National Oceanography Centre, Southampton

Strategy *2008 – 2015*

National Oceanography Centre, Southampton
UNIVERSITY OF SOUTHAMPTON AND
NATURAL ENVIRONMENT RESEARCH COUNCIL

Introduction

From the Director of the National Oceanography Centre, Southampton, Professor Ed Hill

Welcome to the strategy that will shape the work of the National Oceanography Centre, Southampton over the next seven years.

The strategy is intended to be a living document that we will revisit periodically; it sets a blueprint for achieving our overall goal to become the world's strongest and most innovative oceanographic research institution by 2015 – and to lead the international research agenda in our areas of expertise.

Tackling the most challenging and urgent scientific questions, the centre will engage government, enterprise and the public in our science and develop a research-led educational experience, training the scientists of tomorrow. All our functions will be fully integrated to enhance their quality and effectiveness, and a commitment to communicating our work will underpin all that we do.

The strategy sets out the centre's research priorities and articulates the big research topics we will be addressing. It emphasizes our strength in developing leading edge technology and in delivering excellent facilities that support the marine science community. The centre's commitment to facilitating major international scientific programmes is underlined.

With rapid environmental change and the stewardship and sustainable use of the Earth's resources ever more pressing concerns, the publication of the National Oceanography Centre Strategy 2008 – 2015 is a timely and focused summary of our approach to tackling some of the most important issues facing us.

National Oceanography Centre, Southampton

Strategy 2008 – 2015

Our vision is to be the world's most innovative centre for ocean research and technology. We aim to tackle the most difficult and relevant scientific questions in support of the quest for solutions to global environmental change and the increasing pressure on natural resources. We will be viewed worldwide as a premier venue where the best scientists are educated and trained, where they can build careers, and where they wish to visit to undertake research. In so doing, we will support the United Kingdom in maintaining its prominence and leadership in ocean-related science, industry and public policy.

The Challenge

1. We live on a dynamic planet with a growing human population. The most important challenges for humanity in the 21st century include coping with **rapid environmental change**, stewardship of the **natural environment**, and sustainable use of the Earth's **natural resources**.

2. In addressing these challenges, discovering fundamental knowledge of the oceans is essential for:

- **reducing uncertainties** in annual to decadal predictions of global- and regional-scale environmental change to support mitigation and adaptation strategies;
- providing scientific evidence to **develop and evaluate solutions**, both through innovations in the private sector and development of public policy.

Our Role

3. The **National Oceanography Centre, Southampton**[1] (NOCS) is a joint Centre[2] of the University of Southampton[3] and the Natural Environment Research Council[4] (NERC), and is one of the world's leading institutions[5] devoted to research, teaching, and technology development in ocean and earth science. The research mission of NOCS is to undertake the best oceanographic science, to pursue international excellence, to play a key role in developing national and international research programmes, and to be Europe's leading academic centre for oceanography.

4. We value, and will draw strength from, the following attributes that combine to make us a unique institution worldwide:

   - **joint ownership** by the Natural Environment Research Council (NERC) and the University of Southampton, enveloping functions of both a research council institute and a university school;
   - **critical mass of scientists** across all major oceanographic disciplines, located on a single site, with expertise spanning marine geology and geophysics, ocean physics, geochemistry, biogeochemistry, marine biology, engineering and technology – from deep earth to space, coast to abyssal ocean;
   - **immense capacity to undertake multi- and inter-disciplinary research** through our own discipline span and through ready access to expertise across science, engineering, medicine and humanities disciplines within one of the world's top 100 research-led Universities, and through links to other NERC-supported Centres.
   - **wide-ranging mission**, unique among the world's major oceanographic institutions, encompassing provision of **national capability**[6] for NERC and the UK; **education** (both undergraduate and postgraduate) for the University, the UK, and the world; and **research, technology development, enterprise, and knowledge exchange** for all;
   - **national remit** charging us to provide leadership and international excellence for the UK, supply national capability for NERC, and foster an integrated UK research community.

5. We aim to **advance the UK science community** by:

   - **developing** visibility and strategic relationships with key institutions internationally, and
   - **influencing** scientific, environmental, and maritime policy and funding landscapes, particularly in, but not limited to, the UK and Europe.

[1] As with the name of our Centre, we use the term 'oceanography' in its widest sense to encompass all scientific disciplines concerning the ocean, sea floor, the solid earth beneath, and the life forms on and within.

[2] We have 550 staff, 750 undergraduate and postgraduate students, an annual turnover of £35 million ($US 70 million) and occupy a waterfront campus covering 5.0 hectares (12.3 acres) with 54,000 m^2 of internal space.

[3] The University of Southampton is one of the UK's top ten research-led Universities and is in the world's top 100 Universities. It has particular strengths in science, engineering and medicine.

