Institution: Southampton Solent University

Unit of Assessment: 15 General Engineering

a. Overview

This submission draws upon research clusters in maritime, acoustics, computing and built environment within the Maritime and Technology Faculty (MarTec). Activities across these four clusters focus on two common themes:

- applied research concerned with human health and wellbeing in work, leisure and living environments; and
- addressing deleterious environmental impacts to increase efficiency, effectiveness, sustainability and economic productivity.

Faculty of Maritime and Technology (MarTec)				
Research Groups	**Maritime Research** Prof Mike Barnett	**Acoustics** Assoc Prof Chris Barlow	**Computing** Prof Maggie Ross	**Built Environment** Assoc Prof Ramesh Marasini

The following section describes the key elements of the Faculty's research strategy and each cluster and its area of work.

b. Research strategy

The primary objective of Southampton Solent University's (SSU) research strategy (2008-2015) is to support its mission of the pursuit of inclusive and flexible forms of Higher Education that meet the needs of employers and prepare students to succeed in a fast-changing competitive world.
Hence its strategic vision for research and enterprise:

- Recognised widely for knowledge creation and exchange that fuses academic rigour with professional practice.
- A student experience that is enhanced through research, practice and enterprise.
- Students enabled to develop commercially relevant skills and to enhance their employability opportunities in a competitive global business environment.
- The encouragement of entrepreneurship and income generation by University staff.
- Knowledge creation and exchange that support imaginative working partnerships with employers and commercial, professional and voluntary organisations.

The Faculty links with this vision through its commitment to applied research, its connections to businesses and industry, and research-informed teaching for the benefit of its students.

SSU has strived to achieve this strategy is via the distribution to staff of Research and Enterprise (R&E) funds, a process that was conducted via open competitive bidding with funds awarded by a panel made up of three Deputy Vice-Chancellors. R&E funds, partially generated by a successful outcome to RAE 2008 and additional University income, enabled targeted support to be provided to staff primarily working in the research clusters. The funds were distributed via an open competition and awarded by a panel made up of three Deputy Vice-Chancellors via a rigorous process. Successful bids were ones that had the potential to produce, or can evidence, successful national and international outputs that would achieve academic and societal impact and could be produced in a relevant time frame, as monitored by an annual report.

At the beginning of the REF period, Warsash Maritime Academy (WMA) was a separate faculty in its own right, with its own distinctive research strategy, focussing on maritime human factors. By 2011, the decision was made to combine it with the Faculty of Technology to form a single new Maritime and Technology Faculty (MarTec). There were several teaching and learning reasons for this strategic change, but from a research perspective, the strategy enabled the creation of a greater critical mass and a degree of multi-disciplinarity. A new research and enterprise strategy was written for the combined Faculty and was presented to the University's Research and Enterprise (R&E) committee in June 2012, and approved by the Committee. A new Dean of Faculty was appointed in 2013.
Within both WMA and the former Faculty of Technology, the previous strategy had been to establish areas

of strength and develop research excellence through targeted support of particular projects and profile researchers. These projects, like Project HORIZON and the work in the Acoustics group, were all clearly focussed on industry applications. This strategy worked well in most cases, with the creation of Associate Professors to lead clusters and the appointment of research-active or early career researchers to join the clusters. Seven applications were submitted to the 9th round of University R&E funding, largely representing these established areas, notably with a wider range of activity present in the maritime subject area across WMA and the Technology School.

The theme of 'sustainability' has been identified as a unifying thread within the MarTec provision, and includes appropriate treatments of this theme in each of the subject areas. In terms of R&E, the various disciplinary approaches to sustainability are being explored in many projects that are under way. For example, several investigations of the effects of noise on individuals, the safe manoeuvring of ships in confined spaces, the environmental management of shipping, reducing power consumption in mobile communications, environmental data use to improve comfort levels in buildings all include sustainability as a core element, within a social, business or environmental context. Ensuring the sustainability of R&E within the Faculty is also a priority, through increasing the external profile, encouraging consultancy projects and applications for external funding, and using available internal funding to support seedbed projects.

