and decision support for Chinese and Asia-Pacific river and water management

Partners:  Dr. Craig Hutton, Geo-data Institute, University of Southampton
          Dr. Suxia Liu, Ket Lab of Water Cycles and Related land Surface Processes, CAS, Beijing

Amount of Award:  PG £7,300

OBJECTIVE

To conduct a feasibility study to explore the potential for developing a basic model for delivering training in environmental resources management into a financially-sustainable joint approach run between CAS and UoS. A business model was to be developed based on a review of the need for such training and the costs and benefits of different modes of training delivery. As the feasibility discussion matured, it focused increasingly on river and water resources management as a core field with a clearly-defined professional structure and market. At the same time, consideration of the hosting of training delivery has broadened from an exclusively university-based model to one incorporating client-based elements and extending the potential market through Chinese hosts to other countries within the Asia-Pacific Region. At the same time, a narrow focus on training has evolved into a more broadly-defined notion of capacity building and decision support.

OUTCOME

The feasibility study was successfully completed and following an extensive review of options, a business model was developed based on joint development of materials and strategies for delivery through the Hydroinformatics KnowledgeHub in Zhengzhou in the newly-established Centre for Hydroinformatics in River Basins (CHIRB), hosted by the Yellow River Conservancy Commission. The foundation has been laid for expediting such activities in association with the UNESCO-IHE Institute for Water Education, which has been instrumental in establishing the Asia-Pacific Water Forum KnowledgeHub network. In the future there is clear potential for the delivery of a capacity-building programme to be sustainably funded by a mix of third-party international aid and commercial sponsorship, together with partial funding from client organisations within China and related Asia-Pacific countries.

BENEFITS OF COLLABORATION

The ICUK partnership consolidated and clarified the relationship between the two parties and has laid a firm basis for undertaking collaborative capacity building in water management in the future.
KCL14 Anaerobic biological treatment process of waste metal working fluids

Partners: Prof Ken Bruce, King’s College London, Prof. Jun YANG, Beijing University of Aeronautics & Astronautics

Amount of Award: PoC £89,600
Chinese Match Funding: £20,000

OBJECTIVE

Metal working fluids (MWF) are lubricating coolants, extensively employed in the manufacture of metal products which are a source of serious environmental pollution and are in urgent need of a technological treatment solution prior to disposal. The aim of this project is to develop a novel technology to treat the problematic MWF waste anaerobically in bioreactors, degrading the pollutants to consent disposal level with additional benefit of producing a valuable clean energy source, methane, instead of producing greenhouse gas emission during the process.

OUTCOME

A collection of 106 bacterial strains were made and their suitability for use in the treatment of waste MWFs assessed. A group of anaerobic bacteria were selected as target species for use in development of the technology; some bacteria have been selected for their ability to biodegrade MWFs and others as capable of generating methane (methanogens). The isolation of these methanogens from the hostile conditions in MWFs was achieved and was used to establish a simplified bioreactor at King’s. This has been observed to be able to produce a modest bio-degradation of MWFs and produce methane. Using statistical techniques, a rational basis for the complex task of choosing bacteria for bio-degrading waste MWFs and generating methane was established. Furthermore, the bacterial interactions and degradation pathways which may inhibit a waste MWF bioreactor were also identified during the investigation. As a result, a clear path has been identified for further development and commercialisation of this technology and the project has attracted significant industry interest.

BENEFITS OF COLLABORATION

The collaboration took advantage of the complementary expertise available between King’s College London in microbiology and BUAA in anaerobic waste-water treatment technologies. The collaboration, expertise and knowledge exchange between the two organisations made it possible for the smooth progress of project, to select potential anaerobic bacteria strains, characterize the effectiveness of the anaerobic biodegradation of metal cutting fluids, and perform tests on the novel biological treatment.
KCL15 Biotreatment of estrogen – a model for the biodegradation of pharmaceutical products and associated wastes

Partners: Dr. Ken Bruce, King’s College London
Professor Hongqiang Ren, Nanjing University

Amount of Award: PG £15,000

OBJECTIVE
To develop a partnership between Chinese and UK based research teams to work on the biodegradation of pharmaceutical products and associated process wastes which are a major source of environmental pollution in eco-water system. The initial target selected as a paradigm for pharmaceutical product biodegradation was estrogen. Whilst this formed the project’s initial focus, the applicability to other pharmaceutical products and associated waste became clear from investigation. The key technology objective for the project includes two aspects. First, a detailed assessment of the literature and second, an “Experimental phase” that develops the project through research in collaboration with partners and other interested parties.

OUTCOME
A research partnership has been established between King’s College and Nanjing University with the complimentary expertise in pharmaceutical microbiology and waste water treatment and biodegradation. The team delivered a comprehensive report that detailed what was known scientifically about estrogens primarily in relation to estrogen chemistry, biology and regulatory requirements. In the experimental investigation, a number of different carbon containing pharmaceutical products were selected for analysis. The degradability of selected compounds by chosen bacteria was assessed. This project has delivered a system through which any pharmaceutical product can be addressed. As such, it offers much scope for commercialization and intellectual property generation.

BENEFITS OF COLLABORATION
The main added value of this project is that it brings together two groups who are experts in their respective fields. The UK scientists have no experience with the sophisticated technological abilities of the Chinese scientists associated with this project. However the experience which the UK team brought to the project was unique. Combining the research teams allowed work that neither group could do individually to be carried out. Also, the scope for future development of this project is high, very little is known about the processes of estrogen biodegradation. In harnessing the efficiency of microbial consortia to degrade estrogen, this collaboration will in the longer term provide a robust technology that has significant social, environmental, health and economic benefits to both countries.
KCL24 Novel early flood warning system using grand ensemble weather predictions (NEWS)

Partners:  Dr. Hannah Cloke, King’s College London
           Prof. Zhijia Li, Hohai University

Amount of Award:  PG £14,900 / PoC £69,500
                   Chinese match funding: RMB 332,000

OBJECTIVE

Current flood forecasting technology is inadequate for providing an early warning. The aims of this project included: 1) to assess the commercial value and feasibility of the NEWS technology; 2) to establish a research partnership between King’s College London and Hohai university; 3) to produce a commercial prototype software system for flooding incident early forecasting.

