Institution: University of Portsmouth

Unit of assessment: 26 Sport and Exercise Sciences, Leisure and Tourism

a. Overview

Researchers submitted in this UoA are from the Department of Sport & Exercise Science (DSES). Our research groupings make a significant contribution to fundamental understanding and policies and practices of external international groups. This is our first independent submission to the REF; in 2001 and 2008 staff were submitted to UoA 12 ("Allied Health Professions and Studies"). The fundamental and applied research in the DSES arises from three interrelated, multidisciplinary research groups: **a.** Extreme Environmental Medicine and Science (EEMS: Tipton, Corbett, Eglin, Lunt). This group investigates the physiological and psychological response to extreme environments and the selection, preparation and protection of those entering such environments. **b.** Breast Health (Scurr, White). This group investigates breast biomechanics and health. **c.** Human Performance and Health (Corbett, Dicks, Eglin, Scurr, Thelwell, Tipton). This group adopts a multidisciplinary approach to understand, evaluate and enhance human performance for sport, exercise, work and health. Each research group includes additional personnel (academics, post-docs, post-graduates); only those submitted to this REF are listed above.

b. Research strategy

The over-arching strategy for the research within the DSES has been to build on the niche areas of research in which we have developed a strong international reputation, and that recognise relevant national strategic objectives within the domain of Sports Science and Health. Our research strategy 2008-13 has been:

1. Focused development of activity in existing areas of research excellence. This aim has been achieved by the consolidation and development of research strengths in existing critical "niche" areas that sit within sports science, but link to health-related areas. Tipton (EEMS), Scurr (Breast Health) and Corbett (Human Performance & Health) are key research leaders. Growth has been achieved through a number of mechanisms, including the recruitment and development of a cohort of research active staff and the acquisition of internal and external funding and matched funding. Achievements in terms of the number of research projects undertaken within DSES; number of Principal Investigators (PIs); and research-related income since 2008, are evidenced by:

- An increase in the number of research active (i.e. REF/RAE submitted) staff from 7% in 2008 to 57% in 2013 with another five (36%) on the threshold of submission.
- 46% of REF submitted publications with an impact factor of greater than 4.
- An increase in the number of PIs on externally-funded research projects, from three in 2008 to eight in 2013.
- A 60% increase in annual external research REF-submissible income between 2008 and 2012.
- An increase in registered postgraduate research students (PGRS), from a baseline of 9 (2 full time) in 2008 to 21 (5 full time) in 2012. 10 PhD students have completed over this period with no completions in 2008 but 5 in 2012.

Our achievement of research excellence is evidenced, in part, by the number of national and international awards received by staff returned in this UoA, these include: 2008 SHP IOSH Award for Best Health & Safety Achievement in Health Care and Emergency Services; 2009 The RoSPA/BNFL Safety Scholarship Scheme Award. 2011 Best Presentation World Conference on Drowning Prevention 2011, Vietnam; 2012 Best paper International Journal of Health Promotion and Education; 2012 Best paper award ICHES 2011 October, Japanese Society of Human-Environment System, two BASES fellowships (2011, Thelwell, Scurr). For the last eight years, the EEMS research group (EEMSRG) has published more papers in its specialist area than any other laboratory worldwide; it receives an average of one request a month for national and international keynote presentations. The Breast Health research group

is responsible for over half of the scientific publications in its area; it regularly presents this work nationally and internationally.

2. To increase the size and breadth of external research funding and knowledge transfer portfolio. The EEMSRG now undertakes a wide range of fundamental and applied work that is funded by an equally broad group of charitable and industrial sponsors including: UKSport; the Royal National Lifeboat Institution (RNLI); The Energy Institute (EI); Her Majesty's Coastguard (MCA); The UK Ministry of Defence (MoD); The US Coastguard; The US Army; Decathlon (France); WL Gore (USA and Germany). Through the publication of the first procedure to assess dynamic breast movement in 3D (Scurr et al, 2009), the Research Group in Breast Health has developed a unique database on the support requirements of the breast. The Group is well known within the international commercial sector, with research projects informing the design of breast support being funded by many of the major international lingerie (Gossard, Wonderbra, Playtex), sports bra (Shock Absorber, Freya, Berlei) and sporting apparel manufacturers (Nike, Adidas, Reebok, Speedo). The Human Performance and Health Research Group has increased in size from two staff in 2008 to six in 2013. In 2008 the work of this group focused on fitness testing for sports people and teams, this has now broadened to include the development of occupational health and fitness standards for groups such as the Oil Industry, MCA and RNLI as well as organisational psychological assessments and investigation of the impact on psychophysiological factors on sports performance. Details of the research funding received over the REF period is provided in Section d.

