Driving Innovation through Collaboration

PROGRESS AND IMPACTS
Welcome to this report aimed at showcasing some of the exceptional results GWR has achieved during Phase 1 of the project, facilitating and funding collaborative research programs between University research teams in the South West and businesses.

Since 2006 GWR has been supporting innovative research projects at South West Universities by providing matched funding for collaborative PhD studentships, by fully funding research fellowships and by providing postgraduate training.

In Phase 1, with the support of the South West Regional Development Agency, we were able to offer up to 50% funding for 130 PhD collaborative studentships, subsequently securing match-funding of over £3m from businesses across the South West. This resulted in many new and productive relationships between University research teams and South West businesses, and almost 1,000 peer-reviewed research publications and communications.

With the support of the Higher Education Funding Council for England, we fully funded 20 full-time 3 year Research Fellowships, and established a postgraduate training network in the South West, investing £1.2m in video conferencing technology at 6 institutions.

With the support of hundreds of academic staff, research students, Research Fellows, university senior managers and businesses across the South West we have succeeded in fostering a culture of collaboration, both between university research teams and between these teams and businesses, which we believe is unique in the UK.

Many supervisors of GWR Projects have commented that the initiative gave them the opportunity to pursue research which did not fit into the “classic funding models” available, and that their GWR projects often led to follow on funding once initial results had been obtained, thus establishing new productive research themes.

Our funding of innovative research proposals also allowed the foundation stones to be laid for larger collaborative endeavours between research partners and provided the initial critical mass for the development of new research clusters.

We are continuing to support innovative research programs at PhD level across the South West as we move forward into Phase 2 of GWR by working closely with the research intensive Universities and other partners. The GWR model for joint supervision of PhD students has been approved by the European Social Fund as a mechanism to deliver 40 new PhD research programs at the Combined Universities in Cornwall, and GWR is currently managing these studentships. Moreover, GWR are working with the new ESRC funded South West Doctoral Training Centre to deliver a range of collaborative studentships.

I hope you enjoy reading about the GWR projects which are presented here and that you agree with me that the investment made in the GWR approach to collaborative research by both public funding bodies and businesses in during Phase I paid dividends to all of our stakeholders and partners, and will continue to do so as we move forward into the next Phase of the GWR project.

David Billington PhD DSc, Executive Director, Great Western Research
The impact of Great Western Research

Snapshot

Over 100 businesses, from multinational corporations to SMEs, co-funded PhD programs.

£24 million of additional research as a consequence of GWR funded research programs.

Over £23 million of consortium research funding and venture capital raised.

GWR researchers published over 360 journal papers and made 590 conference presentations.

GWR invested £1.2 million in the creation of 10 training nodes at 6 institutions across the South West.

Great Western Research (GWR) is a consortium of the Universities and HEIs in the South West of England, created in 2006 to promote innovative research collaborations between University groups, and between these groups and businesses.

The impact of GWR has been significant. In phase I, via 130 studentships and 20 Research Fellowships, over £45 million of additional funding was channelled to Universities in the region as a result of collaborative research with forward looking businesses. These creative projects helped strengthen relationships between the partner Universities, and helped ensure creative and research-led businesses in the South West were able to forge closer links with some of the foremost academics in the world. New ideas, new technologies and new processes have emerged from the 150 research projects initiated by GWR.

One of the major impacts of the collaborative research process has been less tangible, but no less important. Some 222 new links and networks with institutions and potential collaborators have been established, from Tokyo University to NASA, benefitting both academics and businesses in the South West. Indeed, new collaborative networks have allowed the results of research to be disseminated widely. For example, informing public policy, inputting into business strategic planning and providing the foundation for obtaining new investment.

Due in part to the climate of trust and openness that working together on GWR projects has engendered, strategic discussions at PVC/DVC level now regularly take place between the leading institutions in the South West regarding alignment of research strategies, complimentary purchases of large instruments and joint bids to major research initiatives.
Participation in GWR funded Studentships and Fellowships has been catalytic in establishing many long-term relationships between research groups and businesses.

Discussions during the establishment of GWR projects often led to the discovery and promotion of complementary research interests at Universities across the South West.

Initial GWR funding enabled the establishment of a critical mass of researchers in several areas, which then led to results which generated substantial follow-on funding for research in the area.

GWR was able to fund innovative speculative research projects, which did not easily fit into classical funding streams, thus establishing valuable footholds in new areas for the research groups concerned.

Participation in GWR events and training has led to researchers and research groups developing a clearer mutual understanding of their individual strengths, skills and interests.

**Added value**

The confidence and relationships generated between academics in ESRC subject areas through GWR was a key catalyst in the development of the successful bid to the ESRC for a South West Doctoral Training Centre by Bath, Bristol and Exeter Universities. GWR will facilitate up to 16 collaborative PhD studentships per year for the new SW-DTC. Moreover, GWR helped reinforce the credibility of the successful collaborations underlying the Bath/Exeter joint bid for a research centre focused on graphene research, which received £5 million funding from the EPSRC 2008 Science and Innovation Awards.

The Bristol Robotics Laboratory is a major research partnership between UWE and the University of Bristol. Formally instigated in 2006, a GWR studentship with the robotics company Elumotion was the first externally funded joint research project in the BRL, cementing the partnership between the universities and leading to a string of further successful collaborations. This has included research projects funded by EPSRC, Leverhulme Trust, the European Union Framework 7 and Marie Curie programmes, and a second joint GWR studentship with Avian Technologies.

As a result of the GWR investment, the two universities have been now able to strategically align their robotics work and pool resources to support leading edge, internationally-recognised research.

A GWR Fellowship funded at Bournemouth in collaboration with Bath in the area of “Retargeting Animated Human Characters” led to a relationship being built that went on to win a grant to establish a Centre for Digital Entertainment worth £10 million. A Fellowship and two Studentships in “Numerical weather prediction and multi-scale methods and data assimilation” held between Bath, Exeter and the Met Office have helped to develop closer University relationships, plus closer ties with the Met Office. This GWR funding helped to establish a critical mass of researchers.