[4] NERC is the UK's primary science funding agency responsible for supporting environmental sciences through its strategy *Next Generation Science for Planet Earth* (www.nerc.ac.uk).

[5] Our peer institutions include the Woods Hole Oceanographic Institution (USA), Scripps Institution of Oceanography (USA), IFM-GEOMAR (Germany), IFREMER (France), and JAMSTEC (Japan). Although many universities and other institutions in the UK and around the world excel in one or several of the oceanographic sciences, they generally have less scientific or mission breadth than the Centre.

[6] NERC's definition of 'national capability' encompasses those long-term activities required to support the health of the environmental science base so that it can deliver programmes of research. National capability includes (a) long-term observation, survey, mapping, scientific collections, community Earth system models and data management; (b) provision of major scientific services and facilities accessible to the whole community (e.g., research ships and shared-use equipment); (c) key skills and expertise to support the above including scientists and technologists to develop, manage, coordinate and deliver national and international scientific programmes; and (d) the provision of scientific advice and public good services to UK Government, overseas territories, business and the public.

Overall Goals

6. Our **science goal** is to discover fundamental knowledge and to develop understanding of how the ocean, sea floor, and their life forms function at all space and time-scales within the Earth system. We aspire to lead the world's pure and applied research agenda in most areas where we are active and to be among the best in the remainder. We regard no area of oceanography and marine geoscience to be out of bounds. By 2015 we aim to be the world's strongest and most innovative oceanographic institution. In pursuit of excellence, we will:

- tackle the **most challenging and pressing scientific questions**;
- work with the **international and national scientific community** to advocate and develop ambitious research programmes and provide major shared facilities;
- engage **private enterprise, government, non-governmental bodies, and the public** in the process and outcomes of science in the search for solutions to maximise societal and economic benefits, and;
- cultivate a student-centred, research-led **educational experience** drawing on all of the above.

7. As a science-led institution, our **organisational goal** is to integrate our wide range of functions to the maximum extent possible, so as to enhance the quality and effectiveness of each and to promote innovation by exploiting the beneficial synergies among them.

8. Our **communication goal** is to disseminate our science across the Centre, the University, the UK, and the world, because effective and efficient communication is vital to all aspects of the Centre's remit. Recognising that our web site is the primary conduit between the Centre and the world, we aspire to provide an outstanding web site.

Research

9. Our research spans enduring **environmental research themes** that underpin the priorities of many funders and research partners – some of our specific areas of expertise are noted below:

- **environmental change** – the role of the ocean in the climate system, climate and sea-level change (including past change), biological extinctions and radiations, ocean components of coupled climate models, air-sea interaction and climate quality data products, sustained ocean observing systems;
- **biodiversity** – deep sea and continental margin ecosystems including extreme environments;
- **whole Earth system** – ocean biogeochemical cycles and fluxes, geochemistry; deep Earth and crustal processes; ecosystem and Earth system modelling, air-sea, land-ocean, ocean-seafloor, ice-ocean interfaces;
- **natural hazards** – geo-hazards (tectonic processes, volcanism, submarine slides and tsunami generation), ocean models for improved forecast systems, extreme waves;
- **natural resources** – hydrocarbons, gas hydrates, minerals, deep-sea bio-resources;
- **health and well-being** – radiological protection, medical potential of deep sea biota;
- **technologies** – micro-sensors, deep-towed and autonomous platforms, system reliability, modelling and data analysis and assimilation technologies.

10. A common thread that runs through our current research and future aspirations is engagement with users of science in **developing solutions** to the most pressing problems facing humanity (solving problems manifested in the oceans, identifying solutions involving the oceans).

Research Priorities

11. In areas where we already **lead the world**, we will adopt a 'success breeds success' approach by investing in new resources to attract even more of the world's best researchers to work with us. These areas include:

- **ocean dynamics** – decadal-scale variability and trends in the Atlantic Meridional Overturning Circulation (MOC) from the MOC observing array, large scale mixing in the Southern Ocean, and air-sea interactions;
- **past (palaeo) climate and Earth system change** – major ancient climate-state transitions (greenhouse-ice-house in Eocene-Miocene time), prediction of future sea level change from the palaeo-record, and the nature of ocean biogeochemical cycling in a high CO_2 world;

We are investigating big research questions, including the following

1. How and why has climate changed through Earth history? What are the lessons from this palaeo-record for the future?
2. How are ocean circulation and climate linked? How might changes to the North Atlantic affect European climate?
3. What are the current and projected rates of change in sea-level? What will be the regional effects of sea-level change on coastlines and what are the socio-economic impacts?
4. What controls ocean biodiversity and ecosystem health? How will the biodiversity of the oceans alter with a changing climate?
5. What is the role of biological, chemical, physical and geological processes in the cycling of key elements and compounds, such as carbon, in the ocean and earth system? How will these processes react to a changing climate?
6. What are the mechanisms of the solid Earth cycle from plate formation to subduction, continental growth and break-up, and how do these processes influence the evolution of our planet?
7. What are the major natural hazards facing humankind? How can we improve hazard assessment and prediction?
8. How do we responsibly exploit natural resources?

