Institution: Bournemouth University

Unit of Assessment: UOA15

a. Context

The Technology Strategy Board identifies 13 priority areas as core to boosting growth through innovation, of which the research undertaken in this unit addresses the following:

- **Healthcare** through our biomedical innovation in areas such as Functional Electrical Stimulation (FES) and development of epidural technology.
- **Advanced Materials** through our leading work on product design and tribology, such as prosthetics and slipway design.
- **Resource Efficiency** and **High Value Manufacturing** impacts are addressed through our Sustainable Design and Software Systems, for example, the Lean Manufacture Knowledge Transfer Partnership (KTP) with ETL UK Ltd.
- **Electronics, Sensors and Photonics** stems from our research on Smart Technology which**,** for example, contributes to the development of the chemical processing industry.
- **Information and communications technology (ICT)** and **Digital Services** impacts arise from research on smart systems within Creative Technology including the development of cloud systems and rendering of 3D geometry.
- Impacts on **Energy** are being driven by innovation in tidal renewal energy sources.

b. Approach to impact

Ensuring impact from research is integral to UoA15 at BU; as an engineering community we strive to ensure that our research is framed by the needs of industry, ultimately being applied for the benefit of the economy and of society. This philosophy has been shaped by BU2018 (Strategic Plan 2012-18) which focuses on societally relevant research and the fusion of research, education and practice. Drawing on this institutional strategy our approach to impact can been summarised via a series of steps:

Step one: engaging research beneficiaries. In order to secure pathways to impacts, UoA15 has taken a number of approaches to build links with industry and the general public. These have included delivering continuing professional development (CPD) activities based on our research for organisations including Airbus, Institute for Mechanical Engineers, Sunseeker, Sonar, Cisco Academy and the BBC. Match- and co-funded PhD students are the norm and we ensure that collaboration extends to the whole unit, not just the individual student. For example, Noroozi's ESPRC CASE studentship with Blatchford Clinical Services has led to further development around prosthetics for military service personnel. The Unit has attracted 39 matched- and co-funded PhD studentships with industry since 2008. This has been an important step to identifying future collaborations. Knowledge Transfer Partnerships (KTPs), of which there have been 10 since 2008, have also provided a crucial route for ensuring embedded engagement. For example, work with Morning Data, a micro business, led to profit before tax increasing from £36k to £175k which has led to the KTP. Innovation vouchers and commercialisation also provide an important route for engagement; for example, Cryptic Software Limited. More broadly, engagement events offer the opportunity to explore with industry representatives how our research can be informed by industry to deliver impact beyond academia. Recent activities have included: 19 events as part of the University-wide Festival of Learning which attracted over 4000 visitors to BU; 18 Business Breakfasts averaging 25 companies each; and the annual BU Festival of Design and Innovation which attracts over 100 companies per annum and showcases over 170 innovative student projects related to General Engineering each year. Representation at external events has also been key for engaging relevant partners; for example, the UoA was strongly represented at the GovToday Carbon Reduction 2012, which engaged key policy makers. In total, since 2008, 18 major networking events have taken place attracting in the region of 485 visitors from 428 organisations. Examples of new partnerships arising from these activities include Cryptic Software and Farrow and Ball Limited.

Step two: maintaining relationships and realising impact. Building on strong engagement, our approach has focused on building long-term relationships, in order that our research is continually informed and improved by the needs of industry and society. Examples of this include an on-going relationship with SKF (previously known as Svenska Kullagerfabriken AB) which has led to a series of studentships, consultancy projects and fellowships (to a value of £94k since 2008) –and this in

turn has contributed to the SKF's globally recognised reputation in research excellence. These on-going relationships are being developed with a wide spectrum of organisations, including Energetix and the Poole Tidal Energy Partnership to explore tidal energy solutions. These are relationships that are embedded and maintained by our dedicated business engagement officers. To develop the relationships created by collaborative studentships, the UoA funds ECRs to embed their research findings within organisations. An example of the success of this scheme has been recent work with the Tank Museum at Bovington which has secured funding for a new building after collaborative research demonstrated the need for the unique heritage vehicles (e.g. Tiger Tank) to be kept in a building with the correct humidity levels. Equally, through an EPSRC CASE Studentship with the Royal National Lifeboat Institution (RNLI), a symbiotic relationship has grown to the extent where all RNLI slipways now benefit from BU innovation in tribology. We have built and embedded a relationship with several NHS Trusts (including Salisbury, Bournemouth and Poole) to facilitate medical trials (around, for example, epidurals) and to drive innovation in Functional Electrical Stimulation (FES)

Step three: responding to opportunities. We recognise that in order to build strong pathways to impact, there is a need to be agile in responding to opportunities presented. For example, visiting professorships with the Royal Academy of Engineering have led to visits by senior staff from Nokia and Smith & Nephew. The on-going relationship with Evonik through the INFER project has led to the development of adaptive soft sensors in the process industry.