A studentship project in “Analysis and optimisation of damage tolerant post-buckled composite laminates” involving Bath, Bristol and Airbus led directly to a follow-on contract for 6 months from Airbus (April–August 2010), an EPSRC award of £274,000 for equipment for multiple projects, and to the development of the ABBSTRACT consortium.
GWR collaborative studentship research

Snapshot

- Over 220 collaborative research proposals received
- 200 businesses proposed themselves as co-funders
- 130 studentships were approved
- 40 SMEs funded projects
- 11 HEIs involved
- 222 new collaborations with external organisations reported
- 237 academic papers and 431 conference papers produced as a direct result of the research
- Non-completion rate below 10%

The Background

During phase I, GWR agreed to co-fund 130 studentships with South West businesses using funds provided to GWR by the South West RDA. Proposals were invited originally in five theme areas which were chosen to represent the research strengths of the partner universities: Applied Mathematics, Creative Arts, Materials Sciences, Psychology and Sustainability, and for the final call a sixth theme was added, Information and Communications Technology.

GWR brought together academics from universities across the SW and encouraged them to collaborate by submitting joint PhD research proposals. PhD projects had to identify a business partner who was prepared to fund 50% of the project’s cost, and over 100 businesses became partners in the program. GWR approved 130 studentships with the following subject distribution: materials 46; Sustainability 37; Applied Maths 15; Psychology 18; ICT 8; Creative Arts 6.

Over 18 months GWR received over 220 proposals for evaluation involving 200 partner businesses; some that had not previously worked with universities became involved as partners including over 40 SMEs. These new relationships have increased the spirit of “collaboration not competition” in SW Universities, and academics working together through GWR have reported over £16m of new funding as being “as a consequence of, or in conjunction with, their GWR funded PhD research programs”.

Excellence with impact

This report is an opportunity to illustrate the exceptional strength and depth of GWR’s studentship research, celebrating its impact at a local, national and international level. GWR’s research portfolio ranges from developing new products to fundamental research in promising new areas, and fundamental to the success of GWR research collaborations is excellence.
GWR's PhD researchers and academic supervisors have produced some outstanding results and proved themselves to be leaders in their field. James Parsons (GWR PhD student, University of Exeter), for example, submitted his thesis while also publishing five first-author and two second-author papers in international journals.

Overall, 237 academic papers have been published by researchers on GWR funded projects and 431 conference papers have been delivered by students and supervisors. Carly Daniels (University of Plymouth), GWR PhD researcher at the National Lobster Hatchery was presented the John Rose Award 2009 by the Institution of Environmental Science for outstanding research, and Donna Lovell’s (UWE) research won the Gore Research Excellence Award in 2009 at the 14th National Annual Conference of the Fire Services for her work on interventions for young fire-setters which has been vital for lowering incidences of arson. In total, 12 prizes were awarded to GWR research students, for posters, papers and their dissemination activities.

The students themselves have greatly benefitted from working with industry, exposing them to new ideas and giving them an insight into the needs of users - they have been provided with new experiences and perspectives that will enhance their careers: “I gained a tremendous amount from completing a PhD project in collaboration with a business/organisation using the GWR model...it enabled me to do something academically that was not possible in my own doctoral research...” commented Martin Coombes, GWR PhD student, University of Exeter

**Impact on the South West and policy and services**

GWR’s research has had a major impact on the region and in areas of public policy and services. For example, GWR’s funding of over a dozen PhD studentships in aerospace related research has created a clustering effect, fostering closer interactions between partner Universities and the aerospace industry and stimulating new investment in joint academic/industrial research programs. Results from this cluster include integrating PhD research outputs into the design process of Augusta Westland and Rolls Royce, thus taking it beyond ‘proof of concept’. The work supported by GWR will ensure they can maintain technology leads in the aerospace market (Jean-Paul Henderson, GWR PhD student, University of Bath).

GWR’s investment in both PhD studentships and Research Fellowships in Meteorology has created and supported a multidisciplinary team involving Bath University, Bristol University, Exeter University and the Met Office, working on advanced methods in numerical weather prediction. Dudley Shallcross from the University of Bristol commented that “The Met. Office was the ideal partner and a PhD was the perfect way to cement a partnership. Both partners could contribute and both had complementary expertise. It was also useful to be reminded that there are other drivers than pure curiosity driven research.”

Overall, 222 new collaborations were created for partner Universities in the south-west as a direct result of GWR PhD research, ranging across UK Universities, overseas Universities and businesses and government.
This has led to students and supervisors valuing knowledge and insights from industrial partners. One of the strongest advantages of research between academics and business is the two-way flow of ideas and knowledge. Chris Thornton of University of Exeter commented that “the GWR model provided the opportunity to work with industry partners, which has resulted in tangible knowledge and product transfer from the University bench to industry. This work is ongoing and will lead ultimately to the use of T. hamatum in sustainable crop production systems.”

The results of this transfer have been tangible. From original GWR PhD research, 11 patents have either been awarded (2), filed (4) or considered (5) - new software developed by Edward Apeh at Bournemouth University is to become the main driver of Screwfix web development and data mining strategy – research has led to the development of novel Acoustic Emission and Impedance Spectroscopy at the University of Bristol - Bruno Notarberardino’s GWR PhD research has led to a collaboration with engineering consultants, Arup and N.A.S.A., jointly publishing a paper on how metal matrix composite foams can be used for impact protection on space missions. Bruno’s research won the GWR Impact award for 2011.

