

ANNUAL DELIVERY REPORT



Report for 2007/2008
July 2008

Images: The Environment Centre Wales, which opened in February 2008. This is a joint venture between NERC's CEH and Bangor University and received the highest environmental assessment rating for its design and construction

Executive Summary

The *Annual Delivery Report* is requested by DIUS as part of its performance management system for the Research Councils. The report focuses primarily on the outputs and outcomes from the NERC *Delivery Plan* and Scorecard for 2007/08 and complements the wider view of NERC investments and activities in the *Annual Report*, which is written for a general audience.

In addition to the *Delivery Plan* and scorecard information the *Annual Delivery Report* includes some of NERC's most important highlights from 2007/08 not captured by the scorecard. Top highlights for 2007/08 include; completion of the Environment Centre Wales, discovery of water on an extra-solar planet, and development and launch of the cross-Council programme *Living with Environmental Change* (LWEC).

On-going efforts by NERC to support and encourage knowledge exchange are also producing important results. Top knowledge exchange examples in this report include a spin-out company developed by a NERC-funded PhD student and his supervisors, which was sold for \$275 million; the successful launch of a service to quantify greenhouse gas emissions for a region by researchers at the Tyndall Centre; the guidance BGS scientists have produced on ground conditions for contractors building the Olympic park facilities for the 2012 games in London.

In November 2007 NERC launched its new strategy, *Next Generation Science for Planet Earth*, and new *Delivery Plan* and Scorecard for the Comprehensive Spending Review period (2008 – 2011). NERC has also developed new approaches to managing its delivery and performance against the strategy.

2007/08 also saw the restructuring of two of NERC's Research Centres. The Transition and Integration programme for the Centre for Ecology and Hydrology is on track and on target to succeed, and the British Geological Survey has developed a new operational structure taking account of the new NERC strategy and the changing needs of the centre's stakeholders. NERC has also initiated formation of the National Centre for Earth Observation.

NERC will continue to build on its successes through the activities proposed in its *Delivery Plan 2008 – 2011*, which include: being the lead Research Council in the interdisciplinary research and policy partnership for *Living with Environmental Change* and contributing to the delivery of the cross-Council programmes in *Energy, Nanoscience through Engineering to Application, Global Threats to Security, and Lifelong Health and Well-Being*, in collaboration with research councils and other partners.

Furthermore, economic impact and knowledge exchange continues to be a high priority for NERC in the new *Delivery Plan* and will be integrated within all of NERC's activities. NERC will seek to achieve a dramatic change in how NERC research is used through investment in activities to support this aim, and alignment of existing priorities with stakeholders. One important aspect of this will be to build a strong working relationship with the Technology Strategy Board (TSB) and NERC will collaborate with the TSB to further develop the Technology theme in the new strategy and increase business interactions with the environmental sciences community.

Finally, NERC will continue to ensure the long-term sustainability of the environmental science base through the period 2008 – 2011 and beyond. This includes NERC's continued commitment to pay 80% of the full economic costs of its research and to supporting the training and development of NERC people, supporting established researchers and encouraging young people to develop the skills required to support environmental science research into the future.

1. Introduction

A *Delivery Report* is presented to DIUS every year, reporting progress on activities contained in NERC's *Delivery Plan* and Scorecard for each of the three years following spending review 2004. This report covers the period 1 April 2007 to 31 March 2008. The *Delivery Report* complements the NERC *Annual Report* to Parliament, which describes selected achievements over the same period. The *Annual Report* highlights NERC's progress in delivering our strategy.

These and other NERC publications are available at www.nerc.ac.uk/publications, or call 01793 411750.

2. Highlights of the Year

This section provides some of the many highlights of the year which demonstrate the significant impact of NERC investments that are not covered by the NERC scorecard (see Progress against Targets on page 9). Further highlights can be found in the NERC *Annual Report 2007/08* and on the NERC website (www.nerc.ac.uk)

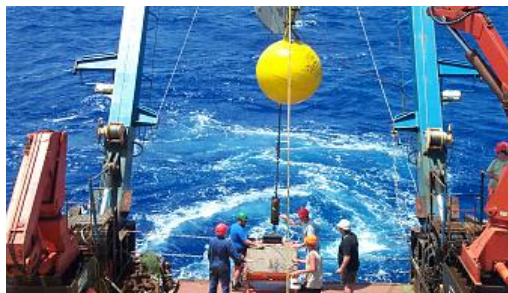
2.1 Strategic Science

2.1.1 Climate System

Rapid Climate Change

For the first time researchers have been able to gather precise knowledge about the daily, weekly and monthly variability of the ocean circulation largely responsible for north-west Europe's temperate climate - the Atlantic Meridional Overturning Circulation, or Atlantic Heat Conveyor. Two papers published in *Science* by researchers from NERC's *Rapid Climate Change* programme show that scientists could determine the average strength of the conveyor from 29 March 2004 to 31 March 2005. Both papers were included in the top ten papers of 2007 by *Nature*.

