Institution: University of Southampton

Unit of Assessment: 7 Earth Systems and Environmental Sciences

a. Context

This return is focused on University of Southampton's (UoS) Ocean and Earth Science academic unit (OES) that forms part of the National Oceanography Centre Southampton (NOCS). The approach to impact is integrated across the scientific remits of the University and NERC's National Oceanography Centre (NOC). The **major** non-academic **user groups**, beneficiaries or audiences of impact from OES research may be divided into three categories: (*1*) commercial organisations including oil companies, instrument developers, and consultancies; (*2*) government agencies and policy makers, from local authorities to national governments; and (*3*) the media and general public, including radio, TV, newspapers, and major local events such as the annual Southampton Boatshow. This diversity of target groups arises from the diverse range of research in OES, that leads to **impact** spanning four major **categories**:

(i) spin-out companies, e.g., Offshore Hydrocarbon Mapping (OHM)
(ii) consulting in both equipment and method development (e.g., with the European Space Agency), and in environmental and policy issues (e.g., for nuclear decommissioning, coastal protection, and offshore site surveys)
(iii) advice to planners and government agencies (e.g., Environment Agency (EA), the UK Climate Impact Program (UKCIP), Ministry of Defence (MOD), Department for Environment, Food and Rural Affairs (DEFRA), Department of Energy and Climate Change (DECC))
(iv) Public outreach and education (e.g., radio, TV news and documentaries, newspapers, *Discover Oceanography*, open days, summer schools, Southampton Boatshow).

In terms of **reach**, the impact ranges all the way from local to global scales.

b. Approach to impact

OES has a pro-active approach to knowledge transfer and to identifying and exploiting research impacts, based upon a combination of strategy and opportunity, and is supported and facilitated by wider University structures. A key University initiative led to the setting up Southampton Asset Management Ltd (SAM); SAM sets the policy for how the University handles spin-outs, licensing and is now embedded in the UoS's strategy for impact and enterprise. The University's Research and Innovation Services (RIS), a specialist department with >60 staff, provides dedicated support and expertise to facilitate interaction with our business partners and to support incubation of new businesses. A specialist legal team in RIS provides support in commercial contracts and IP management, as well as advice and training to staff on developing IP. Six dedicated Collaboration Managers with relevant industry/sector experience are responsible for guiding the exploitation route and negotiating licences. The UoS operates an '*easy to do business with*' framework that includes 'fast-track' templates for commercial contracts and IP sharing developed in partnership with individual companies, similar to the Lambert toolkit for universities. In addition, OES makes full use of NOCS-based opportunities for maximising impact. The result is a flexible but robust approach to impact – as required by the diverse nature of end-users and stakeholders. We ensure that not only do we take a strategic review of impact across OES, but that it is embedded in research projects from inception and that a framework to exploit or pursue opportunities is in place.

The **approach** to impact follows a series of firmly established mechanisms with enduring financial support. An overarching impact **strategy** (described in section c) ensures longevity and joined-up approach with facilitating operational mechanisms. The mechanisms are:

(a) *facilitation of enterprise and commercialisation of research-driven concepts*
(b) *facilitation of interaction and collaboration* (with government agencies, consultancies and other companies, the media, and organisations with general or specific advisory remits)
(c) *soliciting direct feedback from stakeholder and end-user communities*
(d) *systematic evidence collation*
(e) *public outreach and education*.

There is substantial cross-fertilisation and structural reinvestment between these mechanisms. A good example is the use of the £0.9M research vessel *Callista* – purchased from spin-out revenues of OHM – for public education via the '*Discover Oceanography'* programme, which takes bookings from both school parties and the general public throughout the year and is represented at the annual Southampton Boatshow. Key examples of the approach mechanisms are listed below, in

part drawing on our impact case studies, and in part drawing on newly developing impact.

(a) Facilitation of enterprise and commercialisation of research-driven concepts. The University, through its subsidiary SAM, has an agreement with the IP Group plc, an independent investment company (formerly IP2IPO), providing start-up funding for its spin-outs at a pre-determined market value that significantly accelerates the start-up process. Prof. Bartlett, who as Associate Dean for Enterprise oversees this activity in OES, is a Director of SAM (alongside external business and investment experts), as well as *Southampton Innovations plc* and *Photonic Innovations Ltd*. The University also has support in place to provide seed corn funding through the Wyvern Seed Fund and the Higher Education Innovation Fund.

Strategic investment of staff time and funding has enabled OES staff to:

- spin out companies, such as OHM, that was floated on the Alternative Investment Market at a value of £49.3M
- operate the in-house Geoscience Advisory Unit (GAU), which is provided with space and financial autonomy. The GAU has won large contracts from organisations such as the UK Atomic Energy Authority and GE Healthcare, and in 2010-11 realised a turnover of £0.9M.
- explore and develop new enterprise initiatives in areas such as algal biofuels (research funding from the Carbon Trust).

