

Institution: Aston University
Unit of Assessment: 15: General Engineering
<p>a. Context</p> <p>The main <u>non-academic users</u> of the Unit's research include manufacturers in chemicals and plastics, machines and related sectors, healthcare industries and clinicians, and policy makers in local and national governments. Benefits accrue for individuals and communities in the UK and worldwide, as well as the environment. The <u>types of impact</u> achieved are economic, environmental and healthcare-based alongside contributions to public policy and services. The Unit achieves impacts from most of the diverse specialisms within it, with others at Aston in Aston Business School (ABS) or Life and Health Sciences (LHS) and other institutions. Research is incorporated in "products" familiar to end-users, such as contact lenses used by global manufacturers, or through clinicians evaluating healthcare devices. Less directly, impact is achieved within supply-chains, e.g. by improving industrial processes via mathematical modelling, or pyrolysis for sustainability.</p>
<p>b. Approach to impact</p> <p><u>Interactions</u> with groups outside the Unit are numerous and wide-ranging. Companies interacting with the Unit range from large international conglomerates, through local SMEs and start-ups, to long-established family businesses. Relationships are built through formal committees or informal meetings and discussions, attendance at joint events, collaborative projects, short or longer secondments between the Unit and user organisation. These enable knowledge transfer and more tangible exchange of samples, data, specific information, or use of equipment or facilities.</p> <p><u>Links are developed</u> through a variety of mechanisms. Typically, researchers have their own networks and those new to an area are introduced to these. Links with users are developed through intermediate trade organisations and regional/national bodies, such as professional institutions, TSB KTNs, Advantage West Midlands (AWM) prior to its closure, ERDF, UK Trade and Invest and EU schemes. The Vice-Chancellor (Prof Dame Julia King) and Chairman of Council (Dr Paul Golby) are both engineers and bring relevant contacts and interests in sustainability, energy and power technologies to the Unit. The University hosts events (e.g. McLaren Lecture, annual research showcase, KTP awards and new facility openings) with high profile speakers and guests from many business sectors and other bodies. <u>Industrial Advisory Boards</u> have been established, involving businesses appropriate to the Unit (e.g. Jaguar Land Rover, Ricardo, IChemE, E.ON, British Army, IBM). Through these, researchers gain insights into the ways that companies operate and the companies help to shape the Unit's relevant research.</p> <p>One notable scheme pioneered by the University, funded by AWM, ERDF and EPSRC; the INDEX (INnovaton Delivers EXpansion) Voucher Scheme enabled SMEs from the Region to work with a university for the first time on a project costing <£3k. Its success, between 2008 and 2011, resulted in it becoming the national TSB led Innovation Voucher scheme, now offering up to £5k per project.</p> <p><u>Relationships are manifested</u> through collaborative programmes funded by UK Research Councils (mainly EPSRC), TSB, AWM and EU, as well as companies themselves. Most significantly, the Unit won an £8M ERDF grant for exploitation of pyrolysis in the European Bioenergy Research Institute (EBRI). 24 PhD studentships have been undertaken in conjunction with companies through EPSRC CASE, EU awards or company direct support. Many other grant awards are collaborative with companies, such as the major SUPERGEN consortium and various FP7-funded projects. 12 KTP projects have involved companies involved in healthcare products, advanced packaging, mechanical engineering designs, surveillance equipment and environmental services. Aston is a top 10 UK provider of KTPs; several KTPs in the Unit have won prestigious awards.</p> <p>At the highest levels, senior researchers engage with industry and business leaders, as well as policy makers in national/international governments; Prof Bridgwater is adviser to the Energy Innovation Policy Team and Dept of Energy and Climate Change, Prof Tighe is the Vice-President of the International Society for Contact Lens Research and Dr Sutherland is an adviser to Nanoco. EBRI has been formed as a part of the Unit to facilitate the exploitation of extensive research in pyrolysis and related technologies by users, and now includes a "commercialisation team" of 7 staff, in part supported by AWM and ERDF.</p> <p><u>Evidence of follow through-</u> As a consequence of working with researchers in the Unit, companies have expanded their business, recruited new staff, improved products, and/or entered a new market sector. 24 patents have been filed and 103 Disclosures made.</p> <p>From <u>KTPs and CASE studentships</u>: Uponor are investigating novel polymeric stabilisation</p>

