Institution: Anglia Ruskin University

Unit of Assessment: UOA15 General Engineering

a. Context

The main non-academic beneficiaries of our Engineering research are i) industrial companies, especially small and medium enterprises, targeted by the electronics, engineering analysis and simulation teams, ii) groups of people with health problems or potential traffic accident victims, targeted by work performed in our medical engineering and engineering analysis teams and iii) environment and stakeholders in renewable energy, targeted by the electronics team. The types of impact achieved on industrial companies include: performance improvement of business, launching new ranges of products, adopting new design methodologies, and development of environmentally friendly products. The types of impact benefitting groups of people in society include: improvement in orthopaedic (surgical replacement) and venous ulcer treatment techniques, improvements in car bonnet design (becoming "pedestrian friendly" in road traffic accidents) and increased awareness and understanding with respect to renewable energy technologies for electricity generation. These were achieved through knowledge transfer schemes, participation in and leading European projects, collaboration with major hospitals for new orthopaedic techniques, innovative consultancy using close links with the automotive industry and other outreach initiatives, as presented in the *Approach to impact* section below.

b. Approach to impact

The unit actively pursues opportunities to address real-world problems in business and industry. It makes strategic use of the Commercial Manager appointed by the Faculty of Science and Technology to develop new and enhance existing relationships, to assist in negotiation of contracts and delivery of products, and through doing this, to create impact.

Knowledge Transfer Partnerships (KTPs), and Knowledge Exchange and Enterprise Partnerships (KEEPs) are used extensively as mechanisms for enabling collaboration with and impact upon business and industry. Such projects are developed in collaboration with the University's Research, Development and Commercial Services (RDCS) and the Secretary and Clerk's Office; the latter oversees contractual and intellectual property matters. Examples of significant impacts achieved through these mechanisms include:

- i-Dash: 2 KTPs and 2 Low Carbon KEEPs on Software as a Service (SaaS) (2010-14). The company benefitted through the innovative development of several new software products for networking and cloud computing based on the expertise of the electronics team.
- Calex Electronics: Low Carbon KEEP (2011-12). The newly developed infrared temperature sensor, capable of accurately measuring small infrared signals remotely at an ambient temperature over 180^{o}C without additional cooling, is a good example of success. According to the company's MD, "*PyroMini has already been a resounding success... we were able to design a product which has many unique features, making it the most advanced of its kind in the world. This has put us ahead of our competitors in Germany, Japan and the USA…. Its performance is so much better than earlier designs that sales of this type of sensor have increased by 300% and we are currently negotiating a contract in the USA for the supply of 10,000 pieces."* (The source of this quote is available from the HEI on request).

The unit also exploits the collaborative themes of the European FP7 programme, working with Ixion, EU project experts appointed by the University to assist in bid writing, consortium formation, project negotiations and project start-up. The same approach will be adopted with the Horizon 2020 programme. Resulting impact is achieved directly on the industrial partners in the consortium, and on the wider professional community. Impacts derived through this approach include:

- An FP7 *Research for SMEs* EU project *Design of new acoustic absorbers for thermal mass buildings*, "Echo-to-Eco" (2012-14). Nowofol (Germany), manufacturer of polymer foils, leads the consortium, which includes three other companies: Acoustic RPG (UK, installer of acoustic absorbers), DeAmp (Norway, manufacturers of acoustic absorbers) and Skaly & Couch (UK, consultants). Our role is to model and test acoustic absorbers. All the companies involved will implement the results from the project, directly impacting on their business performance.
- An FP7 *Collaborative Project* (2012-14), ECENTRE: Cybercrime Centre of Excellence Network

for Training Research and Education, where our team is working as a partner in a joint project with 17 other UK universities, NPIA/ACPO and Metropolitan Police High Tech Crime Unit, aiming to achieve impact on the protection against cyber-attacks through increased data/internet security.

- An FP6 *Coordination Action*: *Control of Renewable Integrated Systems Targeting Advanced Landmarks (CRISTAL)* (2008-09). Amongst the 11 partners, 3 were companies (Sustainable Technology Solutions, Environmental Park Turin, Cummins Generator Technologies). The analysis and report contributed to increased awareness and understanding of renewable energy solutions by interested stakeholders. Companies benefitted from the knowledge gained.
- The recently awarded FP7 project "REVIVAL" (Sept 2013 start) led by Inflow Control AS (Norway). This will develop an innovative autonomous inflow valve for oil extraction from the North Sea, which will increase yield by 16%. This is potentially the most profitable EU funded project ever: even a 1% increase in production in the North Sea would generate additional revenue of €4 billion. After proposal approval, Saudi Aramco Energy Ventures LLC, the corporate subsidiary of Saudi Aramco, announced an equity investment into Inflow Control AS, proving significant project impact.