The former chairman of the Joint Scientific Committee of the *World Climate Research Programme* described the programme as 'a bold new initiative led by the UK Natural Environment Research Council'.



Low-level ozone stops plants absorbing CO₂

Collaborative research between scientists at the Centre for Ecology & Hydrology (CEH), the Met Office and the University of Exeter has demonstrated that an increased quantity of low-level ozone resulting from industrial emissions will significantly hamper plants' ability to absorb CO₂. The research, published in the journal *Nature*, shows that this will cause more of the greenhouse gas to accumulate in the atmosphere than previously estimated. This indirect effect of low-level ozone on climate could be at least as great as ozone's direct effect as a greenhouse gas.

Climate proxies throw up new uncertainty

Researchers at the Open University have direct evidence that variations in the magnesium/calcium ratio (Mg/Ca) within tiny shells of marine plankton are not controlled by changes in seawater temperature as the plankton move up and down the water column. This means that the Mg/Ca ratio of the shell is mainly regulated by the organism itself. The Mg/Ca ratio of shells is often used as a proxy for past ocean temperatures and so for past climate. It is now clear that scientists need a better understanding of this biological process to define precisely the relationship between temperature and shell Mg/Ca ratio, which is crucial for reconstructing past climates and predicting future climates. The researchers based their study on material recovered from one of the NERC's long-term ocean-monitoring stations.

2.1.2 Biodiversity

24-hour gene linked to seasonal clock

Researchers from the Universities of Leicester and Padova, Italy have discovered a molecular link between the internal 24-hour clock that drives an animal's daily rhythms and the seasonal clock that helps organisms adapt to the seasons. The discovery, published in the American journal *Science*, was made possible due to the discovery of a recent mutation in one species of fruit fly in southern Italy that made the particular species

better adapted to European seasons. The results provide an understanding of the molecular basis of a recent event that selected for a specific mutation: something that is rarely observed in nature.

Temperature threat to Antarctic marine life

Scientists from the British Antarctic Survey (BAS) have shown that many marine species in Antarctica may not survive long-term temperature rises. The scientists studied 14 species in Antarctica and showed that the maximum temperature rise an average species could survive for a year is just 2.4°C. The research shows that the effects of temperature change are complex, affecting not only survival rates, but also population reproductive capacity and food webs.

2.1.3 Sustainable Use of Natural Resources

Upland waters return to natural state

Falling levels of acid rain, not climate change, is causing upland waters to turn brown, say researchers from University College London (UCL), CEH, the Environmental Protection Agency in the United States, and international colleagues. Policies put in place in the 1970s have been successful in reducing acid rain, which has led to reduced acidity of soils. This means that organic matter becomes more soluble, and so more washes into rivers. It is this dissolved organic carbon that causes the brown colour. The results of the research suggest that surface waters are returning to a more natural condition.

Geologists help Olympic delivery authority

Contractors for the 2012 Olympics will use a detailed 3D geological model of the Olympic Park Development Zone, produced by the British Geological Survey (BGS), to guide the building project. The model can help locate ground conditions that may be difficult to build on by assessing the thickness, geometry and distribution of individual geological units. It can also identify potential threats to groundwater quality caused by construction.

2.1.4 Natural Hazards

Human population survived super-eruption

Tools discovered in southern India before and after one of the largest volcanic eruptions in human history indicate modern humans had settled the area much earlier than previously thought. The team working on NERC's *Environmental Factors in the Chronology of Human Evolution and Dispersal* programme found that the tools above and below the ash deposited by the Toba super-eruption 74,000 years ago bore remarkable similarities. This suggests that related, widespread groups inhabited the region before and after the eruption, and that the eruption may not have caused such populations to crash irreparably. The Toba super-eruption left Indonesia and much of southern Asia under a layer of ash 2.5 metres thick.

Low tsunami risk to the UK

Following the 2004 Indian Ocean tsunami, the Department for the Environment, Food and Rural Affairs (Defra) commissioned Proudman Oceanographic Laboratory (POL) to analyse the risk to the UK of an Atlantic Ocean tsunami caused by an earthquake. With help from geologists from BGS, the researchers examined the tsunami of 1755 that destroyed Lisbon and generated three-metre-high waves along the Cornish coast. They found that only one in six earthquake simulations produced waves as high as in 1755. Due to strong sea defences and distance from tsunami-generating regions, the UK is at quite low risk from tsunamis.

Summer floods

In 2007 NERC funded scientists in universities and its own research centres to investigate why Britain suffered severe floods in the summer of 2007 and whether climate change will bring more frequent and intense storms in the future. The research data they produce will help to underpin many of the flood forecasts and defence mechanisms provided by organisations such as the Environment Agency. A comprehensive report on the record-breaking summer 2007 floods was published by the *National Hydrological Monitoring Programme* (NHMP), operated by CEH and BGS. Despite saying that the flooding has 'no close modern parallel for the June-August period' the report goes on to state that '[The floods have] fuelled speculation that flood risk is increasing due to global warming. By their nature, however, any cluster of extreme hydrological events cannot readily be linked directly to climate change.'