- **application of seafloor controlled source electromagnetics** – continuing technology transfer related to direct detection of fluids beneath continental margins;
- **autonomous underwater vehicles (AUVs) and their use under ice** (see Technology Development and Support).

12. In areas where we **rank among the best in the world**, we will invest in developing our early and mid-career researchers for the future and engage more energetically in international programmes that set future research agendas. These areas encompass:

- **Integrated Ocean Drilling Program (IODP)**;
- **continental margin and subduction zone processes**;
- **deep sea and continental margin ecosystems**;
- **ocean ecosystem modelling**;
- **air-sea interaction**;
- **remote sensing**;
- **20th and 21st century sea-level change**;
- **probabilistic climate prediction**.

13. In areas where **significant activity is developing**, and which have the potential over the next three to five years to strengthen by step changes, we will first more effectively marshal and improve the visibility of current research throughout the Centre and the University, and then secure and use pump-priming funds to support development of new research proposals to increase activity. Priority areas include:

- **coastal and continental shelf sea systems** – integrated effects of coastal seas in the Earth system, marine spatial planning, coastal erosion, flooding, ecosystem change and impacts of climate change;
- **ocean modelling** – adopting the Nucleus for European Modelling of the Ocean (NEMO) for enhanced collaboration in coupled climate modelling (medium term) and unstructured-adaptive-grids for next-generation ocean modelling technology and embedding an ecosystem model into the latter to develop a world-leading coupled biological-physical ocean model.

14. In **novel and emerging fields**, our approach will be rapidly to build critical research masses by optimising existing intellectual capital in the Centre and the University as a whole.

Specific prospects apparent now are as follows:

- **Arctic Ocean** – physical and ecosystem dynamics, including implications of the 'New Arctic Ocean' (perhaps largely ice-free in summer by 2050);
- **ocean acidification** – impacts on ecosystems and biogeochemical cycling in the open ocean and deep sea, using sustained ocean observing, laboratory testing, earth system and ecosystem (pelagic and benthic) process modelling and experimentation, and learning from the palaeo-climate record;
- **energy from the sea** – sustainable hydrocarbon exploration, gas hydrate evaluation, marine renewable energy, algal bio-fuels;
- **bio-prospecting and proteomics** – building on our unique capabilities and technologies to access marine biota from isolated and

extreme environments and to exploit opportunities within the University Life Science Initiative;

- **deep sea observatories** – establishing these as a component of global *in situ* earth observing systems and working collaboratively within Europe, internationally and with private enterprise. Our particular interest is in potential deep sea observatories in the eastern Atlantic and Arctic Oceans;
- **marine policy, law and socio-economics** – drawing on our United Nations Convention on the Law of the Sea (UNCLOS) expertise, to work with legal and policy-making professions on horizon-scanning, and foresight of emergent societal challenges in the oceans, commonly stemming from global change and natural resource pressures;
- **geo-engineering evaluation** – testing and evaluating, through earth system models and field trials, ideas entailing human intervention in natural earth system feedback processes; carbon sequestration;
- **microsensors** – for *in situ* biological, chemical, and physical measurements in support of scientific programmes.

Sustained ocean observing

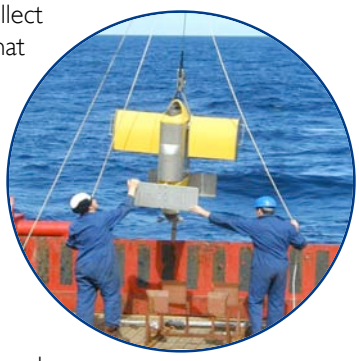
15. In the 21st century, a critical focus of environmental science concerns **decadal-time-scale** change and variability, including the possibility of rapid changes. Consequently, sustained ocean and seafloor observing systems are tools that are essential for the questions that we are addressing. We will:

- undertake sustained *in situ* ocean and satellite observing as a **core element of our mission**, mostly funded through our NERC National Capability stream within our Oceans 2025 and Rapid Watch programmes; and

- strongly advocate sustained *in situ* sea-floor, ocean, marine atmosphere and satellite observing by actively participating in the main **international and national bodies and networks** engaged in development and implementation of long-term observing.