Christopher Frost from the University of Bath graphically illustrates how GWR has impacted on business in the region: “The GWR project enabled us to spend time focused on the commercial needs of an important business collaborator. The success of the project is a direct result of working closely with the Atlas Genetics assay development team and being able to respond quickly to evolving development priorities. I believe the significant funds raised by Atlas Genetics (£16.9 million) to continue their technology development in this important area demonstrates the impact of the collaboration model. I am delighted that this valuable relationship will be continued with the funding for a synthetic chemist to expand their multiplex capabilities.”

In this report we have chosen just a few examples demonstrating that collaboration between business and academics at the PhD level can have successful and wide-ranging impacts.
Highlighting flooding risk

Network Rail in partnership with the Universities of Plymouth, Bath and GWR PhD student David Dawson

"The project has helped to inform our overall approach to climate change adaptation and will be used as an example of how coastal railway issues in the UK can be examined in future programmes."

John Dora, Principal Engineer, Network Rail

Projections based on ground breaking modelling by GWR PhD student David Dawson predict that by 2020 rising sea levels will disrupt access to the Paddington to Penzance railway. Indeed, by the turn of the century it is thought that certain estuary sections of the track will be completely inundated, making the current route impassable, especially over the winter months. With sea-wall defences at a significant risk of being breached, the consequences would be disastrous to the region’s economy.

Network Rail undertook the GWR PhD in partnership with the Universities of Bath and Plymouth in order to examine existing forecasts. Using a new semi-empirical methodology developed in this project and drawing upon historical archives and sea-level records to predict future impacts, the team identified that previous calculations may have underestimated the rise in current sea levels.

This PhD has highlighted the importance of such investigations in key areas where geological evidence of vertical land movements has not yet been unearthed (e.g. cities, ports, harbours). The novel approach can be applied to other coastal regions where significant infrastructure is at risk from future sea-level rise.

The GWR research template has enabled the Universities of Plymouth and Bath to broaden their respective research fields via a range of shared disciplines, including climate change and sea-level research, transport studies and economic evaluation. Preliminary results taken directly from the PhD study were utilised in the region’s draft for Defra’s National Climate Impact Assessment (2010). A specific climate change and transport impacts conference in conjunction with the Institute for Sustainability Solutions Research, (ISSR) is planned at Plymouth University involving corporate and government stakeholders.

John Dora, Network Rail’s principal engineer and chair of the company’s Climate Change Adaptation Group commented, ‘this GWR PhD has been extremely useful in highlighting the impacts of future sea-level rise, and is helping Network Rail in its analyses of potential future impacts of climate change.’ John is currently planning a full network-wide study of climate change impacts on railway infrastructure.

The PhD research also provided input in the consultation process of Devon County Council’s third Local Transport Plan for the period of 2011-2026. Information provided from the study was also used for the County’s response to the Pitt Review on local flood risk, and specifically highlighted the threat of sea-level rise to communities along the Exe and Teign estuaries. Similar uses of the project’s findings are anticipated by Cornwall County Council as the consequent effect of increased closures of the line is an important consideration for the region’s planners.

Due to the transparent nature of the GWR project, it has received publicity in local and regional newspapers such as the Evening Herald, Express and Echo and BBC Radio Devon. David Dawson also appeared on the BBC 2 programme ‘Down the Line’ to discuss the issue of land subsidence and sea-level rise in the region.
Sustainable aviation

Rolls-Royce in partnership with the University of Bristol, Exeter and GWR PhD student Matteo Bianchi.

The aerospace industry has been quietly undergoing a revolution in recent years as metal components are gradually phased out by the use of innovative composite materials. The exploitation of composites is critical for maintaining competitive advantage, as their successful integration allows for significant weight reduction and reduced fuel consumption, thus lowering the carbon footprint of an aircraft. Rolls-Royce were interested in a particular type of composite called ‘auxetics’ for use in components such as fan blades, discs and mounting structures in gas turbine engines, especially for its fire-resistant and damping capacity, and flexible cores in sandwich components.

This PhD has enabled the Universities of Bristol and Exeter to collaborate further and raise their profile as viable industry partners and new links have been established with European companies including Matelys-ACV who specialise in the acoustics of porous materials, CNRS FEMTO Laboratory Besancon who specialise in vibroacoustics of smart materials, and VTT Technical Research Finland, specialists in high-cycle fatigue of porous materials.

The GWR studentship funding initiative provided an ideal opportunity to bring together a cross disciplinary team led by GWR student Matteo Bianchi and supervised by Professor Fabrizio Scarpa and Dr Chrystel Remillat from University of Bristol’s Department of Aerospace Engineering. Locating the PhD at the University’s Advanced Composites Centre for Innovation and Science (ACCIS) provided expertise and facilities for design, manufacture and testing of auxetic foams. Furthermore, 2nd supervisors Dr Smith and Professor Evans from the University of Exeter provided expertise in the manufacturing process and microstructure design of auxetic foam topologies.

The results have exceeded all expectations, with seven journal publications including two papers in Acta Materiala, together with a patent registered on ‘New manufacturing process for auxetic foams. Rolls-Royce has been delighted by the exploitation of ‘blue sky’ thinking into practical and economically viable outcomes in such rapid time frames, which in turn led to an increase in Rolls-Royce’s general scientific research activity.

The research has formed a part of a much more extensive programme of research at the University of Bristol and due to its success additional expenditure in R&D of several million pounds over the next few years is expected, securing jobs for the region’s aerospace industry.
Bio-scaffolds interest NASA

Simpleware Ltd and CH Medical in partnership with the University of Exeter and Universities of Bath and Bristol and GWR PhD student Bruno Notarberardino

“Excellent scheme which allows exploration of new ideas mitigating financial risk from the company’s point of view and bringing in university expertise.”

Phillipe Young, University of Exeter GWR Impact Award winner, 2011

With worldwide market sales of fracture fixation products (holding splintered bones together) valued at well over $2.7 billion, there are business opportunities for small, innovative companies in this niche sector. With this in mind, two South West companies, Simpleware and CH Medical, came together under the umbrella of the GWR studentship scheme to gain market-share through the development of software modelling for the optimisation of micro structures and bioscaffold design in the human body.