The unit actively encourages innovative consultancy leading to impact in the development of industrial designs and high performance products. This includes development of research through to market and achieving repeat business with key collaborators. Outcomes include:

- Collaboration with Sedgewall Communications to redesign the paging system used by off duty emergency services (the current system being too large and cumbersome for everyday use) based on TETRA PMR - TErrestrial Trunked RAdio Public Mobile Radio. The new paging system provides simple messages to off duty officers from the emergency call centre; it was successfully commercialised and we continue the collaboration.
- A novel approach to wash the air using a special atomizer system, industrially exploited by Air Pollution Product Systems (APPS) Ltd for carbon footprint reduction in a range of applications. The solution won the Lord Stafford Innovation for Sustainability award. This is a good example of following a product from its conceptual stage, through research and into the market.
- Close collaboration with Chelmsford Medical Education and Research Trust (CMERT), whose confidence in our research on the treatment of osteoarthritis and venous ulcers has led to continuing funding throughout the REF period of assessment, enabling impact through improvements in orthopaedic (surgical replacement) and venous ulcers treatment techniques.
- Development of the Business Interactive Support Environment (BISE), primarily targeting inventors in order to provide them with assistance and enabling them to develop their ideas into marketable products. Within this framework, advice and support was given to Hybridise, inventors of a vane type Stirling engine which led to a six-month project funded by EEDA. The concept is now patented with the intention to license it to industry.

The agile pursuit of professional links acquired at international conferences is exemplified by the development of a strong partnership with scientists at the Hospital for Special Surgery in New York (a top-rated US orthopaedic hospital). They use our computational modeling skills on hip replacement and the knee joint, translating them into practical assistance for orthopaedic surgeons. The unit encouraged and strategically supported Dr. Mootanah to progress this partnership by funding reciprocal visits and awarding her a six month sabbatical.

The unit regularly uses institutional support through RDCS, the University's Intellectual Property Committee and the Secretary and Clerk's Office for developing patents and licencing agreements, so that designs and products can be taken to the market place. These are particularly important when working with collaborative partners, to ensure maximum benefit for all participants. For example, outcomes of research on honeycomb panel structures were patented in 2005. The subsequent collaboration with Cellbond Composite Ltd continues to bring regular royalties into the unit (approximately £5,000 annually during the REF period).

The unit strongly encourages the formation of long term strategic partnerships with hospitals and medical engineering companies by establishing mixed groups of beneficiaries. It organizes monthly seminars, ultimately aiming to achieve impact on patients with orthopaedic treatment needs**.** Some surgeons become visiting professors and co-supervise research students. For example, we

collaborate with orthopaedic surgeons from Mid-Essex Hospitals Trust on surgical fixation technique evaluation during total hip replacements. This has resulted in increased mechanical stability and implant longevity, enabling cost savings for the NHS and benefitting patients.

The success of our staff is celebrated in research newsletters, internal bulletin and rewarded through the Vice-Chancellor's Awards, the Dean's Awards and further sponsorship of research through, for example, PhD studentships, fee waivers, and conference attendance. Through these outward facing activities, further external awareness and impact are created.

c. Strategy and plans

The strategy of the unit of assessment is informed by Departmental and Faculty strategic plans, which in turn are informed by the University's Corporate Plan (2012-14) and the University's Research and Scholarship Strategic Plan (2012 – 2014). The University Research Impact Strategy is embedded directly into this latter document. We are signatories to the NCCPE's Manifesto for Public Engagement, and support the RCUK 'Concordat for Engaging the Public with Research'. The main objectives in our strategic approach to achieving impact are to:

1. Establish key relationships with stakeholders regionally, nationally and internationally. This will enable us to focus our research towards providing innovative solutions that stakeholders could not achieve alone. Through creation of new knowledge and provision of these solutions, business performance of collaborators will be enhanced, providing demonstrable impact.
2. Further develop existing partnerships, to ensure maximum benefit for all parties is achieved from these collaborations.
3. Enhance knowledge exchange, including increased use of KTP and KEEP mechanisms. The Faculty has employed a Commercial Manager and Anglia Ruskin is in the process of trebling its complement of KTP managers to support this activity and grow the knowledge transfer portfolio. We will increase our interaction with stakeholders, proactively seeking to present our research findings and undertaking visioning visits to potential collaborators.
4. Increase our bidding for international research funds, especially for Horizon 2020 calls enabling collaboration with non-academic partners who will directly benefit through their participation. To be successful, it is pivotal that businesses/SMEs are actively involved in such projects.
5. Increase the offering of research-based CPD/short courses, aiming to achieve impact on companies who are end users of our applied research by up-skilling their staff through bespoke training.
6. Promote and disseminate our research accomplishments by organizing and hosting research conferences, targeting specific industries to enable the translation of research to the market.
7. Emphasise the importance of commercialisation and its impact, supported by the Faculty Commercial Manager, RDCS and the Secretary and Clerk's Office.
8. Encourage staff to engage in public debate and promote research through the media. (Implementation of this objective has already started: for example, Winckles discussed ebay security in a five-minute feature on prime-time BBC TV's *Look East*, September 2013).

d. Relationship to case studies

The case studies present impacts achieved using the approach described in b. above.

i) The long term relationship with Cellbond and the work leading to the offset deformable barrier was established through the then equivalent of KTP and subsequent sponsorship of doctoral students. These were managed by the unit and overseen by colleagues in RDCS. The arrangements around IPR were managed by the unit with the assistance of the Secretary and Clerk's Office. The output achieved could not have been achieved by either party alone.

ii) The strategic partnership with hospitals and medical device companies on improved hip implants surgical fixation techniques, which led to significant patient benefits, was also established through obtaining recurring research funding. On each occasion, the contract development benefitted from input from RDCS and the Secretary and Clerk's Office, working in close collaboration with the unit.