Data in support of research

16. The data that we collect and data products that we generate are **irreplaceable assets**, and the starting point for all future knowledge exchange. As a national centre, we bear particular responsibility for exemplary data management. We will:



- engender stronger recognition within the **culture** of our researchers of the importance of long-term data management, and provide guidance on data management for all researchers, and set out benefits, responsibilities, good practice and the costs that should be included in funding bids;
- interact with the relevant NERC **designated data centres** and other national and international data providers to ensure that data provision matches the changing expectations of researchers;
- ensure that **our data** are available to the wider community, through the relevant NERC designated data centres, in a timely manner and with appropriate quality control and supporting information appropriate to their future use; and
- embed a team of **British Oceanographic Data Centre** (BODC) staff in the Centre by 2009, to provide a more effective link with our researchers and the new ways in which they expect to access and use data, and to ensure an effective direct link between BODC and the NERC research vessels.

Research environment

17. Our true strength and potential in several fields has yet to be realized because activity is dispersed across many researchers in different research groups, and would benefit from enhanced external and internal visibility and communication.

We will retain our discipline-based research groups as management units, but complement them by encouraging flexible, multi-disciplinary groups of researchers to self-assemble in '**Beacon Themes**'[7] that are focused on key scientific issues that become new research directions.

[7]Beacon Themes will be areas of research that span research disciplines and that cross existing Research Group structures. They will generally be underpinned by existing research expertise at NOCS. The diverse scope of activities at the Centre will allow scientists to explore these key areas in ways that might not otherwise be possible.

Beacon Themes are intended to foment creativity, foster transformative research, engender a greater sense of community among these researchers (including across the University more widely), encourage greater synthesis and communication of research between individuals and research groups, provide a supportive environment for exchange of ideas and development of research proposals, and improve the visibility of the totality of our research in these areas. Possible Beacon Themes include Coastal and Shelf Seas; the Arctic; Ocean Acidification; Energy and the Sea; Satellite Oceanography; Geo-engineering.

18. To significantly enhance visibility of our current research, we will make all of our published research papers more **accessible and visible** in a timely way via the Centre's web site. To support this, we require all of our researchers to self-archive their publications, using the University's institutional repository (eprints.soton.ac.uk).

19. As part of changes made by NERC to support delivery of its strategy, *Next Generation Science for Planet Earth*, we will from 2009 receive direct support from NERC in support of key national capability roles with all issue-led and responsive research won in open competition. We aim to:

- develop and maintain a **balanced, healthy and sustainable mix of research support** with funding from a more diverse range of UK Research Councils;
- lead development and execution of collaborative research projects won in open competition (e.g., NERC Consortium and NERC Research Programme, EC Framework Programmes) tackling global scientific problems. We expect over 50 per cent of our research funding to come from multi-institution collaborative proposals by 2010;
- increase the proportion of **income won from industry** to 20 per cent of the total research income by 2012;
- engage strongly with the University's **fundraising and philanthropic-giving** strategy;
- develop **a cross-Centre capital investment plan** for the Centre's own scientific equipment and facilities (i.e., outside the established National Marine Equipment Pool process) by 2009;
- implement cross-Centre **resource management processes** to ensure optimal use of research equipment, laboratories, and space commensurate with changing needs.

20. The ultimate test of success in the aims set out above is the **quality and impact of our research output**.

We will:

- assess the scientific quality and impact by using established **metrics**, including analysis of published output (e.g., impact factors, citations), PhD and EngD completions, measures of esteem of researchers, funding secured, and participation in international programmes. We will periodically benchmark ourselves within particular research areas, as well as relative to peer institutions;
- in terms of the wider relevance and uptake of our research by users, develop case studies in dialogue with stakeholders that illustrate how research has been used.

Technology Development and Support

21. Most major advances in oceanographic sciences have come from **technological innovations** that have enabled us to sample or sense the Earth in new ways or to reach previously inaccessible parts of the oceans. Moreover, to understand the role of the oceans in global change and to make useful predictions (with uncertainty estimates), we must combine information from diverse sources including satellite data, *in situ* measurements and models. This demands the development of new technologies including platforms, sensors, communications, algorithms and statistical techniques and the integration of these tools with models and databases.

22. We **lead the world** in:

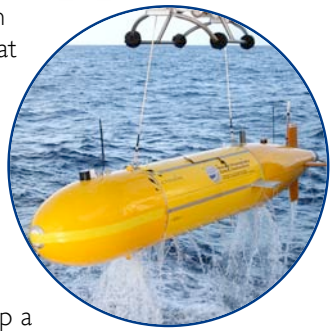
- **development of autonomous underwater (AUV) vehicle technologies**, and will develop Autosub-6000 for abyssal ocean and under-ice experiments in water depths up to 6000 m in 2010; test a prototype long-range, deep-diving AUV ready for long-path, long-endurance hydrographic applications in 2012; devise a system design for low-cost, but effective, air-deployed ocean microbots for large-scale synoptic surveys in 2012 and work on experimentation with gliders;
- ***in situ* miniature micro-chemical, biological, and physical sensors** development, including 'lab on a chip' devices. We will found the 'Marine Sensors Development Laboratory' (incorporating the Centre for Marine Microsystems) based on NERC Oceans 2025, EPSRC, and other funding with first prototype sensors ready for testing at sea in 2008.