2.1.5 Environment, Pollution and Human Health

New treatment for malaria?

As part of an international team, scientists at the NERC collaborative centre, the Scottish Association for Marine Science (SAMS) have identified algae found in coral from Australia's Sydney Harbour as an important evolutionary missing link. It bridges the gap between free-living photosynthetic marine plants and a large group of parasites, including the one responsible for malaria. The discovery could potentially lead to new treatments for malaria and other parasites: The alga contains chloroplasts – cellular structures where photosynthesis takes place in plants and algae. The malaria parasite contains remnants of these chloroplasts, known as apicoplasts but, because apicoplasts are not found in humans, scientists can target them in new malarial drug treatments.

Infectious parasites linked to economic growth

An experiment by scientists at the University of Sheffield, using moth larvae infected with a virus, has given the first empirical support for the idea that more connected human and agricultural populations will lead to the development of more infectious strains of parasites. This has implications for how society manages more virulent disease in human and wildlife populations. The lead author of the research said, 'As populations become more mixed, we might expect that not only will the extent of disease outbreaks increase, but also that more infective strains of parasites may emerge.'

2.1.6 Earth System Science

For the first time, researchers have discovered water in the atmosphere of a planet outside our own solar system. The discovery, using NASA's Spitzer telescope, was based on measurements of key wavelengths in the infrared region to pick out the unique signature of water. The planet, a gas giant similar to Jupiter, is 63 light-years from our sun and is named HD 189733b. Researchers from UCL created a highly accurate database of water absorption parameters across the infrared and visible parts of the electromagnetic spectrum, based on work developed under a NERC grant. This information is essential for climate change research, because water vapour is the most powerful greenhouse gas in the Earth's atmosphere: It absorbs both incoming sunlight, and heat leaving the Earth's surface. This database was used by researchers from the European Space Agency and NASA to locate water on the planet.

2.1.7 Technologies

Scientists carrying out the first direct investigation of the distribution and behaviour of the deepest-living fish have broken the world depth record for successfully operating an unmanned autonomous submersible. On 12 July 2007, one of two submersibles, specially built for the mission by engineers at OceanLab at the University of Aberdeen, reached a depth of 10,015m in the Tonga Trench in the South Pacific Ocean. This is just shy of the deepest point on the planet, the Challenger Deep, at 10,896m in the North Pacific. The research is being undertaken through a collaboration between OceanLab and the Universities of Tokyo, Japan and Tübingen, Germany and will continue in 2008.

2.2 Better Exploitation of Knowledge

In June 2007, Norwegian oil giant Petroleum Geo-Services (PGS) bought Scotland's largest academic spin-out company for \$275 million. The spin-out, formed just three years before, uses a new method to prospect for oil and gas deep beneath the ground. A NERC-funded PhD student and his supervisors invented the new system at the University of Edinburgh. MTEM Limited (Multichannel Transient ElectroMagnetics) used an electromagnetic system to detect variations in electrical resistance deep beneath the surface. This reduced the need to drill expensive and unproductive wells.

Protecting Norfolk's cliffs from erosion is increasing the flood risk of neighbouring low-lying lands, according to the Tyndall Coastal Simulator, which identifies how the future coastline will evolve as the climate changes. The simulator, developed by the Tyndall Centre for Climate Change Research and the Environment Agency, has also been used by scientists at POL to show how two realistic scenarios of future greenhouse gas emissions would affect the UK coastline. Both emissions scenarios showed that in a warmer world stronger, larger waves will reach the UK coast.

Regulators use marine reserves to prevent over-fishing and conserve biodiversity, but uncertainties remain about their ideal design. A European team, including a scientist from the Plymouth Marine Laboratory (PML), has shown that increasing the size of the zone in which fishing is banned (the no-take zone) increases the density of commercial fish stocks within the reserve. Increasing the area of limited fishing around the no-take

zone within the reserve (the buffer zone) results in fewer fish. They also showed the positive effects of marine reserves on commercial fish stocks and how species richness has increased since reserves have been set up. The research has strong implications for managing coastal areas.

Geologists and geophysicists at the National Oceanography Centre, Southampton (NOCS) have delivered independent scientific evidence to the United Nations that could have a major impact on the UK's territorial sovereignty. The UK's sovereignty includes a sizeable area of the seabed that forms the continental margin. According to the UN Convention on the Law of the Sea, a state has sovereign rights to a 200 nautical-mile Exclusive Economic Zone and beyond that, up to a further 150 nautical miles of continental shelf. NOCS staff led the UK technical team in preparing and presenting submissions to the UN which could secure UK sovereignty over continental shelf areas beyond 200 nautical miles.