3. To develop the postgraduate researcher community within DSES. The achievement of Objective 3 is considered in Section c. below.

4. To develop the Department's research culture and environment. The research culture within the DSES is maintained by regular contact and communication. Monthly minuted research meetings include presentations from internal and external speakers and PG research seminars are open to all staff; these help foster the multidisciplinary outputs that are included in this submission. Indeed, a particular strength of the DSES research group structure and function is that it enables multidisciplinary research and cross-fertilisation. This comes about because: a. Each research group has a co-ordinator to facilitate the work of the group by identifying: funding opportunities; useful new equipment; and relevant meetings. The co-ordinators meet with group members, each other and Director of Research (DoR) and Assistant DoR (ADoR) at least four times a year to discuss research objectives and progression. They also report to the DSES Research & KT committee twice a year and provide input to the annual review of the DSES Research and Knowledge Transfer strategy. b. Most researchers are active in more than one group. Examples of multidisciplinary research include: the psychological, performance and thermal aspects of breast health and support; occupational fitness standards for those working in extreme environments; the psychophysiology of comfort and temperature/humidity perception.

A competitive department research award, designed to pump-prime new research and grant applications is available, eight of these have been awarded since 2008, including to Eglin and White who have used the funding to undertake pilot studies and purchase research-related consumables. There are also Faculty start-up funds (£5000); seven of these have been awarded since 2008 including to Corbett and Dicks. The applications of Lunt and White (ECRs) are under consideration. In all cases the funding has been used to support research-related objectives including establishing laboratory techniques. This funding, as well as the matched-funding we have found for research students (see below), benefit our research environment by bringing in additional research students and enabling staff to have supervisory experience they would not otherwise have had. Each of our research groups has received at least three research awards or matched funded PGR opportunities in the last five years. As noted below ("staffing"), new staff appointments are strategic to fit within our research areas, and new facilities and infrastructure are similarly targeted.

A significant portion of the "research environment" and capability within DSES is created by our

unique range of research facilities, some of which are un-matched internationally. University funding has been provided to establish, expand and maintain these facilities.

The Future

Our over-arching strategic objectives for the period 2014-2020 are to grow the research activity and quality, and to establish a sustainable research environment that will endure beyond current key personnel. These objectives are enshrined within the following strategic aims:

- To expand the research activity within existing research groups, and consider new within and across-group occupational and health-related research areas aligned to key national and international research challenges.
- To increase research active staff in DSES by at least 12% (one person) per annum in areas aligned to our three research themes.
- To increase the volume and diversity of external research and knowledge transfer income.
- To continue to develop the research culture and environment.

In recent years the EEMSRG and Research Group on Human Performance & Health have combined their expertise to examine the selection of those working in extreme environments. This has led to work developing occupational fitness standards for the RNLI, MCA and Oil industry as a replacement to age-related retirement. Ageing is an area of particular strategic priority, offering synergies across the three research groups and opportunities to develop multidisciplinary projects with new collaborators from across the University (e.g. the School of Health Sciences and Social Work, Department of Psychology and the Institute of Biomedical and Biomolecular Sciences), as well as with new external partners (e.g. EI, UK Search & Rescue organisations). The University of Portsmouth Ageing Network (UPAN) and university strategic partnership with the Portsmouth Hospitals Trust will be key resources to support achievement of this aim. Currently work is being undertaken looking at the demand placed on older workers in the oil industry. This important recent initiative has responded to national and international societal priorities, and European legislation on the ageing workforce. Similarly, the Research Group in Breast Health has recently begun research on the ageing breast and breast support post-surgery for breast cancer patients. They have secured buy-in from the Research Lead at Portsmouth Hospitals Trust and a Memorandum of Understanding has been signed to enable collaborative projects with the local hospital in the area of Breast Pain. These new areas of research should be supported by RCUK, NIHR and health-related charities; thus it is intended that some of the expansion of our research activity in the coming years will be via funding from these organisations. The research areas also present the opportunity to develop research collaborations with other disciplines and groups outside the University, including strategic partnerships with the NHS. Although some of these activities are still in their relative infancy, the strategies we have adopted to successfully develop our groups in recent years (targeted funding and recruitment), does deliver high quality research with maximum impact. Whilst expanding our research in these areas, we will maintain our focus on our traditional research themes.