The key technology objectives include to enable the King’s-Hohai team (1) to develop a fully-fledged NEWS prototype to be tested in river catchments in China and (2) to have all model codes written professionally as modules packaged in an integrated and user friendly software expert system to be known as “Novel Early Flood Warning and Risk Assessment System (NEWS)”, and (3) to explore the functionality of API web services including (i) real-time communication and data flow (ii) personalized access to information and (iii) data aggregation from multiple sources.

OUTCOME

All project objectives have been achieved during the project. The market need and the commercialisation feasibility of the proposed technology were investigated and a working prototype software system was developed. Demonstration of the system’s effectiveness and other performance details were evaluated through field deployment experiments of the flood forecasting software prototype system at local river systems.

The technology has been proved effective and attracted significant industry interest as well as interest from relevant flood management agencies both in China and in the UK.

BENEFITS OF COLLABORATION

The research group at King’s has gained access to the excellent hydrology expertise at Hohai University. King’s benefited by gaining access to the best hydrological model available in China and the valuable data for testing the NEWS prototype. Meanwhile, Hohai benefited from accessing the substantial experience and expertise of King’s in processing & analysing meteorological data.
Nanotechnology and Materials Science
NOTTS08 High-efficiency carbon nanotube hetero-junction solar cells for energy generation

Partners:  Dr Yanqiu Zhu from the University of Nottingham,  
Professor Jinquan Wei from Tsinghua University

Amount of Award:  PoC £69,907

OBJECTIVE

The aim of the project was to improve the efficiency and to cut down the cost of the novel solar cell jointly developed between University of Nottingham and Tsinghua University. It will establish a protocol of manufacturing the solar cells and developing commercial prototypes.

OUTCOME

Significant technical progress has been made during the project. We have conducted fundamental research on reducing the resistance contact between the carbon nanotube thin films and the Si wafer within the solar cell. High efficiency conversion rate up to 13.4% has been achieved which is higher than what we originally proposed (10%), by reducing the resistance contact between the CNT thin films and the Si surface. Meanwhile, we have prepared detailed technical data files and made the project ready to be exploited by industrial investors. We have also made contact with several potential investors in China for future commercialisation of the project.

BENEFITS OF COLLABORATION

Both China and the UK partners have accumulated experience on CNTs manufacturing and exploitation over the past decade. The initial 1.5% conversion rate of the solar cell developed by Tsinghua team has been improved to the current 6% via collaboration with the Nottingham team, which has evidenced the importance of the collaboration work and has already added value. In this project, further knowledge transfer between the two groups led to a completely new design of the CNT solar cell and significantly advances the current state of this solar cell technology. The involvement of Nottingham contributed to the new design and technical innovation, assisting exploration of the UK market and the internationalisation of the new technology. The Tsinghua team contributed to assembly, prototype testing and validation of the new solar cell.
SOTON01 Nanocrystalline functionally-graded wear and corrosion resistant coatings

Partners: Dr. Shuncai Wang, University of Southampton
Prof. L.P. Wang, Lanzhou Institute of Chemical Physics

Amount of Award: PG £6,614
PoC £69,964

OBJECTIVE

The electrodeposition of hard chromium has been widely used in industrial equipment to reduce friction and wear, but now faces a ban in both the EU and USA following environmental, health and safety concerns and the introduction of stringent regulations. There is a pressing requirement for established plating processes to be substituted by more environmental-friendly techniques. Many alternative processes, substitute materials and new designs have been intensively studied, but few are as good as chromium coatings or as cost effective.

The partners have scaled up the novel nanocrystalline multi-functional and functionally-graded coatings, using advanced electrodeposition techniques, for replacement of the commercial hard chromium used in anti-corrosion and anti-wear applications.

OUTCOME

The team has synthesized nanocrystalline Ni-Co gradient functional deposits, using a direct current plating technique to coat samples of 20cm x 20cm x 60cm. Bar and tubular samples have also been coated to demonstrate effectiveness on samples with more complex geometries. The Ni-Co deposits significantly decrease internal residual stresses, and improve wear resistance and the coefficient of friction compared to hard chromium deposits. This type of processing is more complex and is expected to be more expensive than hard chromium plating, which has only one layer of Cr applied in industrial applications. We have therefore spent a lot of effort on reducing the internal stress by increasing Co content. The new scaled-up prototype for Ni-Co coatings was first demonstrated at the nCATS launch Day, where companies including Rolls Royce expressed interest in the technology. Work is currently underway with Eaton Aerospace, where the coatings are being evaluated as a replacement for hard chromium. The aerospace sector generally will be very interested in the technology due to regulatory pressure to find more benign replacements for chromium with less adverse impact on the environment.

BENEFITS OF COLLABORATION

The links between the national tribology centre (nCATS) in Southampton and Lanzhou Institute of Chemical Physics have flourished since the early contact through ICUK. Joint activities include three RUCK funded tribology summer schools, two in China and one in the UK.
SOTON15  Processing of nanostructured titanium for use in medical implants

Partners:  Prof. Terry Langdon, Dr. Nong Gao, University of Southampton  
Prof. Jingtao Wang, Nanjing University of Science and Technology  
Prof. Xicheng Gao, Xian University of Architecture and Technology

Amount of Award:  PG £14,800  
PoC £70,000

OBJECTIVE

The key objective of this project is to apply Equal-Channel Angular Pressing (ECAP) technology to process billets of titanium at room temperature in order to increase hardness thus allowing for the commercial production of smaller Ti parts for use as biomedical implants.

OUTCOME

Commercial purity (CP) titanium and titanium alloys such as Ti-6% Al-4% V are in wide use for medical implants. Applications include hip and knee replacements and dental implants for crowns and orthodontic purposes. These materials are effective but the applications are limited by the overall strength such that an increase in strength would permit the use of smaller parts and less invasive surgery. The strength of Ti may be increased by reducing the grain size and this may be done by processing the metal using equal-channel angular pressing (ECAP) where it is pressed through a channel bent through a given angle. ECAP has been used to process, successfully, several different metallic alloys. Processing titanium is not an easy task due to its high strength, which is of the order of magnitude of the materials used for die fabrication, and limited ductility which leads to failure under certain processing conditions.

The present investigation successfully processed CP-Titanium at room temperature using a die with 135° between channels. It was found that a single pass of ECAP at room temperature leads to an increase in strength similar to the material processed by multiple passes at a high temperature. It was also found that the pressing speed plays a key role during processing. Reducing the pressing speed to 0.05 mm/s permitted processing for 2 passes at room temperature while processing at 0.5 mm/s allowed only one.