The two SMEs, GWR PhD student Bruno Notarberardino, Dr Philippe Young, University of Exeter, Dr Irene Turner, University of Bath as well as Dr Bo Su, University of Bristol formed a team to develop software tools specifically tailored to the orthopaedic industry, and also to consolidate viable solutions for the rapid manufacturing of implants using hydroxyapatite and other bio-reabsorbable implants. The project successfully explored the use of novel materials (composites, ceramics, bioreposables) for developing a new genre of fracture fixation devices in place of metal. Particular focus was directed to the application of non-load bearing plates and for fractures in the upper torso. The work involved exploring different fabrication techniques and generating patient specific models combining imaging and rapid prototyping solutions.

Simpleware Ltd have doubled in size since the commencement of the PhD, having opened up new markets in oil, gas and composites, which account for around 20% of Simpleware’s business, largely assisted by Bruno’s contribution of extending the use of image-based modelling to micro-structural characterisation. The outputs of this PhD have been well received internationally. With 3 academic papers and 19 conference presentations spanning 3 continents, Bruno and Philippe’s interest in applying the principles of rapid prototyping of complex micro-architectures, frequently used in the aerospace industry, has also led to a surprising collaboration with Arup and N.A.S.A., with the 3 parties jointly publishing a paper on how metal matrix composite foams can be used for impact protection on space missions. There is now an ongoing research project in materials between NASA Glenn Research Centre and the University of Manchester as a result of this work.

Bruno has also contributed towards a successful grant application to the Technology Strategy Board (TSB) for £1 million looking at optimising rapid prototype manufacturing techniques for fabricating microstructures as well as a further €1 million from European Union FP7 Programme for the BIO-CT-EXPLOIT project. The Exeter team also recently submitted a research proposal for 17 million Euros to investigate bio-scaffolds as part of a European consortium alongside Simpleware.
Fluid metering using active materials

Moog Controls Ltd in partnership with Universities of Bath, Exeter and GWR PhD student Dhinesh Sangiah. Dhinesh is now Development Engineer at Moog Controls Ltd.

Servovalves are key components for metering (i.e. controlling) fluid flow in high performance hydraulic actuation systems. These systems are used in aerospace, testing, machine tool, automotive and many other industries. A typical airliner contains about 40 servovalves for actuation, as well as using the same technology for controlling fuel flow to its engines. Globally, many organisations have been exploring alternative actuation technology for valves or other applications and the aerospace industry is particularly interested in smart materials, such as piezoelectric ceramics, which have the potential to reduce both cost and maintenance requirements.

Moog Controls Ltd, a designer and manufacturer of precision motion control systems, wanted to exploit the unique potential of smart materials as efficient actuators for flow metering and, potentially, as sensors for flow characterisation and brought together a South West cluster with expertise in active and non-traditional materials (Drs Bowen, Dent, Smith), actuation, control and hydraulic systems (Dhinesh Sangiah & Professor Plummer), as well as the fluid metering knowledge and industrial guidance from Moog.

Dhinesh Sangiah was based in the Centre for Power Transmission and Motion Control [PTMC] at the University of Bath, in a lively research environment with around 25 other research students and research assistants. The project was further enhanced through interacting with researchers on other related grants, such as the £612,000 EPSRC project ‘Efficient fluid power control’, and another EPSRC project on ‘Integrated systems for high bandwidth ultra high precision actuation’ which included hybrid piezoelectric-hydraulic actuation.

Three conference papers and one journal paper have so far been written and this PhD has been very significant in developing the field of piezoelectrically controlled valves in partnership with Moog Controls Ltd. A further industrial collaboration has since emerged as a direct result of this work with the aim of investigating rapid manufacturing of smart valves. With the simulation model and the methodology for design and optimisation validated by Moog, a patent was successfully filed in April 2011 to protect the concept. Dhinesh has since taken up a post at Moog as a Development Engineer.

The replacement smart technology has been shown to have considerable potential in terms of performance, reliability, and reduced cost. A programme has begun to develop a commercial valve for aerospace flight controls based on research outcomes and the proof of concept device. If successful, this could have a tremendous impact in the aerospace industry, Moog being the largest supplier worldwide.
The common touch

Elumotion Ltd in partnership with Bristol Robotics Laboratory, [BRL] the University of the West of England, the University of Bristol, and GWR PhD Student Craig Chorley.

Humanity’s ability to sense detailed tactile information through its fingertips is fundamental to its ability to interact with the world. If robotics is ever going to successfully move from the factory floor and into the real world, robots are going to have to be able to sense, explore and interact with the world around them.

Looking at human fingertip structures, Craig identified the layered structure of the fingertip skin as an important aspect of our sensing abilities. Craig created and tested prototype layered robotic finger designs and published the work in a paper at TAROS Conference (Towards Autonomous Robotics Systems) in 2008.

In September 2008 GWR funded a research trip for Craig to Japan and, with the guidance and expertise from the research team in BRL (Chris Meluish and Tony Pipe), he returned with the ideas and inspiration needed to design a sensing system that captured the best qualities of human skin. Utilising this step forward, the researchers were able to put the prototype through tests that included reading Braille.

The research Craig produced formed part of a successful European FP7 and ECHORD bid Tactile Finger Tip for Robots [TACTIP] of €289,516, prepared by the Bristol Robotics Laboratory. A research group consisting of 3 BRL researchers and 3 surgeons has been activated for robot-assisted surgery as a direct result of this work. Strong contact has also been made with an EU robotics research laboratory in Pisa Italy (SSSA), via the internship of a PhD student from Pisa in BRL for a year, working on the device created by the project.