(b) Facilitation of interaction and collaboration. OES offers incentives, assistance, and support for its staff to engage in:

- collaboration with, consulting for, and research funding from organisations such as DEFRA, MOD, EA, Police and Healthcare authorities, local authorities, energy and resource industry, insurance companies, nuclear power companies, shipping lines.
- development of and/or participation in outreach via radio, TV news and documentaries, blogs, and Web broadcasts from press releases, press conferences, and commentaries. Over the census period, OES issued c. 50 press releases per year related to our research, averaged 18 reports per year on BBC media, and 252 mentions per year in UK news media, and 820 per year in overseas news media.
- collaborations with and/or initiatives on behalf of organisations like the UKCIP & Roy. Soc.
- contributions to quality newspapers such as the Guardian, Times, Sunday Times, Observer, USA Today as well as the local press.

Media activity is facilitated both through the University and through NOC's Communications and Public Engagement group, with which OES shares one member of staff. Part of the attraction of external organisations to the unit derives from the national focus for marine science at NOCS.

(c) Soliciting direct feedback from stakeholder and user communities. By this mechanism, OES staff have regular opportunities to consult key members of the various stakeholder communities, for advice, guidance and direction, which helps to ensure optimal alignment of the research outcomes with needs and opportunities within the stakeholder communities. This mechanism serves to identify new challenges and opportunities, and thus for direct stakeholder involvement to shape the research programmes. The main coordinated contact routes are:

- six-monthly meetings of the Stakeholder Advisory Board (SAB), that is composed of prominent representatives of the various stakeholder communities (see section c),
- requests for advice from the SAB ,
- alumni events which are regularly attended by alumni with prominent roles in industry, consulting, and advisory organisations.

In particular, OES actively involves alumni to further improve the industrial relevance and linkage of its education and research remits. For example, our annual alumni careers day has been attended by about 20 alumni per year since 2009. Some members of the SAB are alumni who are now in senior positions in key stakeholder and end-user organisations.

(d) Systematic evidence collation. We prioritise keeping track of the most important impact-related activities of OES staff. A structural approach to such evidence collection is beneficial not only to aid documentation, but also for keeping an overview of key activities and of critical contacts. Keeping an overview of impact-evidence in a centrally held system similar to the RCUK-Output Performance Measure database is the remit of a Research Administrator (Debbie Buck).

(e) Public outreach and education. OES offers incentives, assistance, and support for its staff to promote their research through: school visits, web resources, open days and Discover Oceanography activity based at NOCS; participation in science and employment fairs; broader

outreach events such as the multi-university SETsquared event in London; summer schools supported by Headstart and BG group to widen participation; workshops and symposia with focus groups such as Wessex Health Care officials and Police forensics, and with public audiences such as a media-organised public Global Warming symposium; public lectures, and articles and podcasts with New Scientist, Scientific American, Projects and other popular scientific outlets. OES has the largest Student Ambassadors Scheme in the UK putting Undergraduates into 20 schools to support STEMM teaching and provide role models.

Our approach includes public showcasing of the impact of our research during the annual NOCS Ocean & Earth Day, which attracts 2,000-3,000 visitors, and other public events. In particular, we designed and implemented a survey to measure the public's understanding of the impact of our research, as well as what they have learned (a two-way interaction, including 'before' and 'after' questions). We use an interactive large touch-screen display, including images and short video clips. During the most recent Ocean & Earth Day (23 March 2013), 88% of respondents said that their knowledge had improved by interacting with the impact case study display, 87% said that their understanding had improved, and 100% stated that they thought that our research has an impact on society. The demographic data collected show age ranges from 0-10 to 50-65, 75% female, and 83% visited us for the first time. The Discover Oceanography programme gives school children and members of the public a unique, hands-on opportunity to experience marine science by taking part in experiments, and collecting samples and data aboard *Callista*. Since 2008, over 5,000 people have participated, aged from 7 to 93.

c. Strategy and plans

The UoA's impact strategy, embedded within the overall University strategy, is designed to ensure the longevity and joined-up operation of the approach mechanisms outlined in section b. The impact strategy revolves around the following goals and plans:

1) **Targeting of profound links and interaction with current and potential stakeholders.** This follows a structural relationship-management approach, with a focus on (*i*) stakeholder events, (*ii*) the SAB, and (*iii*) alumni. OES has ring-fenced annual budget allocation to support these interactions, as well as 80% of a full-time member of support staff. The six-monthly SAB meeting is a 1-day event where key stakeholders are invited to evaluate and provide feedback on the alignment of the UoA's research, education and impact-related activity with non-academic needs, challenges, and opportunities. At these events, the stakeholders are also actively engaged in developing our strategy for maximizing the impact from newly emerging results. The SAB formalises the mechanism by which the unit's staff are made aware of emerging opportunities and deals with/responds to the non-academic evaluations of its research portfolio. The membership of the SAB is based primarily on currently mature impact activities but is monitored so that representatives of newly emerging stakeholder communities may be added when appropriate.