BENEFITS OF COLLABORATION

The project provided a platform to strengthen the existing links between the teams involved. A researcher from China visited the University of Southampton and conducted research over a period of 6 weeks. The two PIs exchanged visits during the course of the project and are now working together on an international conference to be held in Nanjing in spring 2011.
QMUL04 Oxygen, Glucose and Lactate (Bio) sensor based diffusivity tester for biomaterials

Partners:  Prof. Pankaj Vadgama, Queen Mary, University of London  
Prof. Graham Foster, Institute of Cell and Molecular Science  
Prof. Qin Meng, Zhejiang University

Amount of Award:  PG £15,000

OBJECTIVE

The objective was to use current biosensors to build a diffusion property tester for porous tissue scaffolds and biomaterials, and to verify market need using an independent consultant. Key to this is the collaboration with the Chinese partner who has a comprehensive model system for an artificial liver, not available to us in the UK, which exploits isolated liver cells in artificial gels and in membrane based constructs. Liver cells are especially demanding metabolically, and iterative scaffold design for them, informed by proper diffusivity measurement, will have a critical effect on cell performance and survival. This will subsequently open up a real possibility for a bioartificial liver for supporting patients who have liver failure. Proof of principle will require technical instrument development at QMUL and materials supply by the Chinese partner; the consolidated link will enable the basic elements of the diffusion tester to be in place for the next stage. Success in linking diffusion parameters to cell outcomes in this specific liver model will allow later extrapolation to other tissues, and pave the way for general exploitation of diffusivity by users from both academia and industry. The competitive end user advantage will be the prediction of outcomes prior to expensive and time-consuming evaluation of 3-D cell loaded constructs in complex bioreactors.

OUTCOME

All objectives outlined in the project proposal have now been met:
A market search for an oxygen, glucose and lactate (bio) sensor based diffusivity tester for biomaterials was conducted by Dr. Gordon Nelson of the independent market research firm Burgundy Gold. The report confirms the market needs for the technology and also points to the key attributes that are necessary for the commercial success of such a device.
A first prototype of a glucose biosensor based diffusion tester has been fabricated. Tests, showing promising results, have been carried out at Zhejiang University using their artificial liver system.

BENEFITS OF COLLABORATION

A useful partnership between our group and research groups at Zhejiang University has been established. Both groups will continue to apply for joint funding from UK and Chinese sources to fund the development of a commercial prototype.
ICT, Engineering and Space Technology
**NOTTS02 Development of prototype low-cost GPS receivers for high-precision real-time applications**

**Partners:**  
Dr Xiaolin Meng from The University of Nottingham  
Prof. Chuang Shi from Wuhan University

**Amount of Award:** PoC £70,000

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**OBJECTIVE**

Network real-time kinematic (NRTK) GPS positioning represents the latest development in GPS technology. Using sparsely distributed reference GPS stations, the data centre of NRTK GPS facilities provide users with highly accurate, timely corrections through GSM/GPRS connections to increase positioning reliability, continuity, productivity, accuracy and mobility. The Institute of Engineering Surveying and Space Geodesy (IESSG) of the University of Nottingham have established a dedicated NRTK facility in the past five years. There exists a potential market between current low-cost mass-market sectors and the professional sector standalone handheld GPS receivers cannot deliver adequate accuracy and geodetic GPS receivers are too expensive and cumbersome to use. The proposed project will focus on use of low-cost GPS receivers for higher-accuracy applications, using network real-time kinematic GPS (NRTK GPS) facilities. A prototype GPS positioning system delivering real-time positioning with decimetre accuracy, meeting the requirements of this middle market will be developed during the project.

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**OUTCOME**

Through the PoC project, functional algorithms and software tools have been developed and embedded within the hardware prototype. The prototype has been tested/validated in both UK and China and has been further developed into a commercial prototype with lower cost and higher precision than expected. A GPS company has been engaged through the project to manufacture the prototype. Commercialisation plan is currently in discussion with this company and other Chinese collaborators.

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**BENEFITS OF COLLABORATION**

In the past ten years, both IESSG and CASM/Wuhan University have conducted world-leading studies into low-cost GPS receivers for engineering and environmental applications. Although both organizations have conducted independent research, integrating the existing research findings independently achieved by the both institutions will significantly shorten the development phase of the prototype system, clear the barriers for the potential risks caused by technological, regulatory, marketing issues and promote rapid technology transfer.
**NOTTS07 Novel photo-catalytic mop fan air cleaning system**

*Partners:* Prof Saffa Riffat, University of Nottingham
Professor Yinping Zhang, Tsinghua University

*Amount of Award:* PoC £69,206

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**OBJECTIVE**

The aim of the project was to develop a photocatalytic mop-fan air cleaning device suitable for an office environment. The device will remove gaseous, particulate and odorous pollutants and microbes by the process of photocatalytic oxidation (PCO). This will remove the need for filtration pads and therefore significantly reduce the electrical energy needed for ventilation and air cleaning. The device will be a stand-alone unit meeting the requirement of a specific room space.

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**OUTCOME**

In comparison with the conventional HVAC systems, this system eliminates the need for fresh air input and the associated energy required to condition this air. This produces an estimated saving in energy consumption of 90%. It also simplifies the system design/construction and leads to an estimated 70% reduction in capital cost. In comparison with the indoor air cleaners with filtration pads, it has much lower flow resistance involved in the operation due to removal of the filter, and therefore the system uses lower energy.

The project is currently in discussion with a Chinese and an UK company respectively to explore commercialisation.

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**BENEFITS OF COLLABORATION**

The School of the Built Environment (SBE), University of Nottingham has a world-class reputation for innovative research into building services, sustainable energy technologies and air quality control. The School has particular expertise in the innovative design and experimental testing of new technologies. Tsinghua University is the leading University in China and the Department of Building Technology in Tsinghua has an excellent international reputation for research into HVAC, indoor air quality, thermal storage systems, computer modelling and optimization of systems and devices. The PoC project combines Nottingham's excellence in design and experimental work with Tsinghua's expertise in computer modelling and optimisation, and will lead to the development of a highly innovative photovoltaic air cleaner suitable for the climates of the UK and China.