2.3 Skilled People



Ice core scientists from BAS were joint winners of a major European science prize awarded by the European Commission. The *European Project for Ice Coring in Antarctica* (EPICA) – which retrieved two deep ice cores that have revealed how Earth's climate behaved over the last 800,000 years – was one of three projects to be awarded the 2007 Descartes Prize for excellence in collaborative research. Three winning trans-national research teams shared the €1.36 million prize.

In October 2007, the Nobel Peace Prize was awarded to the United Nation's Intergovernmental Panel on Climate Change (IPCC), along with the environmental campaigner Al Gore. Many NERC-funded experts contributed to the IPCC assessments, either directly or through the research they have carried out. The Prize was given for the IPCC's efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change.

2.4 National Capability: Facilities and Infrastructure

A new £113 million supercomputer, capable of 60 trillion calculations a second, officially opened in January 2008. The facility, known as HECToR (High-End Computing Terascale Resource), gives environmental researchers direct access to the most powerful computer in the UK – from a PC in their own office. The Chancellor of the Exchequer Alistair Darling officially opened the research council-funded facility at Edinburgh University. The HECToR team plan to keep pushing the computer's speed to the limits. While it starts out with a speed limit of 60 Teraflops, by October 2009 peak performance will hit 250 Teraflops. The HECToR service is funded by EPSRC (lead Council), NERC (22% partner) and BBSRC.

Prime Minister Gordon Brown officially opened the £7 million Environment Centre Wales, a collaboration between CEH and Bangor University, on 15 February 2008. 'You are drawing on the talents of people across this country and Europe. I believe this is a fine example of how cooperation in a major area of research should work in the future,' said the Prime Minister. The new building, a joint venture between NERC's CEH and Bangor University, complies with the highest environmental standards of the Building Research Establishment (BRE) for its design and construction; and was rated 'Excellent' using the BRE Environmental Assessment Method (BREEAM). The new building houses the Director of the newly created Wales Environment Research Hub, funded by the Welsh Assembly Government.

2.5 Partnerships

In 2007/08 NERC led the creation and development of the 17-partner, £1 billion, collaborative research-policy programme *Living With Environmental Change* (LWEC). Partners include the six Research Councils, Governments Departments and related agencies. A governing body consisting of all of the partners, and independently chaired by Lord Selborne, was formed and has agreed collaborative ways of working, joint strategic objectives, and a commitment to delivering a programme against these. The LWEC programme forms a significant part of the Research Council activities supported through the CSR2007 settlement. LWEC aims to provide the required predictive science, solutions and business opportunities to increase resilience to - and reduce the economic costs of - environmental change. Further details can be found at www.lwec.org.uk.

Nanoparticles in rivers can cause brain damage in fish and alter their behaviour, according to scientists working on the Environmental Nanoscience Initiative. The research is the first evidence of the adverse

effects of nanoparticles, such as carbon nanotubes – tiny, hollow tubes used by the electronics industry – on wildlife. The research was led through the University of Plymouth, who found that ‘fish showed quite extraordinarily aggressive behaviour.’ Nanoparticles can enter the environment through sewage works. Concentrations in rivers are minute, but can accumulate. The team’s research fed into a Defra report on the known dangers of nanomaterials. The report sets out the UK’s position for the Organisation for Economic Co-operation and Development (OECD). NERC will invest up to £2m over the CSR period in the cross-council *NanoScience through Engineering to Application* programme. This will build on the research capacity developed through the *Environmental Nanoscience Initiative*, a collaboration between research councils and government departments and agencies.

For the second time, the UK Energy Research Centre’s Meeting Place organised a workshop attended by a high-profile international group of energy experts. The results of this meeting are feeding into the G8 decision-making process in Japan in 2008. The Meeting Place brings together UK researchers, stakeholders and overseas experts to develop solutions and further the energy debate. It promotes interdisciplinary working and provides a forum for collaborative projects addressing key issues. In its first four years of operation, the venue has attracted more than 3000 people from 35 countries. NERC will invest £22m over the CSR period in the cross-council Energy programme. This will include a commitment of up to £4m in phase two of the cross-council initiative, the UK Energy Research Centre.

An international team has created the most geographically accurate, true-colour satellite photograph ever made of Antarctica as part of International Polar Year. The mosaic, a collaboration between BAS, NASA, the National Science Foundation and the US Geological Survey, is made up of more than a thousand images from over three years of satellite observations and will be freely available online.

A BAS scientist said, ‘It will deliver the best satellite images of the entire continent. It has a 15-metre pixel resolution so the detail is stunning... The dataset has a range of applications in glaciology and geology.’



Cities all over Europe are queuing up for a new service that quantifies greenhouse gas emissions across a region’s industries and economic sectors. Four regions in Europe have already applied the new service from the Tyndall Centre for Climate Change Research at Manchester University. A further 21 regions are next in line, including ten capital cities: Madrid, Paris, Stockholm, Helsinki, Brussels, Athens, London, Oslo, Moscow, and Ljubljana. The system makes it easy for policy-makers, regulators and industry to produce energy scenarios for emissions reductions based on their own expertise and understanding. The system, known as GRIP (the Greenhouse Gas Regional Inventory Protocol) was co-funded by the Tyndall Centre, the Environment Agency, and a researcher as part of his PhD. A new company, carbon captured ltd, was founded in 2008 to meet further demand.