systems for drinking water pipes. The patented technology is licenced to the company and they are now funding 2 PDRAs. **BASF** have gained FDA approval for clinical trials of Tocopherol. **J & J Pharmaceutical** have been able to undertake human trials investigating the indentation of contact lenses into the eye. From initial work with and INDEX Voucher, chemicals are being used by small companies e.g. **Biomet** use Vitamin E chemistry to stabilise polymers in replacement joints, now in the commercial trials; **Trealt** are exploiting new syntheses in their fragrance and flavouring products; **Gelpack** are using chemicals to stabilise their packaging products; and **Salts** are now licensing wound care technology from the Unit. Similarly, **Robinson Bros Ltd**, **Surgicraft Ltd**, **First Water Ltd**, **Vista optics** and **Optimec** are exploiting our speciality chemistry; materials/medical devices have been trialled with clinicians in Birmingham Children's and QE Hospitals. **Flow Forward Medical LLC** developed a rotary blood pump system, based on our research, to improve patient care and reduce costs. **Partners for Endoscopy Ltd** have filed a patent that facilitates links with a large US medical product developer to produce a new endoscope product and cleaning process. **Lein Applied Diagnostics**, a medical device start-up, developed non-invasive measurements in the eye. A KTP (awarded "outstanding") in 2011, with **Pace Systems International**, enabled the company to enter new markets, with improved security and confidentiality of designs, a vital concern as leading EU manufacturers of surveillance equipment. **Rotec** embedded new design capability into the company, producing 5 new fire safety products for the civil and military aviation markets, and have diversified into the automotive industry. **Loadmac** expanded sales through our design work of more compact truck-mounted fork lifts. A solar thermal collector (RCUK Science Bridges project) has been designed, constructed and now is to be manufactured by **Industrial Boilers Ltd** (near Delhi) to provide vital power for food processing and water purification etc, in rural India.

Agility is demonstrated through our tailored response to industrial users. Since company timescales are often short, projects have been accelerated by deploying 2 KTP associates simultaneously on different aspects of a project, often from complementary areas; e.g. with Aston Business School. Similarly, initial short feasibility studies have been undertaken to scope a programme while plans for a longer project (KTP or PhD studentships) have been negotiated. Experience of drafting/negotiating contracts has enabled agreements with companies to be signed within days of initial contacts. Research for SME, **Accutronics Ltd**, led to the design of a novel mechanical part for a medical device, quickly followed by a longer KTP project with other researchers in the Unit, who helped them diversify into different sectors (enterprise simulation, logistics and supply chain management). The KTP Associate is now an employee and they won the Institution of Mechanical Engineers Lombard Award for Innovations in Products and Processes in 2012.

All researchers in the Unit are supported in building/maintaining interactions with non-academic users. The Unit targets potential recruits with demonstrated track record or potential interests in exploiting research, Prof K Wilson (RAEng Industry Fellow with Johnson Matthey) is a recent example (starting at Aston 1st Sept. 2013) in EBRI. Early Career Researchers are trained in generating impact (during induction). Skills include communicating research to non-specialist audiences, IP management and leading business-focussed projects. Since 2010, all new researchers have developed 5 year research and impact plans, with the Research Development Manager. The plans include attendance at events offering opportunities to meet potential users in companies and intermediaries e.g. in trade associations / professional institutions. They are then mentored by an experienced academic within the unit, with reviews at appropriate intervals. This activity has now been extended to all researchers in the Unit. Research in the Unit is reviewed regularly with the School's Associate Dean and Dean, and areas of research that may be suitable for exploitation are considered with the University Business Partnerships Unit (BPU) for further appropriate development. The Unit holds quarterly meetings that include planning of research and impact for the short to medium term. Longer term plans are developed every 3 years in intensive off-campus sessions lasting several days.