The follow-on TACTIP project is a collaborative partnership between BRL and Elumotion. The result of TACTIP will be a sensitive robot fingertip that can be used for haptics and object grasping, and is ready for the last stages of commercialisation.
Reconstructing Gurney

Ivor Gurney Estate and Gloucestershire Archives, in partnership with The Universities of Exeter, Gloucestershire and GWR PhD Student Philip Lancaster

Ivor Gurney (1890-1937) was a Gloucester-born poet and composer and belongs among the major poets of his time. It has been argued that he was the first Englishman to be truly gifted in both arts since the Elizabethan, Thomas Campion. However, Gurney’s work has slipped from public view and, until now, has remained less well-known than that of his peers.

A life and body of work such as Gurney’s has given rise to numerous potential lines of enquiry. He is a remarkable poet (five of Gurney’s poems appear in the *Oxford Book of English Verse*), but he is also a fascinating figure to study: first, as a Gloucestershire poet with vital connections to some other poets of the region (Edward Thomas, for instance) and as a nature poet who gives us an image of an England in transition during the First World War, further enhanced by his being a private in the trenches. Finally, he is interesting because of the way in which he works so brilliantly in two different fields: music and poetry. This project has made crucial strides in restoring Gurney to his rightful place in the public eye – and specifically to his rightful place as one of the major poets and composers of the British Isles. This has been achieved through the production of a comprehensive chronologically based on-line catalogue of the archive, material making it accessible to local, national and international audiences as well as paving the way for further critical analyses of the aesthetic and cultural significance of Gurney’s work.

This GWR PhD has been almost as prolific as Gurney, delivering four conference presentations, 1 academic paper, several concert performances (including world premières), and 16 publications, including *The Complete Literary Works of Ivor Gurney*, to be published in three volumes by Oxford English Texts, as well as funding applications with AHRC and National Manuscripts Conservation Trust, worth in excess of £370,000 for further projects. The researchers also advised on an anthology of three major war poets (Gurney, Wilfred Owen and Siegfried Sassoon) recently published by Penguin.

A number of musical works have been brought to performance by Philip Lancaster during the course of this PhD, including a professional performance of Gurney’s choral works at the Three Choirs Festival in August 2010, as well as his most important orchestral work, *A Gloucestershire Rhapsody*, which in turn has led to a Gurney CD being commissioned and published by Naxos. Philip has also been interviewed twice by BBC Gloucestershire and held an exhibition of photographs and manuscripts at King’s College Cambridge. Thanks to Philip, Oxford University Computing Services have now digitised a large body of Gurney’s work as part of the ongoing First World War poetry archive ensuring Gurney’s profile has been restored as a national treasure.

The project has not only ensured the preservation of a significant resource, but it has ensured that the protection and enhancement of cultural assets are fundamental to their strategy to make the South West the ‘Go To’ place for literary culture. As a direct result of this GWR PhD, a statue named ‘The Candle’ has been placed at the Docks which uses Gurney’s manuscripts, and a blue Plaque now commemorates Gurney’s name, raising his profile considerably.

Philip Lancaster was supported throughout the project by archivists at Gloucestershire Archives and the University of Exeter, and supervised by leading scholars Professor Tim Kendall of the University of Exeter and Dr John Hughes of the University of Gloucestershire.
Lighter, stronger aircraft

Rolls-Royce and Agusta Westland in partnership with the University of Bristol, the University of Bath and GWR PhD student Michael May

"Schemes such as this are very important to Rolls-Royce"

Adam Bishop; Rolls Royce PLC

The use of composite materials in aeroplanes and helicopters has become increasingly popular in the last few decades. One of the main reasons for replacing metallic components with composites is its structural properties. It allows significant weight reduction, reduced fuel consumption and in turn reduces the carbon footprint of an aircraft.

A major concern regarding components made from composite materials – aside from impact damage – is cyclic loading, also known as fatigue. Fatigue life of composite components consists of two phases – the damage initiation phase and the damage propagation phase. Whilst the damage propagation phase is well understood, the damage initiation phase is often discarded in the design process as there are no standard tests and models allowing the extraction and use of reliable crack initiation data.

Consequently, current design is usually quite conservative and does not use the full potential of composite materials. The work carried out by Michael May in this GWR, Rolls-Royce, and Agusta Westland funded PhD studentship has addressed this gap in the design process by successfully developing and testing a numerical model for the simulation of damage initiation and subsequent propagation under cyclic loading.

The development of novel numerical and analytical models for fatigue and damage tolerance of composite components which are validated against test data is important for both Agusta Westland and Rolls Royce. Outputs from this research will be integrated into their design processes in the future. This will contribute to ensuring that they can maintain technology leads for the design and manufacture of engines and rotor blades.

The project was based in the University of Bristol’s Advanced Composites Centre for Innovation and Science (ACCIS) and the GWR model enabled Rolls-Royce and Agusta Westland’s to fund this research activity. Key skills in the field of composites analysis and experimental methods have been pooled between the Universities of Bristol, Bath and Cardiff facilitating long term partnerships.

Michael May produced four academic papers and five conference presentations during his PhD, including the 2nd ECCOMAS Thematic Conference on Mechanical Response of Composites in London, as well as making important presentations to conferences in Stockholm, Budapest, Edinburgh and Oxford. He has now taken up a research position in the Ernst Mach Institute at the Freiburg Frauenhoffer Institute.
Bio-diverse coastal defences

The Environment Agency in partnership with Exeter University, Plymouth University and GWR PhD student Martin Coombes

Islamic tidal barriers have been around for centuries, with the world’s first tidal barriers built in the 9th century by the Chinese to protect the city of Xiangyang from tidal surges. More than 50% of the world’s population live within 200 kilometres of the sea, and flood protection is of increasing relevance given predictions of sea level rise as a result of climate change. Furthermore, the diminishment of coastal reefs and the recent EU Water Framework Directive stipulating that all coastal defences need to maximise ecological potential, provide the complex engineering and ecological background to this research project.