3. Science in Society

NERC continues to deliver much of its science in society activity through the RCUK Science in Society Unit. In this way NERC contributes to supporting researchers to work with schools through the Researchers in Residence scheme and involves students in research through support for CREST (Creativity in Science and Technology) and the Nuffield Science Bursary schemes. NERC also supports continuing professional development for teachers. NERC’s own training course on communicating science to the public remains extremely popular and is enthusiastically received by the NERC-funded researchers who attend it.



Public engagement remains high on NERC’s agenda. The research centres have delivered a wide variety of engaging activities for the public and school children, with a focus on their own science areas and involving both local and national audiences. NERC has supported a number of public exhibits, for example at the BA Festival of Science in York and in the W5 science discovery centre in Belfast. Working together with BAS NOCS and researchers from Higher Education Institutions (HEIs), NERC exhibited at the Royal Society Summer show in July 2007. The ‘Polar Meltdown’ exhibit highlighted science about shrinking ice sheets, rising sea levels, greenhouse gases and a warmer world and recorded nearly 5000 visitors.

Review of the NERC Science in Society strategy is ongoing. The strategic aims have already been aligned with the refreshed RCUK strategy and NERC is keen to support the aims of the DIUS strategy for Science in Society. This will form an integral part of NERC's overall external communications strategy. NERC is also increasing its dialogue with major stakeholders, including the public. Following an open consultation on the new NERC strategy we are planning several major community events in 2008/09. These events will enable researchers and stakeholders to engage in the development of plans for delivering the new strategy.

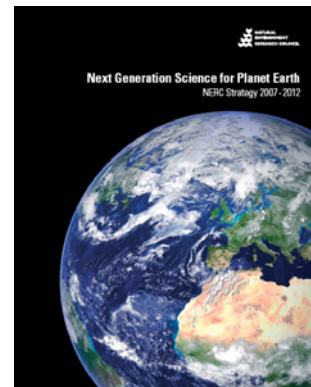
4. Progress in Management

4.1 Strategy & Delivery

NERC's new strategy, '*Next Generation Science for Planet Earth*', was launched on the 15th November 2007. The strategy tackles some of the most important environmental challenges that face society. The strategy will be dynamic; regularly refreshed and updated in consultation with stakeholders. NERC's strategy can be found at:

<http://www.nerc.ac.uk/about/strategy/ngscience.asp>

In parallel to developing *Next Generation Science for Planet Earth*, NERC has developed a new approach to managing delivery and performance of the strategy. This includes; the development of the Strategic Management Tool (SMT) to provide a single place to manage NERC's progress in delivering the new strategy, and help facilitate and inform NERC's decision-making; and new processes for managing and funding science include two new funding modes, *research programmes* and *national capability*. Further details can be found at: <http://www.nerc.ac.uk/about/delivery/processes/strategicmanagement.asp>.



In December 2007, NERC published its latest Delivery Plan setting out what NERC intends to achieve during the CSR2007 period 2008-11. The plan is aligned to NERC's new strategy, HM Treasury's fifth public policy challenge for the Comprehensive Spending Review 2007 (CSR), and the Department for Innovation, Universities and Skills' strategic objectives.

4.2 Organisational Changes

The RCUK Shared Services Centre (SSC) Project is now well into the detailed design phase. Although progress is slower than originally planned, the delays to the Conference Room Pilots process and any subsequent delay to the project, can be used positively to ensure that the business solutions implemented are of the necessary quality and that benefits are realised. On the 1st April 2008, over 100 NERC Staff transferred from NERC to SSC Ltd employment under the TUPE legislation.

Work to reshape CEH through its Transition and Integration Programme has progressed well throughout 2007/08. Office and laboratory facilities have been refurbished and new facilities have been built, including the Environment Centre Wales, which was opened by the Prime Minister in February 2008 (see front cover). Three sites have been decommissioned and a redundancy round has been completed; most of the key staff have been retained and a new business development team has been created. The Transition and Integration Programme was judged to be very well managed and likely to succeed by an independent Office of Government Commerce (OGC) Gateway Review in summer 2007.

A new operational structure for the future delivery of science and information was implemented at BGS in April 2008, arising from a review of the Centre's mission, governance and organisational structure in the light of the new NERC science strategy, the government review on research centres' governance (Costigan, 2006) and the evolving needs of its stakeholders. The change in organisational structure seeks to maintain BGS' position as a world leading geological survey, especially in shallow subsurface modelling, but improve its scientific output and its ability to adapt to changing national and international geoscientific needs.

4.3 New Strategic Investments

NERC has agreed funding for Phase II of the UK *Integrated Ocean Drilling Program* (IODP). NERC will provide £7m investment over the next five years to enable the UK to maintain influence within IODP. Overall NERC's investment in IODP will be £12.6m over the CSR period.