c. People:

Staffing strategy and staff development

With the aim of developing and retaining the very best researchers and supporting their career development, appointments are made in areas that add to or complement existing strengths. Research experience and potential is always considered in selection processes. Within DSES, the staffing strategy over the last six years has focused on recruitment of staff who are already research active in an area that complements existing research strengths. This strategy does not prevent individuals developing new research areas, but we believe it is better if this occurs from a strong starting position (i.e. in an established group). During the REF period all five of the academic staff who have left the department have been replaced; three of these appointments are the ECRs (one in each research group) within this submission, two of these individuals (Lunt and White) completed their PhDs with us. These ECRs have high ranking papers; this is offered as evidence that the research environment in DSES helps to nurture young researchers and quickly make them productive at a high level. Three staff (Corbett, Eglin & White) in this submission gained promotion internally during the REF period, in part

due to their research record. For new appointments to academic posts, the departmental mentoring scheme is supplemented by a one-year probationary period during which teaching and administrative loads are lighter and the establishment of a research portfolio and research progress is monitored and supported. New lecturers receive research start-up funding to support their research-related activities. Researchers are mentored, with support available up to and including Readers; thus research career development is provided at all stages. All research facilities and equipment are available to all students and academics. Additionally, all staff are offered internal peer review for any output, written or oral, that is going external to the University. Research training is available to all staff through internal Continual Professional Development (CPD) courses, and staff development funds are available to support external training opportunities. There is also support for workload remodelling to facilitate research activity. The University have a Research & Knowledge Transfer Group, a Research Development Fund, Grant "Hot Houses" and a Graduate School, all of these are in place to support and develop fundamental and applied research and researchers. Each member of staff receives annual funding for professional development; most use this to attend conferences.

We are committed to actively promoting the role of women (50% of those submitted here are females, one currently works part-time). The University has a strategy to achieve Athena SWAN Bronze in 2014, with individual departments within the Science Faculty applying for Silver Awards in the 2014-16. The University was awarded the European Commission Human Resources Excellence in Research Award in 2013. Thus, DSES has a commitment to equality of opportunity in the recruitment, support and career progression of all research/academic staff, following CONCORDAT guidelines. Research activity is recognised as an intrinsic part of the academic role and is reviewed during an annual Performance Development Review (PDR) that sets out a clear framework for career progression for all research and academic staff. Staff, the Head of Department and DoR meet to discuss research achievements and plans, including those relating to funding, publications, collaborations and dissemination/impact activities. Research-related goals are set for the coming year. An objective of our R&KT strategy is to mentor and develop the supervisory skills of staff by having post-graduate supervisory teams that include a combination of experienced and less experienced staff. In the last three years all supervisory teams have included staff who have had less than two PhD completions and staff who have had at least 5 PhD completions. As soon as reasonable, younger staff are given the role of first supervisor with a more experienced staff member acting as second or third student supervisor/supervisor mentor.

The approaches outlined above have been successful in increasing the number of PIs within the department from 3 to 8 since 2008. We will continue to support staff to engage in collaborative research bids and be members of research supervisory teams; as well as help them by providing mentoring and training opportunities.