Tsinghua’s involvement in the project will be valuable to the proposed exploitation and transfer of the technology in China.
NOTTS11 Development and commercialisation of reconfigurable workholding devices

Partners:  Professor Nabil Gindy, University of Nottingham
          Professor Xin Chen, Guangdong University of Technology

Amount of Award:  PG £15,000
                  PoC £69,097

OBJECTIVE

The fundamental difficulty in advanced manufacturing technology and machining is the art of holding components accurately and efficiently while they are worked upon: workholding are therefore essential tools in the component manufacturing process. Conventionally, dedicated (‘one-to-one’) workholding devices are created for each component to be worked upon. Use of dedicated workholding fixtures in these environments results in long lead times when new fixtures need to be built for new components and disposal costs for redundant fixtures when components are discontinued. As such there is an increasing demand for workholding devices to be flexible to accommodate not just one component but to allow reuse with a range of components. To meet this demand, the proposed ICUK funded project aims to further develop and commercialize two reconfigurable workholding devices, highly suitable for different roles in the manufacturing process. Both types of device are dynamic, conforming to the geometry of the components they hold, and as such can be reused to hold a range of different components.

OUTCOME

As a result of the project, 7 papers were published, one under review, 2 patents filed; a market survey report and an experiment report were produced; several potential customers were identified; a commercialisation route was developed; and improved commercial prototypes were constructed.

BENEFITS OF COLLABORATION

University of Nottingham (UoN) worked closely with the China partner institute, Guangdong University of Technology (GDUT) in all the tasks and we shared the same Gantchart and milestones in this project. We communicated with each other frequently. The results of the tasks were provided to each other in time to promote the progress of the project.

We would like to continue the close collaboration relationship with the Chinese partner. After the identification of new collaboration areas, we are interested in seeking funding for further collaborations. Possible funding sources include ESPRC, EU framework, RCUK, Key international collaboration funding from the Chinese Ministry of Science and Technology and the Natural Science Foundation of China (NSFC).
NOTTS13 Novel dew point air conditioning system

Partners: Dr Xudong Zhao, The University of Nottingham
Professor Junming Li, Tsinghua University

Amount of Award: PG £14,850
PoC £69,955

OBJECTIVE

In recent years, a dew point system has emerged on the market. This system breaks the limits of wet bulb, and allows the supply air to be cooled to a level below the wet bulb and above the dew point of the ambient air. It employs a perforated cross flow heat and mass exchanger, and is able to achieve a dew point effectiveness of 60 to 70%. Tests under UK climate condition showed that the system can lower the supply air (from outside) temperature down to 16 to 20°C. This level of cooling effectiveness is still relatively low, which has impeded the systems’ application in the UK and China.

Following the successful completion of the ICUK PG study, the PoC project aims to develop two sets of commercially available dew point air conditioners; each with 1kW of cooling output and suitable for cooling of a 10 to 20 m² single room under UK and China climate conditions, individually.

OUTCOME

Two prototype dew point air conditioning systems were designed and constructed based on the previous theoretical simulation and feasibility studies. Experimental testing was carried out in Nottingham (UK) and Tsinghua (China). The experimental investigation indicates that the performance of the novel dew point air conditioning has been greatly improved compared with existing indirect evaporative cooling systems. The technology now has been successfully licensed to a Chinese company and a product is expected to be available on the market within two years.

BENEFITS OF COLLABORATION

The collaboration has led to a patented technology which was licensed to a Chinese company and attracted additional funds to continue R&D work associated with the technology, and so the partnership between the UK and Chinese organisations will be maintained in long term following completion of this project.
SOTON07 Web Science: Breaking down the barriers to collaboration on the internet between China and the UK

Partners: Professor Dame Wendy Hall, Professor Nigel Shadbolt, University of Southampton
Prof Yong Jiang, Graduate School in Shenzhen, Tsinghua University

Amount of Award: PG £14,753

OBJECTIVE

The objectives of this partnership project were to support the establishment of a Joint Web Science Lab (WSL) in Shenzhen and the creation of a research roadmap to guide the Lab in its early years of operation. The Lab was formally opened in December 2008 supported by additional funding from the two partner Universities and a small project award from the Science and Innovation Network of the Foreign and Commonwealth Office in Guangzhou.

OUTCOME

Since the establishment of the Lab, regular exchange visits have taken place involving academic staff and researchers from both sides of the partnership. Staff at the lab have been working on a number of projects and are now actively engaging local software development companies with a view to finding a commercialisation partner for IPExplorer, their first major software product. Drawing on knowledge bases from China's top Universities, IPExplorer will provide a search engine for intellectual property, a trading platform and additional added value services using Linked Data techniques. It was first demonstrated at the Shenzhen High Tech Fair in 2009 and the latest version will be showcased again at the 2010 event.

BENEFITS OF COLLABORATION

In December 2009, one year after the opening of the WSL, the two Universities opened the Southampton-Tsinghua Technology Innovation Centre in Shenzhen, again with support from the FCO Science and Innovation Network. The centre will use the expertise and experience available from Southampton's Research and Innovation Services to contribute to the commercialisation of joint research including the outputs of the WSL. The University also intends to use the Centre as an access point for UoS spin-outs and companies from our science park and a business incubation centre that are looking to enter the Chinese market.
SOTON10 Feasibility study of novel partial discharge detection using Faraday effect of optic fibre

Partners: Dr. George Chen, University of Southampton
Prof. Lisheng Zhong, Xi’an Jiaotong University

Amount of Award: PG £11,650

OBJECTIVE

The overall aim of this project is to carry out a feasibility study of using the Faraday effect to detect partial discharge in power equipment. The approach makes on-line PD measurement for power plants potentially more convenient and sensitive. The objectives of the project were to:

1. Select suitable fibre materials with a reasonable Verdet constant
2. Identify a method that can increase the exposure length of optic fibre to the magnetic field produced by partial discharge current.
3. Develop a prototype sensor that demonstrates the possibility of using the Faraday effect to detect PD.

OUTCOME

Glass fibres were initially explored as they generally have a higher Verdet constant. However, the bending ability is limited due to deterioration of optical properties. Plastic fibre was finally chosen and its Verdet constant is lower but it has many advantages over glass fibre such as flexibility, easy coupling with optical sources and detection devices which are important in the initial experimental setup.