23. In **emerging fields** we plan to:

- adopt concepts from the Semantic Web to provide web-enabled sensor networks;
- evaluate integration of AUV technology in deep sea cabled observatory systems;
- develop new satellite sensors, systems and the algorithms needed for the datasets generated in partnership with industry, space agencies and other institutes;
- develop new mathematical and data analysis tools such as for adaptive grid modelling and new earth observation algorithms.

24. It is important that technology development is driven by the right balance of 'science pull' and 'technology push', with emphasis on the former. We will:

- using **technology market place events**, identify and strengthen linkages and communication between researchers and technologists, both within and outside the Centre and in industry to ensure that the most challenging research questions provide the primary drive for technology innovation ('science pull') and that new and emerging technologies can be rapidly adapted for science ('technology push');



- engage with the wider scientific community to develop a **Technology Acquisition Plan** for both new developments and procurement of existing systems, to include estimates of cost, urgency, importance, and pervasiveness, together with an alternative provision analysis, a route to acquisition, and a champion;
- identify, and keep under **annual review**, the technologies and the supporting infrastructure needed for the short-, medium-, and long-term scientific needs of the Centre;
- ensure that the Underwater Systems Laboratory has **equivalent status as a research group** in the Centre with full participation in Centre-wide research discussions including representation on the Centre's Research Committee. We will support emergence of a wider Technology 'Beacon Theme';
- in recognition that support is needed for new ideas, consider the establishment of a **research and technology fund**, which will be used to pump-prime new initiatives.

25. Development and operation of major technologies requires key skills, critical mass, and long-term support. We intend to:

- use our NERC **national capability funding** stream to anchor the core skills and critical mass needed to sustain long-term technology development, support the wider scientific community with access to skilled engineers, technologists, and facilities, and as a platform for developing and delivering collaborative technology research programmes;
- **double our investment** of 2006 levels by 2009 in core technology development capability using NERC Oceans 2025 support;
- work with the other major Centres in Europe (particularly in the UK, France, and Germany) to ensure **maximum complementarity and interoperability** of the new systems that we are developing;
- **increase levels of non-NERC funding by 50 per cent** above 2006 levels by 2010, and diversify our sources of funding for blue-skies and applied technology development projects to include a balanced mix from Research Councils, EC and Industry.

Education

26. We have a critical role in educating future generations of scientists and informed citizens. We aim to deliver both **student-centred learning** (focussed on present and future student needs) and **research-led learning** (informed and delivered by those working at the frontiers of research).

27. Students that graduate from the University, having been trained at the Centre, should bear a unique hallmark that derives from the scope of what we do that no other university can offer. We aim to draw on the uniqueness of the Centre by:

- more proactively exposing students to the **full range of the Centre's mission** and facilities in the course of their studies, including our national capability roles such as marine facilities, data management, sustained observing, project coordination, international and stakeholder relations (e.g., through seminars, project work and work placement opportunities);
- encouraging more of our full-time **research staff to participate in the education mission**, particularly at postgraduate level;
- viewing and using our **data holdings** as an educational as well as research resource;
- improving our **web presence to aid recruitment** of potential students, to **provide information** to current students, and to **maintain relationships** with alumni.

28. Postgraduate students are our life-blood as well as catalysts for integration of research across the Centre. We presently educate approximately 100 PhD students, 50 Masters and 600 undergraduate students per year. We will ensure that PhD projects fit strategically with our key research priorities and will:

- develop the **Graduate School** as the best of its kind in the world and continue to develop it as the dynamo of the integrated research environment of the Centre;
- ensure PhD/EngD students are **members of research groups** and able to participate in Beacon Themes;
- **increase annual recruitment to MSc, MRes and PhD programmes** by 50 per cent above 2007 entry levels, by 2010, which will be achieved by supplementing Research Council sponsorship of research students with industrial project, foundation, and donor support on a long-term basis;
- vigorously apply for **Co-operative Award in Science & Engineering (CASE) research studentships** beyond the normal quota requirements;
- advance the NOCS **Studentship Scheme, increasing to four students per year**, with a review of its implementation;
- **boost numbers of Masters students** including those on integrated Masters courses, by encouraging our top students to transfer to the four year degree;
- on the basis of our National Centre position, **internationalise** the curriculum (particularly at postgraduate level) in specific areas by developing exchange programmes with major universities and centres in China, India, North America, Europe, Oceania, and Japan.

29. **Fieldwork**, including training at sea, is a key component of ocean and earth science education. We will:

- review fieldwork provision regularly to ensure that we meet requirements of accrediting professional bodies and needs of stakeholders;
- maximise the efficiency of fieldwork provision, whilst maintaining innovation and development in the fieldwork programme;
- continue advocacy with funding agencies and professional bodies for fuller recognition of the true costs of fieldwork and engage in fundraising to support this aspect of the student experience.