Research students

A key objective of our R&KT strategy is to develop our postgraduate research community and produce high quality postgraduate students capable, in time, of leading their own research groups. This objective has been achieved as evidenced by the data presented in Table 1, new PhD students have been roughly evenly spread across our research groups.

Table 1. PhD students registered each year 2008/9-2012/13

PhD students registered each academic year (by FTE)	2008/09	2009/10	2010/11	2011/12	2012/13
	4.5	9	10	11.5	12

In 2008 we had nine PhD and Masters research students registered in DSES, these included two full time and seven part time students, three of the students were self-funded. As of October 2013 we have 13 PhD, three MPhil and six Masters by research registered. Between 2008-2013, 10 students gained their PhDs. Since 2009 Faculty funding for four studentships has been used to leverage matched funding from industry, the MoD and UKSport; thereby converting the four studentships into seven, spread across our three research groups. Thus, a

total of £216K has been obtained from outside groups to support PGRS. In addition to the endorsement of our research that this represents, industry and other end user-related PhDs ensure that our research is relevant and impactful. We have followed the same route with MRes students, again obtaining external matched funding.

All PGRS during the REF period have had successful annual progression reviews and MPhil and PhD vivas. More PGRS attended conferences in 2013 than any previous year. This was achieved with departmental and faculty support for travel and accommodation (PGRS conference attendance fund). Attendance has been accompanied by awards recognising the quality of the research undertaken by our PGRS, including: 2008 Ergonomics Society Ulf Aberg Post-graduate Award; 2010 Prof Tom Reilly Doctoral Dissertation of the Year Award, BASES; 2012 "The Cameron Award" for best presentation at the FINA sports medicine conference. Best presentation at the BASES Biomechanics Interest Group (2013), Royal Society of Medicine, short listed for the Helal and Harries Prize (2012), Human Kinetics, Best Poster Award at the BASES annual conference (2011). Winner of the Sportesse, Best Presentation Award at the BASES conference (2009). Winner of Brunel University Poster Presentation Award at the BASES conference (2008). Winner of Routledge-Taylor and Francis Recently Qualified Researcher Award (2008). Rubicon Scholarship award (2011). We also won the BASES MSc dissertation of the year 2012. Since 2008, all of our PhD students have gone onto further employment in science-related jobs. The international reputation of our postgraduate research programme is such that we have attracted PGRS from Canada (3), France, Germany, Japan, South Africa and Slovenia (4). With many other enquiries that we have been unable to accept due to facility availability and funding limitations.

In 2011 the university-wide Portsmouth Graduate School was created with its own dedicated space and staff to support PGRS and their supervisors. All PGRS are members of the school and attend the equivalent of 10 days development training per year. General research and transferable career training skills, recommended by Vitae and RCUK, are delivered by the graduate school (e.g. workshops on research design; data collection; research ethics; understanding the doctoral process; academic publishing; generating impact and career development). Supervisors from DSES contribute to these generic workshops. Specialist training is either delivered in the department (e.g. specialist equipment or facility use) or, where appropriate, externally provided. Students can apply to the faculty and department for funding to support specific research-related training (recent example: Maley [current PhD student] travel to Penn State to learn cutaneous micro-dialysis techniques). In 2012 we initiated, implemented and funded joint presentation/training days between the Universities of Portsmouth and Chichester. This provides the opportunity for post-graduate students from the two institutions to meet, present to each other and receive joint training.

As part of their annual appraisal, student training activities are agreed between the PGRS and their supervisory team and amended as needed to ensure that they are commensurate with PhD progress and training needs. All training activity is recorded via an online recording system (Skills Forge, used by 20 HEIs in the UK). In addition, a major review is undertaken at the end of the first year of post graduate study to ensure that the work is of the standard expected for a PhD. We have a dedicated PGRS room where all PGRS have their own desk space and computer. To facilitate and encourage the integration of PGRS within the research culture of the department, all are expected to contribute and attend our departmental research meetings and seminar series, presenting their work at least twice during their studies. Students also present a poster (1st year) and an oral presentation (2nd year) to the Faculty. Students are also invited to work with members of staff on laboratory studies and fieldwork. All PGRS are given the opportunity to help out with teaching/labs in order to gain experience.

d. Income, infrastructure and facilities

In addition to REF-related income over the REF period (£1,008,587) an additional £262,102 of income, not submissable to REF, has been attracted by our research groups via sources such as University of Portsmouth Enterprise Ltd contracts and industry matched-funding for PGRS. The University invested another £230K in building and maintenance of the research facilities.