Our structural use of stakeholder communities as sounding boards for the commercialisation potential and other impact implications of our research and its applications, ensures that the research's potential impact is aligned with the needs of, and challenges faced by the various user communities. Two wider University initiatives of particular importance to the UoA – which demonstrate its commitment to innovate in emerging areas through its strategic investment in major cross-cutting facilities – are the Institute for Life Sciences (IfLS) and the Southampton Marine and Maritime Institute (SMMI), each sustained with a £1M per year budget for 5 years. These bring together a wide variety of expertise thereby providing opportunities to address multi- and interdisciplinary topics of societal importance. The SMMI fosters links with Lloyds Register and develops further industrial and societal links with the wider marine and maritime community. It constitutes the largest business-focused endeavour of this nature in any UK university. Lloyds is investing £129M on their new building on the Boldrewood campus and the UoS Engineering Faculty has received about £75M from the UK Government to rebuild their part of the Boldrewood site. The IfLS and SMMI include in-depth participation from UoA7, with OES providing one of the Deputy Directors of SMMI. Both IfLS and SMMI are recent developments with only nascent influences on impact, but with great potential for the future. Regardless, they have already spawned 8 collaborative and industrially co-funded PhD projects within OES, as well as increased exchange between academics and non-academic parties about joint research and research exploitation, both commercially and in the advisory sector.

2) **Active encouragement of collaboration, and co-sponsoring of research and R&D, with industry and other organisations.** Research output metrics have become increasingly dominant

in the evaluation of research in our disciplines. This trend poses a danger to applied science and R&D activities, which do not normally lead to highly cited outputs. To counteract this threat, the University has adopted a pro-active stance of recognition and encouragement of applied science and R&D, in conjunction with stakeholder organisations and University RIS. Incentivisation is ensured by positively valuing these activities in the appraisal and promotion system.

3) **A sustained policy of encouraging staff to engage with the public about all aspects of the UoA's agenda**. This covers the entire spectrum from new research results, to education and information opportunities, ongoing research fieldwork/cruise blogs, and news commentaries. Public outreach is only as good as the effort put into it by enthusiastic and motivated staff. Since OES values these inputs, it ensures that there is appropriate incentivisation from valuation of such activity in the appraisal and promotion system. Some of the most influential regional information and public education opportunities arise from Open Days and the *Discover Oceanography* programme. At these opportunities, the UoA shares a wide variety of ocean and earth science topics with the public, including new research developments. Cumulative Open Day attendances over the REF census period are over 14,800. Of wider reach (up to global) are the frequent media interactions and websites/blogs related to ongoing research. In addition, there is an emphasis within OES on participation of staff in public seminars and panel/forum discussions, reaching the general public, schools, and relevant focus groups (e.g., business, healthcare, environment).

Continuity and support for the full range of impact activities is provided through the employment of an 80% full-time member of support staff to proactively help underpin, facilitate, and support impact-related activity (Athena Drakou). This role complements the University Communications and Marketing group's provision to the unit of a 50% member of support staff, with the remit of proactively identifying outreach possibilities and facilitating the participation of staff in outreach.

d. Relationship to case studies

Explore the Deep: Public Engagement with Deep-Ocean Research [02]. This engages the public in exciting scientific discoveries about the ocean and its life, to raise awareness, and to inspire and inform a wide variety of audiences, from life-long learners to children, and from general public to specific focus or interest groups. Novel and traditional outreach and engagement methods are used, focusing on facilitation and encouragement of follow-through on a personal level.

Geoengineering the Climate: Science, Governance and Uncertainty [04]. OES researchers led the writing of a report, commissioned by the Royal Society, that assessed geoengineering strategies which has become a global standard reference for policy makers and opinion makers. This study is an excellent example of international engagement with the media, public, and industrial, governmental and other organisations.

Managing the seabed through innovative near surface geophysical imaging [05]. This exemplifies the approach of strategic awareness of, and alignment of research with, requirements of stakeholders such as energy generation developers, conservation agencies, the aggregate industry, and even police-forensics agencies worldwide.

A new radionuclide waste assessment tool for the Nuclear Sector [08]. This exemplifies the unit's sustained support to targeted method development and applications, in this case with respect to a key concern in society (nuclear decommissioning) led by the GAU (Geoscience Advisory Unit).

Raising awareness of the rapidity of past sea-level change [10]. This exemplifies optimised outreach to the public, focus groups and other stakeholder communities, using in-depth media engagement, lectures and panels/workshops for the public and professional bodies, and follow-up interactions with the public. Initial 'passive users' have been enrolled as full partners in the planning and execution of further research, to maximise alignment with stakeholder needs.

Hydrocarbon exploration using marine electromagnetic techniques [11]. This spin-off company was the UoA's largest success in commercialisation of research results and involved extensive consultation, collaboration with users, and integration of stakeholder needs.

Enhanced usability of satellite sea surface temperature data [12]. Collaboration with stakeholders worldwide (e.g. UK Met Office, ESA, NASA) led to a framework within which all satellite SST data can be shared, indexed, processed, quality controlled, analysed and documented. Pioneering instrumentation (ISAR) establishes the absolute accuracy of global SST time series for monitoring climate change with demonstrable implications for policy.

Stimulating new exploration strategies for Copper mining in Africa [13]. This work has led to a new exploration paradigm in the Zambian Copperbelt due to direct working with exploration companies, and by ensuring a flow of highly skilled geologists from academia to industry.