30. We aim to enhance the **employment** prospects of all our students. We will:

- develop a greater breadth of placement opportunities;
- engage a range of employers in curriculum design, especially those parts concerned with transferable skills (such as team-working, and project, financial, and change management);
- work with professional bodies to expand and improve our degree programmes that form part of professional accreditation schemes.

National Facilities

31. Oceanographic science is resource-intensive and depends heavily on infrastructure. Typically, both UK and worldwide infrastructure costs (ships, equipment, data management, specialist facilities) constitute 40-50 per cent of the total funding envelope for marine science.

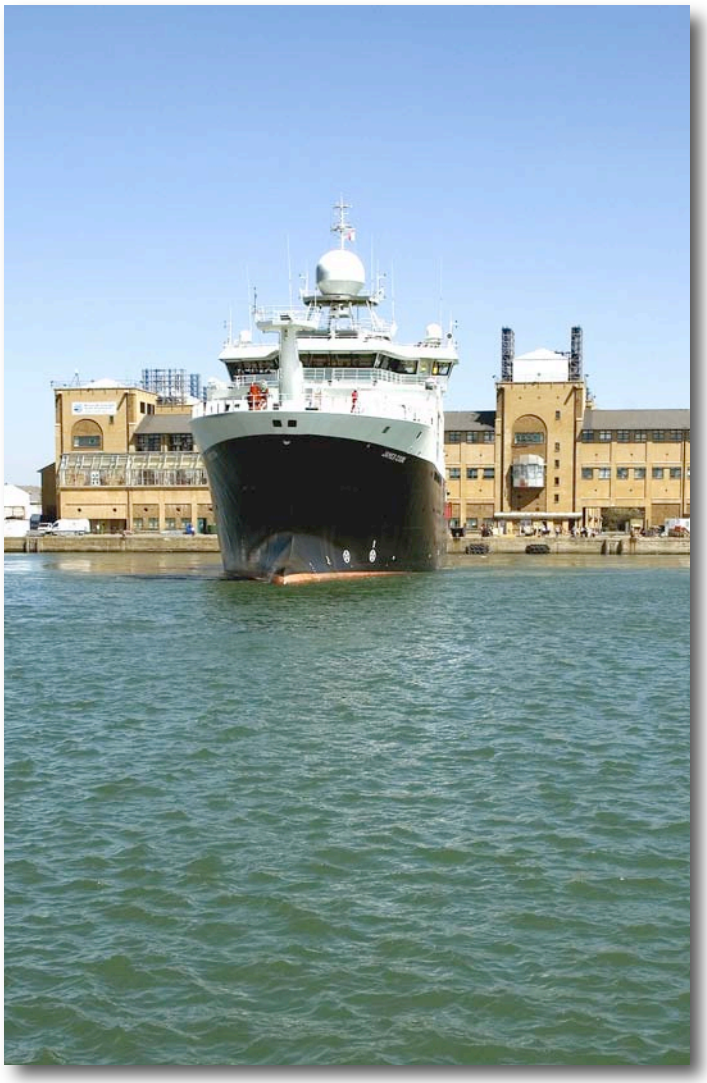
32. In delivering national capability and facilities on behalf of NERC for the entire scientific community, we will place increasing emphasis on continuous **innovation in both facilities and their mode of service delivery**. In particular, the research vessels will increasingly need to be viewed as platforms, not only for research, but also for sustained ocean observing, as well as training and public outreach.

33. We will:

- on behalf of NERC, provide access to **large specialised equipment** and other unique facilities and expertise in an impartial manner to meet the needs of the whole UK marine and earth science community which will be supported under our NERC national capability funding stream;
- maintain up-to-date **understanding of the user community's needs** through independent user-groups.

34. We aim that provision of marine facilities remains at the frontiers of innovation for the benefit of the UK scientific community. In particular, we aim to develop approaches that will result in **enhanced capability** for the benefit of the user community. In pursuit of this aim, we will (working with NERC where appropriate):

- explore international opportunities to increase access of UK researchers to large facilities, including maximising interoperability of research equipment across European research vessels;
- explore possibilities for greater cooperation amongst UK research vessel operators;
- innovate in further development of the new marine planning website in ways that enable users to have clear visibility of the cruise planning process and, through access to information, encourage greater collaboration within the scientific community;
- rapidly strengthen the relationship between National Marine Facilities Sea Systems and BODC to ensure that data management considerations are integral to cruise planning and that cruise data are transferred to BODC immediately upon completion of a cruise;
- ensure that UK research vessels contribute appropriately to integrating the world's research vessels into the global Earth observing system by the routine transmission of oceanographic data (underway and profile data) in near real time via the Global Telecommunications System (GTS) for operational use;
- work with the scientific community to deliver the RRS *Discovery* replacement project on time (first quarter 2012) and within budget;
- expand by 2010 the space available for core archiving and new analysis tools in the British Ocean Sediment Core Research Facility (BOSCORF);
- working with NERC, take a leading role in developing environmental protocols for research vessels.