Martin Coombes (GWR PhD University of Exeter) alongside supervisors Dr Larissa Naylor (University of Exeter) Prof Richard Thompson (University of Plymouth), and Dr Stephen Roast from the Environment Agency (EA), brought geo-morphologists, engineers, ecologists and designers together to focus on these issues. They successfully demonstrated that coastal defences can remain durable and interact with nature to create habitats which encourage the colonisation of intertidal species through initial material choice and the use of surface texture.

Coastal defence structures are traditionally built using a range of materials, from natural rock to maritime concrete. Previous research has shown that material type can have a significant effect on the diversity of intertidal communities, yet the geological properties of materials and how they change by weathering and erosion have never been examined in detail.

With the involvement of Professor William Allsop, Technical Director of the Maritime Structures Group at HR Wallingford, there has been interest around the globe, with six academic papers and eight conference presentations, including the Institute of Civil Engineers annual conference in Edinburgh, and the 7th International Conference on Geomorphology in Melbourne, Australia.

Collaboration was strengthened through a two-year follow-on project funded by the Esmée Fairbairn Foundation with the University of Oxford and the MBA. This is the first research group consisting of physical scientists working on ecological enhancement in the coastal zone. Similarly, a new collaboration with Falmouth brings together the expertise of 3D designers, architects and concrete manufacturers in the design of hard coastal structures. Research outputs from the project influenced designs for the EA’s £6.5 million Shaldon and Ringmore Tidal Flood Defence Scheme. This scheme has been showcased as an EA best practice case study.

Further funding from the EA and the University of Exeter’s Link fund was used to translate the research into national guidance, providing a synthesis of existing research alongside practical suggestions for the planning and design of hard coastal structures. The new guidance was circulated across the UK to maximise impact. David Baxter, Head of Catchment Management and Coastal Environment at the EA said: “We needed guidance on the scientific evidence... and how to get them designed into hard coastal defences and approved through the planning process. This research provides a valuable guide to the techniques that are available and...be of great interest to those involved in coastal defence works”

Engagement with practitioners in the South West greatly expanded the initial project partnership from 6 to more than 25 organisations. The success of the collaboration was recognised with short-listing for the University of Exeter’s Award for Outstanding Regional Impact.

“I gained a tremendous amount from completing a PhD project in collaboration with a business using the GWR model...it enabled me to do something academically that was not possible in my own doctoral research – involve a rocky shore ecologist in the research process.”

Martin Coombes
In response to increasing pressure on the natural environment, the National Lobster Hatchery (NLH) was set up to focus on the long-term re-introduction of lobsters back into the ocean to revitalise fishing in an economic, environmental, and socially sustainable way. The National Lobster Hatchery and Great Western Research came together to jointly fund a PhD project to investigate increasing the culture success of baby lobsters through enhancing their diet.

Using natural dietary supplements in feed at different stages of larval and juvenile development, GWR student Carly Daniels has been able to establish that baby lobsters are very sensitive both to nutrition and the environment. Carly found a link between better gut health and its impact on the successful metamorphosis of larvae into lobster adults. Her work has also looked at optimising gut health by putting friendly bacteria (Probiotics) and complex sugars (Prebiotics) into their food to enhance gut development thus improving immune and digestive capabilities.

This research has improved our understanding of how such dietary supplements function in lobsters and yielded 18 academic papers and conference presentations, including 3 high profile international talks around the globe. Carly was a lead or named author in 4 chapters of the book ‘Aquaculture Nutrition – Gut Health, Probiotics and Prebiotics’ (Wiley-Blackwell) and gave presentations at Alltech’s 26th Animal Health and Nutrition Industry Symposium in Lexington, Kentucky, the World Aquaculture Event 2010 in San Diego, California, and the 9th International Conference and Workshop on Lobster Biology and Management at ICWL, Bergen, in Norway in 2011.

The PhD research has led to collaborations between the NLH and Swansea University, the Marine Biological Association, and both Plymouth Marine Science Partnerships and Laboratories. The impact of Carly’s work has not been confined to the UK, where the Canadian Lobster Hatchery have a keen interest in applying her findings with species of American Lobster.

As part of her PhD, Carly produced a food in pellet form, which has been designed to aid growth and limit disease by improving gut health, and therefore ensure that baby lobsters have a significantly higher chance of surviving when released back into the wild. To this end, NLH have tripled the amount of juvenile lobsters released into the wild and survival rates have notably increased. Carly’s work has paved the way for further funding and she now oversees a further 2 PhD students, 10 Masters, 8 undergraduate research projects and 4 Foundation degree students as part of her permanent post as head of research for the NLH.

“This [GWR Studentship] model allowed me to understand the importance of my research and apply the results into daily practices of the business. Overall results from the PhD have allowed for enhanced lobster rearing and production and thus improved the conservational outputs of the National Lobster Hatchery (NLH). The impact of Carly’s work has not been confined to the UK. For example, the Canadian Lobster Hatchery now have a keen interest in applying her findings with species of American Lobster. In the broader picture supporting the sustainability of lobster stock around Cornwall and the isles of Scilly.” Carly Daniels, National Lobster Hatchery.
Atmospheric modelling

The Met. Office in partnership with the University of Bristol, University of Exeter and GWR PhD student Alexander T. Archibald.

It is clear from episodes such as the fire which broke out at the Buncefield oil refinement centre on 10 Dec 2005, that it is critical that the UK has the capability to manage the fall out of high scale industrial accidents in terms of their impact on the public’s health and the resultant atmospheric and environmental damage. It has been concluded that the UK must have the predictive tools to deal with the release of toxic contaminants into the atmosphere, in order to mitigate the potential repercussions, both within the United Kingdom and beyond.

The Met. Office NAME dispersion model is one of the premier dispersion models in the world, and has been used to forecast the type of pollutant loading which are particular to such incidents. As we begin to understand the complex interplay between emitted chemicals and their physical transport and chemical transformation, both high resolution transport models and complex chemicals models are required. Alexander Archibald’s project with the University of Bristol and the Met. Office, was in part to improve and update the chemical schemes in the NAME model to allow complex chemical and transport modelling of air pollution to be carried out.