A primary aim of the Faculty's research strategy is to champion multi-disciplinary applied research through cross university research network and clusters in order to create: a greater cross university awareness of expertise; greater critical mass and a more stimulating research environment. The expected outcome for this is that as well as consolidating achievements in this area, a greater proportion of staff engage in clusters each year. These aspects of the strategy which apply to all the clusters are highlighted below:

- Developing new collaborations with leading academic research groups working in related areas, internally and externally;
- Maintaining and developing existing links with industry, for example, through Knowledge Transfer partnerships (KTPs);
- Developing a higher international profile through a more proactive marketing approach and closer working with national press and media;
- Doubling the number of research students registered;
- Recruitment of further research-based academics and research assistants in maritime and acoustics;
- Securing EU funding to further develop research in specific growth areas;
- Doubling the number of staff participating in research clusters.

The R&E clusters are central to the realisation of the Faculty's strategy for creating a dynamic research culture. Their role has been to provide an overarching structure in which thematic or discipline specific research can be supported by peer group interaction and focused funding streams. The management of the cluster is the responsibility of the cluster leader, who organises the activities of the cluster: for example, through regular meetings, networking visits, the giving of conference papers and in-house symposia. Throughout the academic year, cluster members meet to discuss or peer review the work of colleagues. All staff are directed to the research and learning opportunities provided by these clusters and postgraduate students are actively encouraged to regularly participate in cluster activities and use them as senior and peer review opportunities.

With these key objectives in mind, the four clusters in maritime, acoustics, computing and built environment were formed and are the basis for most R&E activity in the Faculty.

Maritime Research cluster

Maritime research at SSU has been in three main areas: maritime safety, maritime human resource management, and marine environmental management.

Research projects funded by UK Government and industry have focussed on both WMA's core business of maritime education and training to reduce accidents and improve safety and also in maritime resource management. These funded projects allowed the group to gain experience in proposal writing, conducting

research for external sponsors, and disseminating information to the international shipping industry through high level international and European committees. Such activities informed the EU funded project HORIZON (2012) which used linked simulators to study the effects of fatigue on the performance of watch keepers. This collaborative project is having a significant impact on the international shipping industry through its empirical evidence of fatigue at sea. The group has doubled its membership from three researchers in 2008 to six.

Research in marine environmental management has involved several themes. An EU funded Intensive Programme in Coastal Zone Management (COZIP) ran from 2005 – 2007, involving partners from around Europe and coordinated by Southampton Solent University. One of the issues considered by this programme was that of climate change and this was the basis for further funding received from the British Council for a project entitled 'adaptation to climate change for small islands' (2009), which focussed on the Azores and involved a partnership with the Universities of the Azores and Lisbon. Staff are also working currently in an EU Interreg IVa funded project entitled Climate Change 2150 (CC2150), and in particular the Coastal Communities Adapting to Climate Change (CCATCH) project (2011-2013). The purpose of this is to foster public communication on the impacts of climate change so as to enable the development of effective community driven adaptation plans.

Research in marine environmental management has also revolved around shipping with a maritime research team carrying out an evaluation of the Wadden Sea Particularly Sensitive sea Area (2010) on behalf of the trilateral Common Wadden Sea Secretariat; the results of which have since been the subject of an intergovernmental conference.

Acoustics research cluster

Acoustics research by SSU staff has concentrated on two main areas: research into acoustics linked to health and medical practice; and research in measurement, transmission and control of noise.

Projects have looked at the occupational health risk (2009) and hearing loss (2010) of musicians and students of popular music, as this is a population identified as being at high risk of hearing damage. Further studies have examined leisure noise exposure from personal music players (2011), and the use of hearing protection of staff and customers in music venues. Research expertise in these areas has led to staff involvement editorial boards of journals and conferences broadcasts on national radio and committees for the industry representative bodies. Staff in the group have also been researching into the development of mechanisms for diagnosing bone health through acoustic means (2009), particularly the assessment of bone conduction. This developing field is highly important, as it could make a significant different to the speed of diagnosis of osteoporotic problems, and the basis of new applications for funding to develop a working system for use in clinical situations.

Staff are also working on projects relating to the control of noise emissions from aircraft engines, transmission of noise and vibration onboard maritime vessels and environmental noise. One key project in this field is environmental noise exposure, and particularly the relationship between noise in residential areas to deprivation and social welfare (2008). This project assessed the relationship between noise in residential areas and levels of social deprivation, particularly linked to the 'access' to quiet areas, identified by the EU as a critical factor for urban populations as noise exposure is linked to increasing levels of stress related disease. Staff are also working on improving the standard measurements of intelligibility of speech reproduction using binaural methods (2013), which could have a significant impact on the tests used to categorise speech reproduction in public address systems.