In order to measure PD the system needs further improvements on several fronts. The measured lowest current needs to be extended down to a few mA and even tens of μA. The following two approaches may be pursued to increase the optical response and signal magnitude. (i) Increasing turns of current passing through the tube to boost the magnetic field strength. (ii) Amplifying the signal via electronic circuitry and signal processing to reduce noise.

A current measurement system based on the Faraday effect was successfully established and it provides a platform for future research on partial discharge detection using an optical approach. Preliminary results indicate that it is feasible to measure a small current using the optical sensor. To measure partial discharge currents, which are typically small magnitude current pulses, further improvements are required to increase the sensitivity of the system and extend the test to alternating current and pulse currents.

BENEFITS OF COLLABORATION

The partners continue to work together in this area and are currently looking for additional sources of funding in China and the UK.
SOTON11 Development of a high performance MEMS gyroscope

Partners: Prof. Michael Kraft, University of Southampton, School of Electronics and Computer Science
Prof. Guizhen Yan, Institute of Microelectronics, Peking University
Dr. Zhenchuan Yang, Institute of Microelectronics, Peking University

Amount of Award: PoC £69,921

OBJECTIVE

The key objective was to develop a high performance, digital micromachined gyroscope for mass market applications such as GPS bridging, novel computer input devices, automotive safety systems including roll-over protection, intelligent airbag deployment, inertial navigation of vehicles on land, sea and air, virtual reality, robotics and many others.

OUTCOME

Incorporation of advanced gyroscopic sensing elements in original closed loop control systems holds the key to achieving the highly desirable goal of realizing a so-called ‘navigation grade’ gyroscope necessary for many of the aforementioned applications.

A prototype of the gyroscope consisting of the micromachined sensing element, interface and control electronics has been completed and tested using discrete components on a standard PCB. This is the main outcome of the project. However, there are two further steps required to implement the design on an Application Specific Integrated Circuit (ASIC). The PCB circuit must be ported onto an ASIC and the ASIC interface developed.

The estimated cost of the work is somewhere between £15- £25k and the team is currently looking for routes to complete the above work. We have concentrated on a small number of leads, where continued interest has been evident, for example:

MIR Enterprises, a small company with experience in MEMS device fabrication who have worked with the PI on other MEMS projects, are currently evaluating options in relation to collaboration/licensing. We believe that an industrially relevant mini-collaboration either with MIR or another organisation interested in a bespoke implementation will be the best way of fully proving readiness of the technology.

BENEFITS OF COLLABORATION

The natural synergy between long term and in-depth research efforts at Southampton and Peking Universities provided the inspiration for this project. The team of Prof. Yan at Peking University has an extensive track record of designing and fabricating micromachined sensing elements for vibratory rate gyroscopes and has established a world class expertise in this area. The team of Prof. Kraft at Southampton University has a similar reputation and track record for developing innovative and intelligent control and interface circuit and systems for micromachined sensing elements.
SOTON17 Optimising ride comfort for motor grader operators by modelling the cabin-seat-driver dynamic system

Partners: Dr Yi Qiu, ISVR, University of Southampton  
Mr Wei Jia Yan, Tianjin Research Academy for Construction Machinery

Amount of Award: PG £14,901  
PoC £69,800

OBJECTIVE

China has a thriving industry building large scale construction machinery for use in the construction of China’s roads and cities. However, much of the machinery currently manufactured in China does not meet US and European safety standards, causing health and safety hazards for operators and preventing manufacturers from exporting to US and European markets.

The aim of the project was to develop and validate a process and model for optimising the ride comfort of the cabin-seat-operator dynamic system of a Motor Grader. The outputs from the model will feed directly into the seat/cabin design process, removing the need for repeated field testing, greatly reducing the product development cycle and helping to meet the necessary ISO standards.

OUTCOME

The Tianjin Research Academy for Construction Machinery (TRACM) is located on the same site and under the same high level management as the Tianjin Dingshen Construction Machinery Co. who will provide the initial route to commercialisation. They have an output capacity of 2000 large construction machines p.a. and are very keen to gain access to European and US markets to offset falling orders in other overseas markets.

A cabin from TRACM was shipped to the UK and modelling was carried out in the Institute of Sound and Vibration Research at the University of Southampton. Work is now complete on the UK side and following the conclusion of negotiations on the commercialisation agreement implementation of the system will commence in Tianjin.

BENEFITS OF COLLABORATION

During the course of the project the UK PI had the opportunity to visit 8 different construction machinery manufacturers in China. The process and the mathematical model that was developed and applied as part of this project are transferable to the cabin/seat dynamic systems of other types of construction machinery. The University of Southampton is currently in the late stages of negotiation on a contract with one of China’s largest construction machinery manufacturers to apply the same techniques on a similar project for their hydraulic excavator.
QMUL01 EMC testing of mobile communication platforms

Partners:  Prof. Xiaodong Chen, Queen Mary, University of London  
Prof. Jinshen Yu, Beijing University of Post & Telecommunication

Amount of Award:  PG £6,756  
PoC £70,000

OBJECTIVE

The aim of this project was to fill the gap in the Electromagnetic Compatibility testing market and develop a new class of high sensitivity and high resolution Electromagnetic Compatibility testing equipment.

OUTCOME

A commercial prototype has been fabricated and is currently being tested by a leading international mobile equipment manufacture. A technology licensing deal is pending with a Europe equipment manufacture.

The new prototype can cover broader frequency ranges and has a higher sensitivity than currently commercially available products. It has the capability of testing the electromagnetic emission of individual components as well as any combination of the different components, which will greatly help the design of new mobile handset. The prototype comes complete with a software packaging for analysing the test data.

The prototype has attracted strong commercial interest from the mobile phone industry and is currently being tested by a major international handset manufacture. The Technology Transfer office at QMUL is currently in discussion with a potential licensee.

BENEFITS OF COLLABORATION

The collaboration between the UK PI Prof. Xiaodong Chen and the Chinese PI Prof. Jinshen Yu is a long established one. The communication between them is excellent and there were frequent visits to each other’s lab. In addition to the current project, they are also working on a number of other joint projects.

It is expected that the two research groups will continue working with each other in the further development of this technology (if required) and on other research projects.
QMUL08 Improved colour filter arrays for digital cameras

Partners: Dr. Pengwei, Hao, Queen Mary University of London
Prof. Chen Zhang, Peking University

Amount of Award: PG £14,911

OBJECTIVE

This project aims to develop a novel, quantitative, medical image analysis software based on the unique technology developed by QMUL and HUST on tissue-specific microstructures to assist radiologists in breast tumour diagnosis.