First, the Atmospheric Chemistry Research Group (ACRG) at the University of Bristol had already established itself as a world leader in measurements of trace level halogenated species in the atmosphere and in the use of inert perfluorocarbon compounds as tracers of air flow on a range of scales. The GWR funded PhD carried out a number of medium range tracer experiments that allowed significant testing of the NAME transport model. Second, through the development of the CRI (Common Representative Intermediates) mechanism and its variants, all based on the Master Chemical Mechanism for atmospheric chemistry, a significantly improved chemical mechanism has been trialled.

Due to other international research units wanting to gain a better understanding of this problem, several key collaborations and research clusters have evolved during the course of this PhD. Ongoing work has led to further funding, including collaborations between the ACRG, the Met. Office and DECC (Dept. of Energy and Climate Change) and a new cluster between Explore@Bristol, ScienceScope (Bath) and Bristol to set up a project to look at indoor/outdoor interactions.

Strong international links have also emerged, to address fundamental issues in atmospheric chemical transformations, including a strategic partnership with the Sandia National Lab. USA (Taatjes) and the ALS at Berkeley USA as well as a collaboration with a consortium of South African Universities to establish atmospheric dispersion methodologies. An emerging research programme on indoor dispersion and chemistry is also being developed.

With 21 academic papers, several national and international presentations, including two invited international presentations, Alexander Archibald has now taken up a research post with Cambridge University. His contributions have helped to secure a £2 M grant between the ACRG, the Met. Office and DECC which is being run by Dr. Simon O’Doherty to measure greenhouse gas levels across the UK.
GWR Fellowships

Snapshot

- 49 research proposals received, 5 research themes
- 20 three year Fellowships funded at 5 institutions
- Institutions agreed that Fellows then move to permanent contracts
- 60 “person years” of post doctoral research effort funded
- 0% non-completion rate

The Background

A call for applications for 20 HEFCE funded GWR research & training fellowships was issued in April 2006 and a total of 49 applications were received. All were made available to the 5 Subject Theme Panels who considered them and ranked them on their academic merit and research quality. The applications were then considered by the GWR Regional Research Board, which decided on a recommended short list of 33, and the GWR Strategy and Management Board made the final decisions.

20 fellowships were awarded as follows: Applied Maths 4; Creative Arts 3; Materials 5; Psychology 4; Sustainability 4.

The Fellowships were distributed across five Universities in the South West: Bath 4; Bournemouth 1; Bristol 9; Exeter 5; University of the West of England 1.

A condition of the award of a Fellowship was that the host institution agreed to convert an awarded Fellowship into a permanent post at the end of the GWR funding period, and that Fellows contribute up to 10% of their time to the development of the GWR Regional Postgraduate Training Network. During the term of their Fellowships the GWR Fellows have published over 130 research papers, books and book chapters. Fellows currently have over 20 papers under review, including one paper in Nature. Their research results have been communicated in over 160 conference papers, posters and talks, many at high profile international meetings. Fellows have been invited to speak at Universities all over the world, presenting their work in dozens of seminars and workshops.

The GWR Fellows have built up their own research groups and attracted over £6.5 M of research funding into their host Universities. Several Fellows have won recognition for their research, including a 1M euro innovation award from E.ON, the award of the ImechE George Stephenson Prize, and the prize for the Best Scientific paper at the 3rd international green Energy conference in Sweden. The GWR Fellows continue to generate new funding, and publish their results in journals and as conference presentations in their follow on academic posts.
Experts from the National Centre for Computer Animation at Bournemouth University are working on an ingenious new system, in partnership with Exeter University, to bring more realistic movement to animated characters. The development led by Professor Jian Zhang and GWR Research Fellow Dr Xiaosong Yang will allow animators to literally ‘flesh out’ characters more effectively.

As a result of a consultation process with industry, Professor Zhang has sought to engineer a template to enable game designers to accurately depict their characters by using the shape of the skeleton and the major muscle groups whilst remaining true to the original specification of how characters should appear.

In the past, muscle groups and anatomical functioning have been considered too complex and expensive to develop within the games industry, leaving existing humanoid characters missing vital human traits, particularly in their depiction of accurate real life movements, such as walking, running and jumping.

Building on his previous work, using templates for skin models, muscle and bone structures and captured motions, GWR Fellow Dr Yang has retargeted deeper anatomical structures on to new character models to reproduce humanoid characters with more authentic and accurate features, based on the way human beings actually function.

These templates, which will be able to assist front-line developers to make complex humanoid characters more efficiently, could save the computer games/entertainment industry invaluable development time, and there are also potentially important applications for the software in medical imaging.

As part of the GWR Research Fellowship program, Dr Yang’s Research Fellowship was converted into a permanent academic appointment by the University of Bournemouth.

Dr Xiaosong Yang,
GWR Research Fellow,
National Centre for Computer Animation,
The Media School,
Bournemouth University
A bright future for Solar power generation

A Bright new future for Solar power generation – GWR research fellow Dr Neil Fox, at the University of Bristol

With the imminent decommissioning of our aging nuclear power stations, a question mark hangs over a viable, long-term replacement of the UK’s electricity producing capacity, and renewable energy is being increasingly favoured for its clean, practical and low cost energy production. It is estimated that renewable resources such as wind and wave energy in the UK will accounted for around 15% of input to the national grid in 2011.

Although lagging behind at present, solar power is rapidly becoming a major player in the worldwide energy market; traditional photovoltaic modules expected to increase significantly, and installed capacity of the heat based Concentrated Solar Thermal (CST) expected to increase fourteen-fold to 6400MW by 2013.