NERC's new National Centre for Earth Observation (NCEO) began in April 2008 following approval of the science programme and funding allocation for the centre by NERC Council in February 2008. The NCEO is taking forward and adding to key elements from the previous NERC Earth Observation Centres of Excellence, with the aim of exploiting data from earth observation satellites, including those which monitor global and regional changes in the environment, to address a range of key NERC science questions. The centre also includes wider, national earth observation activities such as technology development, mission support, and post-launch support activities (in the context of NERC's considerable international investments, e.g. through the European Space Agency).

The Oceans 2025 programme has successfully completed its start-up year, bringing together strategic marine research at seven NERC-funded centres (NOCS, POL, PML, SAMS, the Sea Mammal Research Unit - SMRU, the Marine Biological Association – MBA, and the Sir Alister Hardy Foundation for Marine Science - SAHFOS). All of the programme's scientific activities are underway, and coordination mechanisms have been established - these are comprised of an Executive Board, Advisory Board and Science Coordinator, working closely with the National Marine Coordination Office. Strong links to major stakeholders have been developed, with University engagement achieved through Strategic Ocean Funding Initiative (SOFI) awards. Six other partnership awards have been made through the Sustainable Marine Bioresources programme. The Oceans 2025 Implementation Plan is online at www.oceans2025.org, and includes regularly updated status summaries on the programme's science components.

4.4 Generating Knowledge

Responsive mode grant applications to NERC are now required to include knowledge exchange (KE) plans, relevant to the nature of the proposal, for any proposals submitted since March 2008. This is to encourage researchers to embed plans for KE within initial planning for all NERC research investments with the aim of increasing the impact of NERC-funded research in future.

In 2007, NERC launched a new service to collect for the first time all published academic papers from NERC's research centres. The NERC Open Research Archive, or NORA, is an online repository for storing the research outputs from the British Antarctic Survey, the British Geological Survey, the Centre for Ecology and Hydrology and the Proudman Oceanographic Laboratory. The repository now has over 2000 entries, mainly from 2007 and 2008, but it holds information on research papers published as far back as 1972. The service is managed by library staff from all four NERC centres and is free to submit and browse.

In 2007/08, NERC committed just under £500k through the Follow-on Fund; representing a significant increase over previous years. The scheme aims to support the commercialisation of ideas arising from research funded by four of the research councils (NERC, BBSRC, EPSRC, and STFC). The new Follow-on Fund Pathfinder scheme was launched towards the end of 2007/08 alongside the main Follow-on fund scheme. The purpose of Pathfinder grants is to provide small amounts of funding (up to £20k per grant) for short projects such as initial market assessment. It is hoped that this will promote better understanding of commercialisation issues and increase the quality of subsequent full applications.

Follow-on funding awarded to a team at Lancaster University allowed researchers to further develop a technique, using the naturally occurring pesticide jasmonic acid, to confer long-term protection to crops. The pesticide also has low toxicity and is rapidly broken down in the environment. A patent was awarded in 2006 and in 2007 the technology was assigned (a transfer of ownership in exchange for royalty payments) to Plant Bioscience Ltd.

The bioremediation company Microbial Solutions Ltd has successfully raised £1.2 million to develop industrial applications of research carried out at CEH. NERC's Commercialisation Team has collaborated with the Oxford-based firm H2O Venture Partners to develop the project. The company relies on bacteria that can break down toxic chemicals used in the aerospace and car manufacturing industries to safely treat toxic metalworking fluids in an environmentally friendly way. The metalworking-fluids treatment market in Europe is estimated to be worth \$1 billion.

5. The Efficiency Programme

The Research Councils are required to find annual Gershon efficiency savings of £170m per annum by 2007/2008, compared to a 2004/2005 base year; of which NERC's annual target was £5.71m in 2005/2006, rising to £12.12m in 2006/2007 and £17.29m by 2007/2008. Of this, 50% is required to be cashable in nature (available for reinvestment into priority areas).

During 2007/2008 NERC declared savings of £26.765m (45% cashable), comprising the following:

- a. £6,633k by increasing the level of co-funding of research;
- b. £14,723k through the effective reprioritisation of science;
- c. £5,127k by increasing the efficiency of NERC research centres;
- d. £282k by centralising some financial functions and improving site utilisation.

Research centre efficiencies include the sale of three sites (Earlyburn, Merlewood and Banchory) during 2007/2008, and ongoing procurement savings on the countryside data capture survey software. Co-funding includes all new contract research won by NERC research centres during SR2004, demonstrating the leverage engendered by the Science Budget.

6. Progress against Targets

In 2007/08 the NERC Scorecard set out 79 targets for the 2004 spending review period (cascading from the 50 deliverables set out in the Delivery Plan). Details of the colour-coding used by NERC can be found at Annex A to this report. The full NERC scorecard for 2007/08 can be found on the NERC website at: <http://www.nerc.ac.uk/about/perform/documents/scorecard200705.pdf>.