This Proof-of-Concept project is built upon an earlier ICUK Partnership Grant project.

OUTCOME

The technical development work was carried out both at Peking University and QMUL. Two research students were involved in the development work, one at QMUL and one at Peking University. A software prototype has been develop and tested. Comparison with more commercialised and published CFAs has been made. The test results show that the new design performs better than commercially available products, however the improvement is relatively modest.

BENEFITS OF COLLABORATION

The grant allowed both partners to explore the feasibility of the design. It was concluded that further work needed to be conducted to produce a unique, patentable technology. The PI is working to improve the performance of the technology and is keeping an eye on future commercial opportunities.
QMUL09 Enhanced GPS for indoor and urban environments

Partners: Dr. Yue (Frank) Gao, Queen Mary, University of London
Ming Bai, Beijing University of Aeronautics and Astronautics

Amount of Award: PG £14,899

OBJECTIVE

Global Positioning System (GPS) signals are very weak at the Earth's surface. Consequently when the path to the receiver consists of multiple reflections, for example when the receiver is either close to a tall building in urban environments, or inside a building surrounded by absorbing materials, such as concrete or steel structures, further attenuation renders the GPS signals obsolete. The aim of the project is to develop a unique design of a GPS diversity antenna that can overcome this difficulty, and can be used in indoor applications and highly attenuated environments.

OUTCOME

All the objectives specified in the Partnership Grant Application have been achieved during the course of the project. Joint technical development work at QMUL and BUAA has seen the design and testing of the novel diversity antenna. A 4-5 db improvement has been detected in the preliminary tests. Although this is below the maximum 9db predicated by the computer simulation, it is a significant improvement that is enough to draw serious industry interest. A couple of other factors that effect the signal other than the antenna design have been identified, which include data processing algorithms and the low spec GPS signal receiver used. Independent market research has indentified very positive market needs and provides a motivation for perusing commercialisation.

BENEFITS OF COLLABORATION

After a making an unsuccessful joint PoC application the team are now working together to secure further sources of funding.
**QMUL11 Compact multiband antenna for mobile terminals**

**Partners:** Xiaodong Chen, Queen Mary, University of London  
Junsheng Yu, Beijing University of Posts and Telecommunications

**Amount of Award:** PG £14,750

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**OBJECTIVE**

Recently, multi-functional thin mobile phones or Personal Digital Assistant (PDA) phones with a thickness of about 10mm are becoming very attractive for wireless users. For use in this kind of thin mobile phone, the low profile internal antennas for mobile devices are required to be capable of multiband operation. For this application, many planar antenna designs are studied to provide thinner, smaller structures with sufficient performance. The aim of this partnership grant is to optimise the design of a multiband antenna previously developed at QMUL for mobile communication applications and assess the commercial potential of the technology.

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**OUTCOME**

Technical progress occurred, mainly in the optimisation of the design of multiband antenna.  
The independent market research commissioned as part of this project has indentified the full coverage in the band 900 as a key prerequisite for multiband antenna in mobile applications. Therefore this problem needs to be addressed through further improvement to the design.  
Another potential issue identified by the market research is the size of the antenna. Although it is very compact already, for mobile applications, it may still be too bulky. The design of the antenna means that it may be necessary to change the mobile handset design to accommodate the antenna, something very unlikely for the handset manufactures to adopt.  
In the original proposal, it was planned to fabricate the design into a prototype product. Due to the limited technical capacity of the University workshop, the fabrication has been unsuccessful. The team is currently trying to identify an external company who is capable of fabricating the design into a prototype.

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**BENEFITS OF COLLABORATION**

The independent market research reveals that while there is a market interest in compact multiband antennas, the current design of the antenna has some serious obstacles to overcome before the handset industry is likely to embrace the technology.  
Despite this, the antenna may still be used in other mobile devices. The team will try to identify an external company who is capable of to fabricating a product prototype. After that further tests will be carried out. The IP position of the technology will be revisited and the commercial potential of the technology will be re-evaluated.
QMUL13 Video analytics software for real-time human profiling

Partners:  Prof. Shaogang Gong, Queen Mary, University of London  
           Prof. Jimin Zhang, Fudan University

Amount of Award:  PoC £70,000

OBJECTIVE

The aim of the project is to develop a software system capable of automatically searching and profiling the gender, age and type of human subjects/populations captured in video, and to provide a facility for either real-time information gathering on people movement, or off-line demographic analysis on human populations in public or private space.

OUTCOME

The main outcomes were that a software platform was established; a research paper will be published; and there has been interest from the industry to develop a specific software package for security applications. The QMUL team has secured a contract with ULTRA, a major UK defence company. Beyond that, the QM team would like to explore the field of consumer behaviour analysis, which has a larger market than the security applications.

BENEFITS OF COLLABORATION

The current project builds on a two-year Royal Society and Natural Science Foundation of China international collaborative project with the Chinese team at Beihang University. The Chinese group made some important contributions to the project. The main contribution has been the large database of images which have been labelled and analysed. This was used as standard for the comparison of computer analysis and real data. This project strengthened the existing collaboration between the two groups and they are already in discussion regarding a new major collaborative programme mainly funded by the Chinese side.
QMUL15 Quantitative medical imaging: technology innovation and clinical applications

Partners:  Prof. Wen Wang from Queen Mary, University of London
Prof. Enming Song from Huazhong University of Science & Technology, China (HUST)

Amount of Award:  PG £15,000
PoC £89,930

OBJECTIVE

This project aims to develop a novel, quantitative, medical image analysis software based on the unique technology developed by QMUL and HUST on tissue-specific microstructures to assist radiologists in breast tumour diagnosis. This Proof-of-Concept project is built upon an earlier ICUK Partnership Grant project.

OUTCOME

The main outcomes of the project are:
1. Established a software platform for the quantitative analysis of medical imaging
2. Extensive clinical test data from trials in 15 Chinese hospitals
3. 18 papers have been published
4. 4 Chinese patents granted and 2 new patents filed
5. 2 software copyrights registered

The project has also attracted commercial interest from a UK medical imaging company. The company wishes to evaluate the software and see whether it can incorporate it into its existing system or possibly develop it into a new product.