Between 2008-2012 the annual number of projects being undertaken by the DSES increased by 44 %, the commensurate invoiced income rose by 60 %. This income came from a wide variety of sources including industry (UK, France, Germany, US), various charities (e.g. RNLI, EI) and government agencies (MoD UK, MCA, US Coastguard). This funding has supported both fundamental and applied research, as evidenced by our research output. Our funding has, in part, come about because of the reputation we have developed in our niche research areas. We have also been successful in obtaining repeat and continuation funding; the large majority of our current research sponsors have supported us on previous projects. We believe this is indicative of our ability to run projects to time, objectives and produce high quality and relevant outputs. As noted, strategic investment has brought improved infrastructure and equipment as well as matched funded PGR and MRes opportunities. Consultancy income has supported research equipment purchases (e.g. portable oxygen analysers) which have enhanced and extended our ability to undertake field work with, for example, occupational groups such as the RNLI, MCA and oil industry. The EEMSRG runs a cold injuries clinic which sees patients funded by various legal firms and HM Treasury solicitors. Research on the assessment of non-freezing cold injuries runs alongside the clinic, and the funding generated by the clinic is re-invested into the research infrastructure within the department.

Significant investment has been made to establish a combination of well-equipped research facilities that are unmatched internationally. The department has three environmental chambers with control of climatic conditions (-20 to +50°C) and oxygen levels for hot, cold and altitude research. A swimming flume and immersion tank are integral to these facilities and a hypoxic system allows us to simulate altitudes up to 7500m in each chamber. We have the only laboratory in the world that, in one environmental chamber, can control altitude, temperature and includes a swimming flume with control of water temperature. A second chamber can achieve the same combination, with the exception that this chamber contains a 2.5m deep immersion facility providing some shallow water hyperbaric capability. In addition, DSES has a large exercise physiology laboratory, a small trials laboratory, two state of the art biomechanics laboratories and a psychology research laboratory. Strategic investment has included the addition of a second laboratory for the Research Group in Breast Health in November 2012 and provision of a dedicated IT data analysis suite in early 2013. The demand for the use of the facilities is high and carefully managed with a generic booking system. In recognition of the unique provision we have in terms of facilities, the DSES annually hosts groups from other local and national institutions, including Birmingham University (Medical School) and King's College, London (MSc Course in Human & Applied Physiology) who undertake research-based field courses in our laboratories with our support. DSES has also "pooled" its research facilities as part of its membership of the UK Space Biomedicine Consortium.

Research in DSES is co-ordinated by the DoR and ADoR who report to the Departmental Management & Strategy Committee chaired by the Head of Department. Research active staff are supported by Senior Research Associates and Research Assistants who are employed on a contractual basis via external research income. University funded technical support (seven technicians) and general administrative support (four administrators, one with a research brief) complete the team supporting research. Research governance is embedded within our research policies and processes: all research proposals undergo scientific scrutiny by a specifically constituted Faculty review committee that examines both the scientific and ethical aspects of the proposed work and the risk analysis associated with it. Our guidelines for the use of our laboratories outline standards for calibration, data acquisition and storage. Our DSES Research Policy covers all aspects of research from protocol preparation to publication.

e. Collaboration and contribution to the discipline or research base

The EEMSRG is an internationally recognised centre of excellence with strong collaborative links with other academic institutions internationally. Research staff have undertaken and published collaborative research with groups from the Universities of Sheffield, Leeds and London. The EEMSRG is one of five laboratories forming the EPERE grouping, the others being in Australia, France, Japan and Slovenia. This group is supported by Memoranda of