Enabling Roles

35. We will continue to play our role in facilitating major international scientific programmes by hosting **international project offices**, particularly where they will be significantly enhanced and stimulated by proximity to active researchers working in fields relevant to the programme.

36. We aim to **facilitate** a collective and coordinated approach within the UK marine science and technology community to national and international policy initiatives and issues of common interest. We will:

- develop the role of the **National Marine Coordination Office (NMCO)** secretariat to facilitate regular strategic dialogue within the UK marine science community;
- work with our peers in Europe to initiate regular tri-lateral institutional-level dialogue among 'The G3' – the three largest oceanographic research institutions in Europe (NOCS, IFREMER, and IFM-GEOMAR) and to develop appropriate bi-lateral agreements with other key institutions;
- work closely with others in Europe (e.g., European Science Foundation Marine Board) to play an active role in bodies that enable the wider European marine science community to develop a more coherent voice on issues of common interest;

- work in international partnerships with similar institutes, coordinating bodies, and international organisations (e.g., Partnership for Observation of the Global Oceans (POGO), Group on Earth Observations (GEO), Global Climate Observing System (GCOS), World Meteorological Organization (WMO), Intergovernmental Oceanographic Commission (IOC)) to further the contribution of marine science and ocean observing to the understanding and prediction of global environmental change.

Knowledge Exchange

37. We aim to nurture and reward a **positive enterprise environment**, and to encourage a greater **entrepreneurial spirit** in Centre staff so that we are more naturally conscious of the commercial potential of scientific innovations and more confident in engaging in dialogue with private enterprise. To do this, we will:

- work with our parent organisations to clarify the ground rules for, and reduce barriers to, private consultancy, streamline schemes for rewards to inventors and entitlement to research leave, and facilitate short-term secondments to the commercial sector;
- improve access to training and development in key skills (e.g., intellectual property protection).

38. Working with the University, including through the Corporate Relations and Development offices, we aim to develop more **strategic relationships** with commercial partners and other users of science, enabling us to work together on topics of mutual benefit (research projects, professional development, student placement, staff exchanges, graduate recruitment, public engagement, and corporate social responsibility). We will:

- use databases so that we achieve a better strategic-level understanding of our multiple interactions with private enterprise and other stakeholders;
- work with the University's Development, Corporate Relationships, and Enterprise and Innovation teams to develop relationships with select companies, particularly those with established or developing interests in the energy, environment and leisure markets;
- strengthen relationships with the UK Met Office and its Hadley Centre through the National Centre for Ocean Forecasting (NCOF) and the NERC–Met Office joint climate research programme;
- aim to establish at least one new Knowledge Transfer Partnership per year.

39. Dialogue between scientists and wider society is a major priority for us and for many of our funders, and is important for broader visibility and societal impact. We aim to:

- **inspire** children to consider science as a career by: participating in the Science Ambassador Scheme; facilitating school visits; developing a structured work-experience programme by 2009; expanding innovative e-learning schemes for engaging children and teachers (e.g., classroom@sea); and developing partnerships with some of the key science learning centres;
- **raise the overall awareness** of the public to stimulate their natural interest by: increasing the overall visibility of the ocean sciences as a whole – aiming for an average of at least two positive marine science stories per month in international/national media; supporting our staff with media training; engaging with the local community (e.g., open days during Science and Engineering Week);
- **inform public debate** with independent comment concerning the scientific evidence base by: ensuring that Centre staff are familiar with the Royal Society's guidelines on responsibly communicating science to the public; engaging more proactively in making public comment on topical issues concerning the oceans by explanation of the science; sponsoring programmes of public lectures and facilitated public debates on major issues with emphasis on the underlying science.

40. In engaging with the public, our philosophy is that scientists themselves should explain their work, albeit supported by communications, marketing, and outreach **professionals** within the Centre.

People

41. We aim to advance a working environment that will make everyone in the Centre feel **valued, engaged, and motivated**. In particular, we will place increasing emphasis on valuing and developing leadership and management skills for those responsible for teams of people and will:

    - promote an inclusive culture that respects and draws strength from the **diversity** of its workforce;
    - ensure that everyone understands the vision and mission of the Centre and where each individual's specific contribution fits into that **bigger picture**;
    - ensure that all staff are **appraised** regularly, so that forward objectives are clear;
    - introduce a structured staff **development programme** and succession plan, involving all early and mid-career staff, that encompass the generic skills needed for leadership and management roles;
    - build a **greater sense of community** through facilitating better formal internal communication and informal interaction, including improving physical space and opportunities for both professional and social interaction.