The University supports impact significantly, notably in facilities such as the £8M University investment in EBRI that is aimed directly at generating impact. The University Business Partnerships Unit identifies likely contacts in relevant sectors, negotiates contracts with external partners, provides commercial and legal expertise, supports patenting and licensing of IP, where appropriate with external specialist advisers such as Oxford's ISIS Innovation Ltd. The BPU holds events and promotes research to business and industry in the region, nationally and internationally.

Impact template (REF3a)

Specific achievements are recognised by the University through “Aston Excellence Awards”, some of which are specifically for impact; winners include Drs Martin, Strickland and Topham, and Profs Tighe and Bridgwater.

Where there is no conflict of interest, staff may take on external activities, for example up to 50 days consultancy per year for companies or part-time work in a company. Prof Hornung is employed 50% in the University and 50% Director Sulzbach-Rosenberg, Fraunhofer Institute. When appropriate, teaching commitments are adjusted to facilitate staff interaction externally.

c. Strategy and plans

The aim is to continue generating significant impact from its research. The types of impact will remain economic, healthcare related and environmental, as well as advice to governments and policy makers. Research is aligned with national strategies expressed in Research Councils, TSB and EU programmes, as well as Aston’s key theme of Bioenergy and Sustainability.

Individual academics and research teams (mainly EBRI and chemistry related) with existing links, will continue to build and maintain contacts with specific organisations and companies, coupling the interests of users directly into their research. This is particularly applicable where the supply chain from research to user community is established or clearly evident. Further links will be forged with companies, such as those in section (b) where there are already good relationships, particularly as economic conditions become more favourable.

Activities identified as having more potential for generating impact (eg engineering mathematics and modelling, manufacturing, logistics and supply chain management), but with fewer existing contacts, will be provided with training and more support to create impact. This will be a complex process as capabilities require careful alignment with individual company interests. Building awareness of appropriate market sectors and the trends/ways in which a business operates takes time. Unit and wider University support will be exploited, and reinforced at Associate Dean level.

To align research with the needs of users, workshops will be held with researchers from different disciplines across the University, other Institutions and representatives from external organisations. Recruiting more and replacing leavers in the smaller teams will be prioritised to aid the generation of impact. Specific topics for the Unit include:

- (1) work with LHS and healthcare companies internationally to develop chemicals, medical devices/ instruments and using catalysis and nanotechnologies for specialist and bulk chemical producers (e.g. Robinson Brothers Ltd);
- (2) generate power and fuels from residues for companies in the paper industry (Aylesford paper), sewerage (Severn Trent), chemical and plastics (Dow Corning) and power (E.ON),
- (3) generate mid to high value chemicals and materials for manufacturing industries worldwide;
- (4) use specialist techniques (mathematical modelling and simulation) for small companies, enabling more effective product development and commercial advantage over international competitors. E.g. Sustainable buildings/refurbishment for construction and civil engineers (Arup);
- (5) exploit expertise in supply chains, logistics and transport to improve the efficiency of businesses in global engineering sectors;
- (6) in power engineering, exploit the facility they are constructing at Willenhall for energy storage technology, funded by EPSRC and with Renault and TML. This is to be combined with our current expertise in photovoltaic technology to test solar cell devices (supplied by Belectric OPV GmbH).

d. Relationship to case studies

The 3 case studies exemplify approaches adopted to achieve impact from our research. Long-standing interactions with a company led to the exploitation of novel chemistry for contact lenses. The company continued the development of the products through to manufacture, selling to millions of users worldwide. Interaction with the company also exposes key topic areas suitable for further study. Working with a company for the first time is exemplified in the fluid flow case study, modelling turbulent flows in industrial heating systems. Initially, the company approached the university through AWM with a request for support to understand better how their systems performed. This led to significant environmental and economic benefits for major companies in several market sectors including food processing and manufacturing. Achieving impact from bioenergy research is more complex. The University itself has created routes to market; having invested with partners in the design and construction of its own pilot scale facility and spin out company. These are enabling companies and policy makers to evaluate and access directly the economic and environmental impacts for themselves in their own businesses and communities.