Understanding between the laboratories designed to facilitate collaboration. Researchers from EEMSRG have contributed to the multinational (12 countries) task force on drowning prevention, and work with companies in the USA, Germany and France. The output from the EEMSRG has been used to inform treatment and policy, increase public engagement in science and influence equipment design. Collaborators with the group include: Decathlon (France), EI, UK, US and NZ Maritime and Coastguard Agencies, MoD, RNLI, WL Gore. The EEMSRG's Extreme Environments Laboratory (EEL) is the designated thermal physiology laboratory of The Fuchs Foundation and was, until recently, a UKSport (Partner for Innovation – now discontinued with UKSport re-organisation). **The Research Group in Breast Health** engage in multidisciplinary collaborative research spanning for example, health and engineering via long term collaboration with the Sports Engineering Group at Sheffield Hallam University. Additionally, the Group collaborate with many industry partners including Nike, Adidas, Under Armour, Speedo, Playtex, Gossard, Berlei, Sweatshop, Moving Comfort, Lululemon, Shock Absorber, Courtaulds, Lanka Equities, QP Sport. **The Human Performance and Health Research Group** have supported the Services expedition to Makalu, the 'Spirit of Scott' British Services Antarctic Expedition, and specialist support to 15 UK Olympic sports teams. In addition this group has forged strong collaborative links with industry partners (MCA, MoD, EI, WLGore), sporting groups (Hampshire CCC, Rugby Football Union, Middlesex CCC, ASA, Portsmouth FC, Southampton FC, UKSport, GB Pistol Shooting), and charitable foundations, (Fuchs Foundation, RNLI).

Research collaboration is encouraged where it improves the quality or breadth of the work undertaken, or is likely to facilitate funding. There is regular liaison and collaboration with groups within the University (e.g. Psychology Dept., Ageing Network, Environment Network, Institute of Biomedical and Biomolecular Science). External to the university, researchers are supported to visit potential collaborators and produce joint applications. A recent Erasmus grant with the University of Ghent has led to an exchange programme that has already produced a research publication (Sports Medicine) and a new programme of work in muscle function. In recent years the research work of the EEMSRG has increasingly combined whole body integrative human physiology with both *in vitro* and *in vivo* animal work. Examples include recent fundamental work on the pathophysiology of Non-freezing cold injury (human work plus rat tail model - collaboration with Portsmouth Pharmacology) and our "Autonomic Conflict" theory of sudden death (human work plus isolated heart preparation - studies with a group in London). We have had sabbatical visitors from Australia, Canada, France and Slovenia and we have honorary visiting lecturers from the MoD Institute of Naval Medicine (Dr Roiz de Sa), British Cycling (Nigel Mitchell) and Industry (Dr Mark Newton, WL Gore; Amanda Brasher, Sweatshop). These appointments provide additional expertise and perspective, as well as links with key external group that use and fund our research.

Staff in our research groups have a wide variety of leadership roles including: **Patron** of SARbot charity. **Trustee & Director** of Surf Lifesaving GB **External committee memberships** including: UKSport Research Advisory Group (Chairmanship) to 2013; English Institute of Sport, Technical Advisory Group; Medical committee for the Society for Ectodermal Dysplasia; Medical & Survival Committee, Royal National Lifeboat Institution; Medical Advisory Board, Surf Lifesaving Association, UK; Maritime Coastguard Agency, Lifejacket Expert Panel Member; Energy Institute (Oil Industry) Health Technical Committee; Non-Freezing Cold Injury Review Group Advisory Committee (Deputy Chairman) and BPS Division of Sport & Exercise Psychology Training Committee (Chair). SkillsActive Panel members; Member of the Hampshire B NRES Research Ethics Committee. Chair of the BASES Awards Committee; BASES Accreditation Committee Representative for Biomechanics and Psychology. **Editors:** International Journal of Swimming Kinetics; Extreme Physiology and Medicine; Journal of Science and Medicine in Sport; European Journal of Sport Science. **Memberships** of Physiological Society; BPS, HCPC, BASES; ISBS, ECSS, HEA, ACSM. **Conference organising committee** for the: International Conference on Environmental Ergonomics; Energy Institute International Meeting Scientific symposium; BASES student conference 2014.