BENEFITS OF COLLABORATION

The team is made of two university research teams (QMUL and HUST). In addition, the clinical team at Nanfang Hospital, Southern Medical University contributed to the clinical trial of the software system. The three partners have worked together previously in a number of international joint research projects. It is clear that among the three groups, the team at HUST is the driving force of the project as it undertook the bulk of the development work and it is also leading the commercialisation of the technology in China.

The QMUL and HUST collaboration with no doubt will continue beyond this project.
QMUL16 Energy efficient mobile networks by interference management

Partners:  Prof. Laurie Cuthbert,  Queen Mary, University of London
           Prof. Zhimin Zeng, Beijing University of Post & Telecommunication (BUPT)

Amount of Award:  PoC £51,652

OBJECTIVE

The aim of this project is to produce a demonstrator software tool that will allow mobile phone network operators to plan and then build networks that significantly reduce carbon emissions. This tool is based on a combination of patented co-operative smart antenna technology developed at Queen Mary University of London (QMUL) and methods on interference management in a distributed multi-antenna system developed at Beijing University of Post and Telecommunications (BUPT).

OUTCOME

The main outcomes from the project are listed below:
1. Established a software platform for network planning and construction in order to achieve optimised energy saving
2. Simulation results demonstrated that potentially up to 50% energy saving could be achieved by combining the two individual technologies developed at QMUL and BUPT respectively.
3. Two International conference papers
4. Two patent applications in the pipeline
5. Establish extensive links with industry in China
6. Potentially further funding support the from Beijing Local government for bringing this technology to the market

The team has already held discussions with ZTE through the Chinese PI’s connections. ICUK has also helped initiate discussions between the team and the Beijing Science & Technology Commission. Beijing based TD Technologies is interested in working with the QMUL-BUPT team to further develop the technology. The Beijing Commission has indicated that they will consider providing support for the project through its international collaboration funding scheme.

BENEFITS OF COLLABORATION

The collaboration has been a very successful one. The UK PI is also leading the joint degree programme between QMUL and BUPT and travels to China on a monthly basis. The communication has been excellent. The Chinese PI has good links with local companies and there is a joint effort in the commercialisation of the technology.
KCL02 Development of a prototype anthropomorphic robotic hand

**Partners:** Prof. Jian S Dai, King’s College London
Prof. Shuxin Wang, Tianjin University

**Amount of Award:** ICUK PoC Award: £70,000
Tianjin Municipal S&T Commission: RMB 700,000

**OBJECTIVE**

The overall aim of this project is to develop a prototype of an anthropomorphic robotic hand by incorporating a foldable and flexible palm which moves independently from the fingers, which can address the unmet market need for high performance flexible prosthetic hand that allow a handicap person to recover most of the lost ability due to the loss of a hand in accidents or due to illness, more flexible prosthetic hands capable of functioning closer to real human hands.

**OUTCOME**

The structure of the hand design using metamorphic technology has been investigated, further analysis carried out, design and optimization of the hand structure have been performed. High stiffness and low density materials were identified and consequently the prototype of a new generation of anthropomorphic robotic hand has been produced. The control hardware system has also been set up and tested on the prototype of the novel prosthetic hand.

The prototype prosthetic hand technology developed in this project has been presented at two technology transfer conferences in China. It has attracted significant interest from various companies working in the robotic hand areas, not limited to the medical use only. The joint team are currently continuing to working on issues related to artificial skin and control algorithms and trajectory planning of hand/finger movements in order to make the prototype market ready before engaging with companies for technology transfer.

**BENEFITS OF COLLABORATION**

The collaboration of these two research groups offers the best opportunity to develop this flexible palm technology into a commercially viable technology. It allowed the UK originators of the technology to collaborate with the researchers in China who have the skills and contacts to develop a convincing prosthetic device. During the research, the two research groups exchanged their ideas and expertise such that the prototype MetaP-hand was successfully designed, manufactured and assembled. The collaboration gives the most realistic chance to commercially develop this technology. This combination of skills and expertise is the real added value of this ICUK project and we are sure that the partnership will be maintained following the successful completion of this project.
KCL07 Optical biosensor for monitoring microbial loads in food and water

*Partners:*  Professor Peter Quinn, King’s College London  
Professor Xiaoyuan Wang, Jiangnan University

*Amount of Award:*  PG £14,800

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**OBJECTIVE**

The aim of the project is to (i) establish a joint research partnership between King’s College and Jiangnan University and to combine the complimentary expertise in Biochemistry research and Food sciences and technologies, and (ii) to evaluate the technological feasibility of developing a novel optical biosensing technology using novel genetic biomarker photonic detection method in order to address the market need in the food processing industry for integrated fully automated analysis platform in process QA and QC.

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**OUTCOME**

The project has delivered its proposed deliverables. A joint research team has been established which enabled the King’s and Jiangnan team to apply modern genetic biomarkers and photonic sensing techniques to measure the microbial loading in the food processing environment and to evaluate the technology feasibility of the proposed technology. The performance of the genetic biomarker and photonic detection system was characterised and a preliminary design of a sending system completed. The market need for this technology and the commercialization route were also verified. To further progress the development of the technology, the team are currently seeking funding opportunities to carry out further detailed investigation and development of the technology, also to further engage relevant industries to gain a greater understanding of detailed industry requirements.

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**BENEFITS OF COLLABORATION**

The key added value of this collaboration is that it enabled the formation of a research partnership between the two institutions, each with their own expertise which is complimentary to each other. The effective combination of this complimentary expertise enabled the joint team to open a new research frontier and to delivery this project successfully which would have been impossible without this joint effort and research partnership.
KCL09 Development of a geostationary forest fire monitoring and characterising system for China and the wider Asia region

Partners:  Professor Martin Wooster, King’s College London
          Professor Liu Cheng, National Satellite Meteorological Centre, China Meteorological Administration

Amount of Award:  PoC £63,500
                   China Meteorological Administration: RMB 115,000

OBJECTIVE

To utilize King’s expertise in wild fire remote sensing and NSMC’s geostationary satellite technology to develop the first wild fire remote sensing system for the whole Asian area, which is based on detection of radiated heat from actively burning forest and grassland fires. Such an approach delivers information in near real time for true monitoring, early warning and short-term forecasting purposes.