42. As a research-led organisation we aim to attract and nurture the **best researchers, development engineers** and **innovators** in the world, and to stimulate international exchange of researchers. We intend to:

    - focus on recruiting **early- and mid-career researchers** who have the potential and opportunity to lead research within a Centre of international renown;
    - create a **Post-doctoral Fellowship Programme** by 2009 to attract the very best early career researchers into the Centre;
    - establish a **Visiting Researcher Programme** to enable scientists from across the globe to spend extended periods working in the Centre;

    - develop clear **career-path guidance** (particularly within the NERC Strategic Research Division), identifying what is required to pursue a 'prime mover' in contrast to a 'research support' career path;
    - target some recruitment at **interfaces among key disciplines**, which are important for promoting our priority science areas (notably the natural-social science interface).
    - infuse **numerical and statistical modelling skills** more pervasively across the Centre, taking these skills into account in recruitment on an 'all other things being equal' basis. Encourage more staff to acquire modelling skills through staff development.

43. We seek to develop lifelong relationships with our **alumni**, both as natural ambassadors for the Centre, as future supporters and as exemplars and role models to others of successful, fulfilling careers initiated or built here. To this end, we will improve our alumni data base and communicate regularly with alumni about the work of the Centre as part of the development and alumni relations remit

44. To measure our progress toward these aims, we will seek Investors in People accreditation or equivalent by the end of 2009

Supporting the Science

45. In order to deliver world-class research and technology, we need to be supported by a high quality professional support infrastructure that is fit for purpose. This team will **develop and implement** relevant resources, strategies policies and approaches in support of the delivery of this strategy.

46. Within the terms of the NERC/University Agreement[8], we will review the arrangements for **financial management** responsibility by mid-2008, with a view to focussing NERC financial management systems on the 'national capability' elements of our support.

47. Working with our parent organisations we will **maintain and develop our physical facilities** so that they develop to meet the advancing needs of a world-class institution. We will implement a **sustainable buildings policy** and achieve ISO14001[9] accreditation for our building environmental management systems in 2008.

48. We aim to improve meeting and **conference facilities** by 2010 to make it easier for us to host significant meetings in what should be a natural venue for the international scientific community. We will undertake progressive remodelling of space to enhance flexibility and to facilitate varied approaches to research and education.

49. Our decision-making processes aspire to be well-informed and our work culture aims to be **open and transparent**. Our business systems and support teams will work within an ethos of empowering managers to take timely, well-informed decisions, incorporating appropriate levels of risk, by being supported with robust, reliable information.

50. To support the Centre's aspirations, particularly in relation to research and education, we will seek an element of relatively unconstrained funding through **sponsorship and philanthropic giving**. We intend to use such support to make the critical difference in stimulating highly imaginative innovations in research, education, and outreach beyond that possible through traditional sources of funding. Our priorities are: a Fellowship Programme, Endowed Lectureships and Professorships, a Visiting Researcher Programme, Student Fieldwork Support and Conference Facilities.

51. We will continue to strengthen internal governance processes and our engagement with our independent **Advisory Council** as a voice for stakeholders on the strategic direction of the Centre.

[8]The governance, legal, and financial arrangements between NERC and the University of Southampton are detailed in the joint Agreement dated 29th June 2006 and 13th December 2006.

[9]ISO14001 is the recognised standard for effective environmental management.

Conclusion

52. The National Oceanography Centre, Southampton represents a major public investment in marine and Earth science and, after more than a decade, has a proven record of achievement. We will build on this and are eager to take on even more responsibility in pursuit of our intended purpose – to be the UK focus, providing international visibility, for all aspects of the oceanographic sciences. Now more than ever, our science is emerging as key to tackling the challenges of global change and natural resource exploitation facing humankind in the 21st century.

Acronyms

AUV	*Autonomous Underwater Vehicle*
BODC	*British Oceanographic Data Centre*
BOSCORF	*British Ocean Sediment Core Research Facility*
EPSRC	*Engineering and Physical Sciences Research Council*
IFREMER	*Institut Francais de Recherché pour l'Exploitation de la Mer (French Institute for Exploitation of the Sea)*
JAMSTEC	*Japan Agency for Marine-Earth Science and Technology*
IFM-GEOMAR	*Leibniz-Institut für Meereswissenschaften (Leibniz Institute of Marine Sciences at the University of Kiel)*
IODP	*Integrated Ocean Drilling Program*
MOC	*Meridional Overturning Circulation*
NMCO	*National Marine Co-ordination Office*
NCOF	*National Centre for Ocean Forecasting*
NEMO	*Nucleus for European Modelling of the Oceans*
NERC	*Natural Environment Research Council*
NOCS	*National Oceanography Centre, Southampton*
Oceans 2025	*NERC Strategic Research Programme in Marine Science 2007-2012 (www.oceans2025.org)*
UNCLOS	*United Nations Convention on the Law of the Sea*

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