Computing research cluster

Computing research at Solent has been in the following three main areas: research into adaptive search heuristics to advance knowledge in search and optimisation; data mining and its applications; and pedagogy for computing studies.

Research in Adaptive Heuristic methods for search and optimisation and their application have been

conducted since 2002 and publications in this area contributed to RAE2008. Since then, three research projects supported by internal funding have been successfully completed. These projects advance the current state of knowledge in search and optimisation by resolving tasks resistant to other available world-leading methods. Two books and more than 10 articles were published at international conferences and journals. Two international conference papers were awarded with the best paper award. The International Conference on "Optimisation of Mobile Communication Networks - OMCO NET" hosted at Solent, in June 2012, attracted participants from the UK and Europe.

Research in the area of data mining has extended across knowledge management and data engineering through data mining and graph-based modelling to knowledge discovery and knowledge engineering. Applications include the analysis of customer behaviour, bioinformatics, web navigation and workflow. Peer-reviewed publications have featured since 2008 in international journals covering data warehousing, mining, modelling and management as well as international conferences on data mining and knowledge management. The design of novel models and development of effective new data mining techniques in the context of gene sequence motifs could help to discover new biological information and reduce the cost of experiments.

The provision of a continually improving learning experience for our computing/IT students has been a key driver to our research strategy for inquiry into contemporary pedagogical issues (flagged by institutions such as HEFCE, QAA, HEA and the EU) since 1998. Consequent publications include an online approach to course design, balancing software development theory and industrial practice, approaches to harnessing technology for pedagogy, sharing online resources, the provision of formative feedback, integrating the learning experience, and currently includes employability and its link to internationalisation.

Built Environment Research Cluster

The aim of the Sustainability and Health in the Built Environment research cluster is to investigate, develop and test innovative new ways of delivering efficient design, construction and operation of constructed facilities in a sustainable manner using experiments, virtual design and simulation studies.

The research group capitalises on its members' experience and research over many years. The main objective of the group is to promote research and innovation in the Built Environment by realisation of efficient and effective processes of design, construction and operation of constructed facilities. Members of the group specialise in the use of digital modelling of buildings including simulation modelling, virtual design and visualisation techniques; experimentation with renewable energy solutions and monitoring of performance of buildings for intended functions in terms of space, energy, acoustics etc.; evaluation and testing of materials and development of sustainable and practical solutions to the design and management of emergency shelters.

c. People

i) **Staffing strategy and staff development**

Team and partnership-working are essential planks of the Faculty's strategy for Research and Enterprise and staff development, alongside the emphasis on applied research which both forges and exploits the extensive and increasing links with industry, employers and professional, statutory and regulatory bodies. The thematic linkage thorough the various explorations and applications of sustainability – associated in particular with the built and the marine and maritime environments, and safety, health and wellbeing in work and leisure – enables exchange and interaction across staff groupings and research clusters, providing a cohesive research environment and opportunities to share expertise and experience.

The strategy has been to foster development of research capability and achievement of outputs through team working, based on an experienced cluster leader bringing in and bringing on less experienced colleagues and thereby expanding the research base. This incremental approach has been successful in growing capability and developing ambition within and across the research clusters. Initially by bidding for small-scale projects, either internally funded via the University's competitive Research and Enterprise Funding process, or securing small-scale consultancy and development work with industry (funded or supported in kind), teams have honed their ability and moved on to larger collaborative projects involving

external partnerships and funding (e.g. Horizen, Wadden Sea and a successful Knowledge Transfer Partnership in the Acoustics area).

Such mentoring and leadership activities in the clusters have enabled a number of cluster leaders and key cluster members to apply for and be awarded Associate Professorships through the University's research recognition scheme over the past two years.

As part of this strategy, the Faculty has a staff recruitment policy with three elements: appointment of a number of senior, research-active academics in key areas, to provide leadership and boost research engagement and achievement; recruitment of doctoral candidates or post-doctoral academics (early career researchers) to vacancies across the Faculty and involvement of these appointees in research cluster activity at an early stage; and recruitment of suitably qualified candidates from industry who have industry currency and connections and can both contribute to the applied research activities in the clusters and increase contacts with potential industry clients and partners.