OUTCOME

The project has achieved and delivered all the deliverables and milestones tasked in the proposal, which mainly include: 1) Design & Construction of Fire Detection System from FY-2 Satellite Data; 2) Development of Optimised Cloud Masking Algorithms; 3) Development of Fire Characterisation Approach; 4) Operational Deployment in UK and China; 5) Ingestion of Fire Products into ECMWF GEMS/MACC Atmospheric Model. The evaluation of the experiment results demonstrated that the characteristics of the data source proved to be effective for larger fire incidents, but in some ways to be non-ideal for the smaller fire incidents due to limited instrumental resolution currently on board the old FY2 satellite, however this is likely to be improved in future following the deployments of enhanced FY2 systems so the performance levels will increase.

BENEFITS OF COLLABORATION

The collaboration led to the development of the first known system to use FY2 geostationary satellite data for the real-time detection and characterisation of vegetation fires. The award led to an effective collaboration between King’s and the NSMC, and led to the successful development of the first such wild fire remote sensing system in Asia which could used to achieve better and more efficient wild fire management and control.
KCL11 Broadband multi-layer optics for extreme ultraviolet lithography and other applications

Partners: Prof Alan Michette, King’s College London
Prof Zhanshan Wang, Tongji University

Amount of Award: PG £15,000

OBJECTIVE

A key factor in determining the speed of microelectronic circuits is the density at which components can be placed onto a microchip. Higher densities smaller component sizes; current photolithographic techniques are reaching their limits, imposed by the wavelength of the radiation used. The new EUV photolithography technology currently under development is suffering from several technical problems including low optical efficiency. The three key objectives of this project are:

1. to establish and strengthen the research partnership between King’s College London and Tongji University on novel high efficient EUV optics development
2. to evaluate the feasibility of using novel high efficiency optics developed by the joint team to develop new generation EUV photolithography technology
3. to assess the market and commercialisation issues relating to this technology.

OUTCOME

The project has achieved all its key goals; it strengthen the research collaboration of the two organisations and established a joint research project team who work together closely; it has designed and characterised a novel high efficiency EUV optical components using aperiodic multilayer optics; and it verified the technological feasibility for developing high efficiency photolithography system using such novel optics. In addition, the market need for such technology and the commercialization feasibility were investigated and verified. The joint team are currently seeking funding opportunities to develop a working prototype.

BENEFITS OF COLLABORATION

The project enabled the leading EUV optics research groups at King’s and Tongji to continue to work together and to expand on previous successful collaborative efforts. It also ensured the effective cooperation of the two parties and explored their respective technology strengths by establishing a combined team with complimentary strengths, i.e. the strength of King’s in modelling, characterizing EUV optics and sources, with the strong track record in optical modelling, and manufacturing of EUV and x-ray multilayer optics at Tongji.

The collaboration between King’s and Tongji has been very fruitful and the work is now at a stage where its commercial applications have become attainable. Neither the publications nor the commercial possibilities would have been realisable without our collaborative effort.
KCL12 Exploration of a novel wheeled-legged robot and compliant metamorphic structure for lunar exploration

Partners: Prof Jian Dai, King’s College London  
Prof Xilun Ding, Beijing University of Aeronautics & Astronautics

Amount of Award: PG £14,900

OBJECTIVE

Metamorphic structure can achieve great foldability and can be used in robots for lunar exploration. The aim of this project is to investigate commercial feasibility by exploring the potential of using the Chinese partner’s experience in lunar data and lab facilities and the UK partner’s mechanisms and design experience. The new approach of using compliant metamorphic mechanisms is to be investigated based on the potential markets for these new types of robots.

OUTCOME

A commercialisation feasibility investigation was conducted on exploitation of the novel wheeled-legged robot with compliant metamorphic structure for lunar exploration. Feasibility of deploying metamorphic mechanism into a wheel-legged robot for space exploration has been evaluated, key compliant problems on the design of space metamorphic mechanism identified, and a scaled-up model explored. The concept of integrating the compliant metamorphic mechanisms with the lunar exploration robot with the potential development for reconfigurability, adaptability and controllability, was assessed via simulation, modeling and through preliminary tests in the lab on a prototype model. The new robot integrated both wheels and legs with a locomotion system that mimics the structure of insects and mammals and it has been proved to be agile, and meets the requirements for the complex environmental conditions in planetary exploration. In addition comprehensive market research was carried out, and the research team is seeking further funding opportunities to develop the technology.

BENEFITS OF COLLABORATION

This collaboration brought the substantial benefit of a novel mechanism to the Chinese partner, which could be further disseminated for wider benefit to other academics and for industrial growth. It also led to significant benefits for the UK partners in space robotics and space exploration expertise. 

The research team also benefited from the fruitful and productive exchange of knowledge throughout the project. Personal relationships between various members of the groups have been established and our complimentary backgrounds in robotics (mechanisms, design and control) were exploited.
KCL21 Development of power laws and Bayesian belief networks for a digital forensics software system

Partners:  Dr Richard Overill, King’s College London  
Dr K P Chow, University of Hong Kong

Amount of Award:  PG £13,000  
PoC £68,000  
Hong Kong University Funding: HK$180,000

OBJECTIVE

The project aimed to evaluate the feasibility of a novel digital forensic technology for examining digital crimes, clarify key technology solutions, verify its market’s needs as well as to develop a prototype of a digital forensic software system, including: 1) to develop digital forensic templates to cover all five identified key digital crime classes 2) to develop a close-to-optimal cost-effective digital forensic investigation procedure which can be specified and implemented under real-world laboratory conditions; 3) to develop rigorously justified likelihoods that the digital evidence found supports the case to provide guidance for expert witnesses in court; 4) To develop a user-friendly interface.

OUTCOME

A prototype digital forensic software system was developed. Not only has the project delivered a novel piece of customisable, commercialisable software, it has also developed and applied techniques from complexity theory, information theory and statistical theory to the calculation of the likelihood of the various feasible routes by which a particular recovered digital evidential trace was formed. The five analyses demonstrate that it is in principle possible for an expert witness to give a quantitative estimate of the plausibility of the prosecution’s case versus that of any alternative scenarios. The technology has been presented at several digital forensic related conferences and attracted significant industry interest. A US company has expressed strong interest in licensing this technology.

BENEFITS OF COLLABORATION

The collaboration and the combined expertise of the two research groups made it possible to open up this new research project and de-risk the project and ensure the successful development of the world’s first such commercialisable digital forensic software tool for digital crime fighting.