Number of Targets: 79			
Green (on-going beyond scorecard period)	12	Completed	62
Amber	5	Red	0

6.1 Green/Completed Targets

62 scorecard targets have now been completed and twelve are on-going beyond the end of the scorecard period. Of those that were concluded in 2007/08, notable successes include:

Science

Researchers from POL have successfully set up equipment at three sites in the Antarctic to provide real-time sea-level information to monitor the role of the Antarctic Circumpolar Current (ACC) in climate change: <http://www.pol.ac.uk/ntslf/networks.html#SA>. (Target 2.5)

NERC Council agreed funding for RAPID-WATCH 2007-2014, for the redeployment of the trans-Atlantic RAPID observing system and the Western Boundary WAVE array, and work to redeploy the sensors in collaboration with international funders began in April 2008. This will deliver a decade-long time series of the strength and structure of the Atlantic Meridional Overturning Circulation. (Target 3.1)

BGS has initiated a programme of multi-beam surveys of the UK continental shelf to generate new knowledge of the marine landscape (sea bed) and near shore environment. This work in partnership with marine mapping agencies will help to underpin marine management objectives. (Target 9.3)

The Technology Management Plan was published on 15th November 2007. The plan will guide Council's investments in using and developing new technologies and complements the new Technologies theme. Implementation is already underway by the Theme Leader for Technologies and through the new NERC funding stream for National Capability. (Target 17.1)

Knowledge

NERC contributed to the Earth observation element of the UK Civil Space Strategy 2008-2012, which addresses many of the issues raised in the House of Commons Select Committee Inquiry into UK Space Policy report. In particular, NERC has established the new UK Centre for Earth Observation Instrumentation in partnership with DIUS, and launched the National Centre for Earth Observation in April 2008. (Target 47.1)

In 2007/08, NERC's external income from provision of valuable services to the public and private sector is forecast to be £56m gross, and £47m net (which excludes £9m income from other government bodies) against a target of £40-50m per annum. (Target 38.1)

NERC successfully increase revenues from data sales and products in 2007/08 to exceed a target of £3.5m per annum. Latest (unaudited) figures show software & data sales of £3,128k, royalties & license fees from intellectual property of £2,768k and sale of products worth £76k. The majority of royalties and license fees from intellectual property are data-related, and hence the target has been comfortably met. (Target 39.1)

People

In the 2nd quarter of 2007/08, NERC, with ESRC, funded 20 interdisciplinary studentships; 14 of which had some relevance to LWEC. Further training elements of LWEC are also being designed. It was agreed in October 2007 that computational training will be an important element of any joint programme with Microsoft Research. The DFID/ESRC/NERC component of LWEC, Ecosystem Services & Poverty Alleviation, will also include a range of training activities. (Targets 4.1, 23.2)

Research Facilities and Equipment

The science and business cases for the replacement of the RRS Discovery were approved in the third and fourth quarters of 2007/08. The project has entered into a procurement stage where shipyards will be sought and invited to bid via the Official Journal of the European Union (OJEU) process. (Target 49.1)

Partnerships

In partnership with the then Department for Trade and Industry (DTI, now DIUS - Department for Innovation, Universities and Skills), NERC established the new Centre for Earth Observation Instrumentation, which started work on 1st April 2007. The Centre is led by Astrium Ltd., who is working in partnership with the University of Leicester, QinetiQ Ltd. and the Science and Technology Facilities Council (STFC) Rutherford Appleton Laboratory. (Target 15.2)

6.2 Amber Targets

NERC had five amber targets at the end of the SR2004 scorecard period, and no red targets. The five amber targets are where the target may not have been achieved on time or there had been other problems, the amber targets were:

- FREE Programme - Not all the funds were allocated in the third funding round. Options are being explored with stakeholders to allocate these funds as part of the FREE programme's planned KT activities. (Target 6.1)
- Construction of Halley VI -The first season's construction on the ice was a great success. However, the production of cladding panels in South Africa remains problematic and will force a delay in the remaining construction from the 2008/09 season to 2009/10. Project planning has been adjusted to minimise the cost increase and impact on the science. (Target 29.1)
- Public consultation -There are no immediate plans for a public consultation but the concept for the new website, Planet Earth Online, which is currently being developed, includes plans for facilitating public debate through this medium. (Target 35.1)
- Establish a pilot-scale brokerage unit to facilitate knowledge transfer -The outline tender for a London Environment Network is in the *Official Journal of the European Union* (OJEU). Short-listing for interview will be made in July. (Target 44.1)
- Piloting of the new Shared Services Centre processes - The RCUK Project Board has changed the implementation timescales and is placing emphasis on the approach to quality within the project. These new measures, once fully in place, should ensure that the Research Councils are able to achieve the long term benefits within the full business case. (Target 48.1)

7. Recent Successes from Outputs 1 and 2

The NERC Economic Impact Framework reports some notable successes for 2007/08:

- Two spin-out companies established, two major licence agreements signed and 10 patents filed
- A university spin-out arising from a 1999 NERC-funded PhD has been sold for \$275m

- There were 6,960 publications from NERC funded research, growth of +5% in two years
- 49% of refereed ISI journal publications were internationally co-authored, up +11% in two years
- 957 occasions where advice given to Government, growth of +28% in two years
- 371 Masters studentships were funded, growth +10% in two years
- Gershon cumulative efficiency savings totalled £26.77m

8. Future Activities on the Economic Impact Reporting Framework

During 2007/08 NERC has worked with DIUS to develop a new Delivery Plan and Scorecard for the CSR2007 period. This scorecard is based on the eighteen Strategic Objectives and associated activities from NERC's Strategic Management Tool. Examples of activities that relate to the Economic Impact Reporting Framework are set out below:

- *Develop skilled people (to ensure a healthy environmental science base) to meet future science priorities (SMT Objective 14); including a project to review NERC's and the UK's training priorities and identify future skills gaps.*
- *Ensure that NERC's national capability meets the needs of current priorities (SMT Objective 16); including establishment of a National Capability Advisory Group (NCAG) to maintain an overview of NERC's portfolio of National Capability (NC) and horizon scan future NC needs and opportunities. Council will also agree a definition of national good and prioritise areas of national good relevant to NERC.*
- *Strategic partnerships with key UK and international organisations are supporting research delivery (SMT Objective 1); NERC will be the lead Research Council in the interdisciplinary research and policy partnership for LWEC and will make significant investments in other cross-Council programmes in Energy, Nanoscience through Engineering to Application, Global Threats to Security, and Lifelong Health and Well-Being.*
- *Establish a culture of knowledge exchange between NERC and stakeholders and ensure knowledge generated from NERC-funded science, and data and information holdings, are communicated and used (SMT Objective 3); including identification of areas of knowledge exchange need, embedding public engagement activities in all of NERC's major strategic research programmes, launching the Science Impacts database and publishing an annual Economic Impact Report, and working with the Technology Strategy Board (TSB) to increase business interaction with the environmental science community. NERC will also work with stakeholders (including government, regulators, industry, NGOs and society) to identify their needs and ways in which they can contribute to research.*

9. Summary Financial Table

	Outturn	Science Budget	Variance
	£k	£k	£k
RESOURCE DEL (Departmental Expenditure Limit)			
Income			
Pay related receipts	-23,074	-20,341	-2,733
Receipts for goods and services	-30,754	-28,839	-1,915
Interest Receivable	-56	0	-56
EU Receipts	-3,490	-2,964	-526
Expenditure			
Pay Costs	115,883	114,911	972
Current expenditure on goods and services	94,408	91,211	3,197
Current Grants			
Current grants	125,025	129,675	-4,650
Current grants - overseas	38,660	37,196	1,464
Interest on Assets			
Interest payable on finance leases (PFI)	1,320	1,320	0
TOTAL NEAR CASH	317,922	322,169	-4,247
Non Cash Costs			
Cost of Capital charges	8,933	8,669	264
Movement in provisions	-8,178	-9,715	1,537
Depreciation on tangibles	23,510	21,200	2,310
TOTAL NON CASH	24,265	20,154	4,111
TOTAL RESOURCE DEL	342,187	342,323	-136
CAPITAL DEL			
Capital Grants			
Capital grants	3,849	3,178	671
Capital grants - overseas	7,800	8,000	-200
TOTAL CAPITAL GRANTS	11,649	11,178	471
Direct capital expenditure			
Additions - Buildings	19,027	21,966	-2,939
Book value on disposal of buildings	1,069	620	449
Additions - other assets	17,923	14,758	3,165
Profit and loss on disposal			
Profit/loss on disposal of buildings	-2,997	-1,708	-1,289
TOTAL CAPITAL	35,022	35,636	-614
TOTAL CAPITAL DEL	46,671	46,814	-143
CAPITAL AME (Annually Managed Expenditure)			
Impairments			
Write-offs/Write-downs (Impairments) - AME	5,359	2,000	3,359
TOTAL CAPITAL AME	5,359	2,000	3,359

Note: In double entry accounting, expenditure is shown as debit entry, while income is shown as a credit entry. If shown in the same column, income will be a negative.

Annex A - Definition of the traffic light system for progress reporting

Red	Outside boundary condition, action required. There has been no progress on target, or, if work on the target has started, it is likely that the target will not be delivered in specified financial year. The delivery date and/or the detail in the target may have to be changed substantially.
Amber	Some deviation from plan, action taken. Progress is being made but the target may not be delivered on time or there have been or will be other problems. Some aspects of the work (e.g. delivery date) may have to be changed to ensure delivery of the target.
Green	Proceeding to plan, no action required. Progress on the target is as planned and no problems are envisaged
Blue	Completed. Once a target is marked as completed, no further progress updates are provided.