The Faculty is working with the University's Employability and Enterprise department to build on its Knowledge Transfer Partnership activity, currently taking place in Acoustics and with potential in Built Environment. Success to date in securing EU funding and engaging in collaborative research with UK and EU partner institutions (particularly as lead institution in respect of Horizon and Wadden Sea) is a basis for further development along these lines across the four clusters.

Equality and Diversity

Under the current University Strategic Plan the University strives to be a vibrant, inclusive and successful University and is committed to the pursuit of inclusive and flexible forms of Higher Education that meets the needs of employers and prepares students to succeed.

The strategic plan is supported by the current Equality, Diversity and Inclusivity Scheme which aims to: help develop an inclusive culture that fosters good relations for all; promotes equality, diversity and inclusivity and demonstrate good practice across and between all of the designated equality groupings - age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, sex and sexual orientation; and promotes cohesive working across the University to progress six identified Equality, Diversity and Inclusivity Objectives. Included in these objectives the University will be paying particularly attention to the Government's highlighted areas of concern as identified for HEFCE and the sector by reference to our annual monitoring reports including the numbers of female and black research staff which are currently significantly under-represented in the sector. It is also committed to develop equality, diversity and inclusivity training for academic employees through the sharing of best practice in teaching and learning. The University has also recently become a Stonewall Diversity Champion and as such as has access to best practice in policy and procedure development to ensure equality for LGB staff at the University.

Research activity is specifically supported by the Research and Enterprise Committee whose terms of reference includes the requirement to give due regard to the University's policies and strategies on Equal Opportunities

The Concordat

The Concordat makes a clear statement about the responsibilities of researchers, employers and funders of research in maintaining high standards in research. (as on the website – link below)

http://www.solent.ac.uk/research/connecting-communities/connecting-communities.aspx

The Concordat sets out five commitments that will provide assurances to government, the wider public and the international community that research in the UK continues to be underpinned by the highest standards of rigour and integrity. This Concordat seeks to provide a comprehensive national framework for good research conduct and its governance. As signatories to and supporters of the concordat to support research integrity, we are committed to:

- maintaining the highest standards of rigour and integrity in all aspects of research • ensuring that research is conducted according to appropriate ethical, legal and professional frameworks, obligations and standards;

- supporting a research environment that is underpinned by a culture of integrity and based on good governance, best practice and support for the development of researchers;
- using transparent, robust and fair processes to deal with allegations of research misconduct should they arise;
- working together to strengthen the integrity of research and to reviewing progress regularly and openly.

ii)Research students

Our research students reflect the Faculty's diverse range of disciplines. The University's Research Degrees Office carries out the procedural management of research students, with discipline specific management provided by the Faculty's staff and topic support provided by supervisors.

Student enrolment is dependent upon the suitability of the applicant; the efficacy of the application; and the capacity of the Faculty to provide the appropriate research environment for the study in question, both in terms of resources and staff expertise. A Faculty Scrutiny Panel, chaired by the Faculty Director of Postgraduate Research Students, assesses the merits of applications and will make recommendations as to their progress. The capacity for research supervision within the Faculty is enhanced by specific supervisor training, organised by Academic Services, aimed at ensuring an appropriate standard of supervision. As part of the recent Postgraduate Research Experience Survey, satisfaction with the standard of supervision amongst University research students scored significantly higher than the Sector average, with a satisfaction level of 89.3%.

Given the availability of an appropriate supervision team, successful applicants are expected to produce a full research proposal within an allotted amount of time (6 months fulltime; 12 months part-time). This is then presented by the Director of Studies to the University's Research Degrees Committee for full approval prior to the student continuing their studies. The usual route thereafter involves the submission of a Transfer document and viva as a progression from MPhil to PhD and subsequently the submission of the PhD and viva. PGR students are supported by the burgeoning research environment. This is multi-faceted in nature and includes the requirement for all students to undertake a PG Certificate in Research Methods during the first year of study, covering all of the key methodological areas issues relevant to a successful outcome. International students are further supported by the availability of Advanced Academic English courses. Faculty specific support is engendered both through students belonging to relevant research clusters and through the provision of suitable facilities and resources. This ranges from the provision of the basic desk, computer and IT support to the more specific use of relevant software or hardware, with additional resources to fund visits, conferences and specific training.

d. Income, infrastructure and facilities

Income:

Adaptation to Climate Change for Small Islands: A case study of the Azores: Assoc Prof Anthony Gallagher: £1,000
Evaluation of the Wadden Sea Particularly Sensitive Sea Area: Assoc Prof Anthony Gallagher: £18,315.28
Review of shipping accidents for WWF: Dr Kate Pike: £18,825
Bridge Resource Management: Prof Mike Barnett: £19,000
Project HORIZON: Prof Mike Barnett: £1,123,472

Infrastructure:

The University provides research students with a significant level of support via its comprehensive Learning Support Services, which include Libraries and information services; IT resource centres; web-based learning development; study assistance and disability support; and media resources service. There are two libraries within the University, the Mountbatten library serving the City Campus and a satellite library serving the Warsash Campus. The modern, purpose-built Mountbatten library offers a modern spacious study environment, including study accommodation for almost 1,000 library users. The facilities reflect the different needs of its users, providing bookable study carrels for researchers and large separate areas for silent study and group work. In addition, it combines significant and growing collections of print and multimedia materials with an advanced electronic library, which offers fast and extensive information access both on and off campus.

Facilities

The maritime group has access to the specialist facilities operated by Warsash Maritime Academy, which include a range of simulators and a manned model facility. In addition, there is a towing tank facility at the main campus. The acoustics, computing and built environment group have access to the following extensive facilities located on the main campus:
Several TV, sound, video laboratories and production/post-production studios; a hemi-anechoic and acoustics laboratory; a material production lab; a computing games academy and 3 computer laboratories; a computer networking and usability laboratories; a construction science laboratory and a specialist laboratory for soil and geological experimentation.

e. Collaboration or contribution to the discipline or research base:

i) Maritime Research cluster

Project HORIZON has allowed collaboration with European partners including the Stress Research Instutue in Stockholm University. This collaboration has led to further project funding and the extension of collaborative working with the University of Southern Denmark where one staff is now a Visiting Professor. Collaboration with the University of Southampton has also been strengthened as a result of fatigue research. The environmental group has also been working with external partners in the Sustainable Shipping Initiative (SSI), as part of a cross-industry group looking into ways of making shipping more sustainable (2012).

ii) Acoustics research cluster

UK Government funded projects have included the assessment of vocal training and development on young musical theatre and classical singers (AHRC 2007), and the potential impact on vocal health of the different training regimes- this involved partners in both the UK and USA, including some of the highest profile performance arts academies. A knowledge transfer partnership currently in progress, funded by the Technology Strategy Board (2013), examining improved screening audiometry tools in order to better diagnose hearing loss at an early stage, in partnership with an audiological services provider. This if successful will have a significant impact on getting appropriate diagnosis to a much wider range of people, while reducing costs of audiology referrals.

Computing research cluster

International co-operative research projects include the proposed “Analysis of Gene Sequencing based on Structural Relation Patterns Mining”, under review by the National Natural Science Foundation of China.
External communities have provided a context to inform, evaluate, disseminate and maximise the impact of the pedagogical aspects of computing: drawing upon the employability and internationalisation communities in the past 2 years, international collaborative (with the b.i.b. International College, Germany) strategic University, HEA/UKCISA “Connections” (in 2012) and EU Leonardo Mobility funded projects taking a transnational approach to enhance employability have been completed. This research has resulted in organising and contributing to dissemination events, OERs and other publications including a HEA STEM conference paper in 2012. In particular, evaluated models (eg developing transnational work placements) are now implemented in the participating institutions and are in the process of wider dissemination by the HEA/UKCISA in 2013. Core to the methodology in the cluster’s research throughout has been to engage academic, student, employer, service, public institution and other internal and external stakeholders. More specifically, maintaining long-term collaborative links has been key to maximising the potential, impact and sustainability of this inquiry.

Built Environment Research Cluster

The group has established links with Small to Medium Enterprises (SMEs) as well as large companies in the South of the UK. The group is developing an international profile through collaborative research, publications in international journals and conferences and as well as through education and training activities and international exchanges. Recent research projects undertaken by the group concentrate on the topics of digital modelling and visualisation of buildings and their performance, building information modelling, post-occupancy evaluation of buildings, applications of fractal geometry in architecture and digital manufacturing, waste management including direct soil exchange of uncontaminated soils, quality management, project management interfaces between main contractor and sub-contractors, use of reliability centred maintenance in the facilities management, testing of different materials used in the emergency shelters and utilisation and enhancement of rammed earth blocks in developing countries.