Step four: supporting the development of impact. Since 2008, we have invested in the development of impact, drawing on resources both from within the School and at a University level. In particular, we have sought to ensure that colleagues benefit from expert, bespoke staff development delivered by experts in Knowledge Exchange. For example, the Creative Technologies Group has received training from Professor Dennis McKeag from University of Ulster on how to develop Knowledge Exchange activities around their research. Each research group within the UoA regularly meets with industry specialists to feed into their research strategy, a recent example of this includes consultation with Hewlett Packard around how to enhance development of the HEIF-funded Cyber Security Unit. Our Business Development Officers (2.2 FTE) support researchers to maximise opportunities and provide appropriate guidance on ensuring that relationships flourish. The UoA also encourages staff to draw on the support of centralised University services, which has included support from the Research Communications Manager, Public Engagement Officer and Knowledge Exchange Officer. Engagement with Poole Tidal Energy Partnership has helped to develop relationships with Poole Harbour Commission, Poole Borough Council, Dorset Energy Advice Centre and Poole Housing Partnership. Members of staff attend centralised training initiatives on engagement and impact to further enhance their skills. The UoA has been awarded funding from BU's HEIF-5 award in order to develop particular strands of knowledge exchange activity; for example, cyber security which now has two 0.6 FTE Business Relations Officers.

Step five: embedding impact. Crucially, in the preparation of future research proposals, UoA15 at BU draws heavily upon the knowledge gained during the impact cycle and seeks feedback from industry partners to ensure our research is responsive to the needs of our research beneficiaries.

c. Strategy and plans

Our current and future research strategy is focused around delivering impact; as a community of engineers this is fundamental to the philosophy of our work. We are developing tools to build on our guiding belief and respond to the needs of industry and society to maximise the impact of our research. Specifically, this approach will be shaped by the strategic plans of the EPSRC and the Technology Strategy Board to explore impacts both within a short term (0-7 years) and longer term (7 years+) through a University-wide interdisciplinary, societally focused research theme of Technology and Design.

Goal 1: Supporting staff. Looking forward we will support staff to maximise impact arising from our research through a number of initiatives. Principally these will focus upon development around impact, both subject-specific from suitable engineering colleagues (recruited from both within BU and from other HEIs) and also generic training on impact as part of BU's researcher development framework. Funds from Fusion Investment Funding (£3m annual revenue fund to drive fusion) will be used to support impact-enhancing activities such as travel for networking, product development or collaborative events.

Goal 2. Enhancing engagement and building networks. From 2014 we intend to build on the

partnerships described above, as stated in our institutional strategy (BU2018) – which facilitates fusing professional practice with research and teaching. Activities will include industrial placements with such firms as Rolls Royce, Jaguar Land Rover and GE Aviation, an increased number of KTPs with a target of four in any given year and recruitment of industry experts to advise on our research strategies. We already have such panels for our education but plan to extend them to cover research as well. We will also look to host regular alumni events to facilitate stronger industry networks. BU provides more student placements than most HEIs and currently at a unit we offer over 310 annually. We will increasingly use these links to develop impactful research collaborations. We will also look to further embed and build upon industry networks. For example, from 2013 each completing PhD candidate is to be offered three months of funding to begin embedding impact arising from their doctoral studies within an appropriate context. We will also seek to expand our public engagement initiatives through a wide variety of established and new channels, including the Festival of Design and Innovation, BU Festival of Learning, the British Science Festival and initiatives with local schools. Drawing on the support of the Business Relations Officers already in-post, an engagement task force will regularly meet with BU's Public Engagement Officer to review engagement strategies and explore methods of continuous improvement.

Goal 3. Providing leadership on impact. To ensure that colleagues within the unit are led and inspired to develop impact we propose to introduce an Impact Champion to lead this agenda. In particular, our Impact Champion will work closely with our early career researcher community to embed impact as part of researcher development, drawing from a BU Researcher Development Framework based on Vitae. We will also engage external research users to support the unit in understanding the future trajectory of where impact is required and to provide colleagues with insight into the needs of industry. These leaders will be supported to develop agile responses to opportunities, with specific targets, for example to increase the number of postdoctoral KTP partnerships.

Goal 4. Develop impact incentives. As a unit, we believe that all members of staff should ensure that their research is of benefit to society. Therefore, we will require all research groups (REF5) to provide quarterly updates on areas of impact, which will be reviewed by the Deputy Dean for Research and the BU's Impact Officer so that promising avenues can be identified and supported early. We will ensure that contributing to impact is recognised in the appraisal system by providing appropriate reward and recognition. Much of the industry-focused work we have developed is confidential; however, we work with clients to enable impact to be evidenced without breaching confidentiality.

Goal 5. Capturing evidence of impact. Embedded throughout the future strategy is the need to review the evidence of impact, and ensure that it is appropriately captured and reviewed. This will take the form of a database which will be managed by our Business Development Officers. Evidence for this database will be identified using reviews that are provided to the School research committee and using a self-assessment tool, developed jointly with the BU's Impact Officer.

Goal 6: Using impact to inform future research. Our final goal will be to reflect on the impact arising from UoA15's research and how this understanding can be applied to the future development of research proposals. This will be carried out regularly at the School's research committee and used to develop dynamic and responsive research proposals.

d. Relationship to case studies

The vast majority of the General Engineering research undertaken at BU is externally collaborative. The collaborative nature of our research provides an excellent array of case studies, which are useful in illustrating the expertise and ability of the University and in providing a broad spectrum of material that supports teaching at both undergraduate and at postgraduate level. Indicative examples of the diversity of case study material are the research carried out with the RNLI, Odstock Medical Limited and SMEs (e.g. Morning Data Ltd). The RNLI research was in the area of sustainable tribology applied to lifeboat slipway designs, and post-research consultancy resulted in the development of design guidelines and maintenance procedure documentation. The Software Engineering Case study is a good example of how our strategy of KTP engagement has benefited SMEs in terms of development process improvements leading to financial benefits. The research carried out in collaboration with Odstock Hospital resulted in the establishment of the first NHS spinout company in England, Odstock Medical Limited.