In 2007 Neil Fox was appointed as a GWR Research Fellow based at the University of Bristol due to his experience in combining leading edge scientific thinking with commercially applied research. He immediately saw the potential of establishing the University of Bristol as a development and research hub for the commercial exploitation of solar powered technology.

One of the lesser known solar technologies is termed ‘concentrated photovoltaics’ (CPV), which uses a variety of mirrors and lenses to concentrate the intensity of light falling onto the solar-cell material, allowing high energy densities to be channelled through small cell areas, thus improving their efficiency.

Neil’s focus involving combining elements of the emerging CPV technology with thermionics has drawn significant international attention due to its potential to convert heat to electricity at high efficiencies. This unique emerging nano-technology is different to traditional solar technology as the device contains microscopic diamond parts which heat up in the sun and then emit electrons, which can be harvested to generate electricity. This can be engineered to take place at much lower temperatures than conventional thermionic materials, with wide-ranging implications for using the technology in cooler climates.

Indeed, because the new solar panels are more versatile than conventional solar cells, and can utilise a larger proportion of the sun’s energy, the costs involved in generating equivalent power are substantially lower. Neil has also established a partnership with Bristol based industry leaders Wind Prospect to match-fund Tomas Martin’s GWR PhD Studentship to research further advanced energy generation systems in solar technology. The GWR funding is enabling the team to gain an important understanding of the materials, and how they operate in the device technology. The University of Bath is also contributing expertise in optical modelling to the program through Tomas’s GWR link to Professor Duncan Allsopp, his associate supervisor in Bath.

With increasing international visibility of this research, Neil has also attracted funding of €1m from E.ON. With support from engineering company Bitworks in Cheltenham as well as the Bristol University’s Research and Enterprise Department, Neil is positioned to turn his ideas into commercial reality.
Smarter weather forecasting

The Met Office in partnership with the GWR Research Fellow Dr Melina Freitag, University of Bath, University of Exeter, and GWR PhD students James Kent and Sean Buckeridge

In today’s highly advanced information and technology age, it is ironic that modern computer processor capabilities still lack the speed and capacity to handle the complex equations necessary to perform prompt and accurate forecasts within ever pressing timescales for the UK Met office.

Coupled with tight budgets and the growing requirements for streamlined mathematical modelling for both localised weather patterns and large scale weather features and formations in the atmosphere, the Met office has raised the bar and collaborated extensively with the GWR Fellow Melina Freitag, and sponsored GWR PhD students James Kent and Sean Buckeridge from the Universities of Exeter and Bath to improve upon its existing methods.

Extreme weather conditions such as flash floods and the resultant dangerous driving conditions can occur with little prior warning. This project work will contribute to the ongoing efforts to forecast such weather more quickly and accurately, so that people can be forewarned, saving lives.

The current model which tracks weather patterns has historically been based on partial differential equations that describe the evolution of quantities like wind speed and direction, pressure, and humidity. The initial conditions for the forecast calculation are obtained by combining actual observations from satellite, aircraft, buoys, and weather stations with the output of a previous forecast to produce the best estimate of the actual state of the atmosphere; this is a mathematically complex procedure known as Data Assimilation. As it is not feasible to gather all the observations needed to correctly populate calculations, some aspects of forecasting are either incorrect or incomplete.

Developing improved mathematical modelling and algorithms to tackle problems such as dynamic coupling has cost implications and so these projects have helped the Met office to remain competitive by exploiting the expertise at hand.

With modelling software now being integrated into the Met Office’s operational systems, certain calculations can be made up to ten times faster as a result of this work. Dr Robert Scheichl, supervising Sean Buckeridge, has also provided important input to assist the Met Office to make optimal use of the massively parallel future supercomputer architectures.

GWR has been instrumental in bringing together the research groups at Exeter, Bath and the Met Office, creating a ‘cluster of academic excellence’ in the South West.
Strategies aimed at reducing CO₂ emissions are playing an increasingly important role in energy production, and the British Government is committed to using biomass as part of its renewable energy strategy. Indeed, bio-energy from biomass (non-food crops grown for energy uses; waste; timber products) already accounts for about 15% of the world’s primary energy consumption and the debate has intensified as how best to address the UK’s energy requirements leading up to 2020.

Dr Marcelle McManus was appointed GWR Research Fellow at the University of Bath in 2007 to lead research into the environmental impact over time, and resource issues, of bio-energy production. A crucial component of Marcelle’s work has been the development of a rigorous analytical and theoretical understanding of environmentally sustainable decision making.

Environmental life-cycle assessment (LCA) formed part of the approach to understanding the complex equations determining the best way to use bio-energy and the land available, with the least environmental impact. The LCA approach enables all of the various environmental impacts to be identified, so that improvements can be made to the biomass production processes from "cradle-to-gate".

Marcelle and her colleagues were part of the successful bid for the new BBSRC Sustainable Bioenergy Centre, which links universities with industry. Marcelle was awarded best Scientific Paper Award in 2007 for Energy Environment and Sustainable Development at the 3rd International Green Energy Conference in Sweden and awarded the prestigious George Stephenson Prize, 2008, from the IMechE.

Marcelle is also supervised GWR sponsored PhD student Paul Adams, in partnership with the Environment Agency, analysing the feasibility and environmental impact of a Gasification Plant. This project helped establish whether the energy obtained from wood waste can be used to power engines, and what impact this process has on the environment.

Local industry has been involved with Marcelle’s research, in which she has examined specific aspects of their use and production of bioenergy and made recommendations for improvements in their systems. Marcelle and Paul have conducted further research, together with their colleagues Will Mezzullo and Geoff Hammond, into exploring the different barriers and drivers to bio energy use, from policy makers, farmers and end users, and presented their findings at the 3rd Bio-Mass and Energy Crops Conference in York.
GWR Fellows:

**Timothy Jupp**  
Observational constraints on climate-carbon cycle feedbacks through more rigorous mathematical approaches; Peter Cox, Exeter; Colin Prentice, Bristol

**Anna Rabinovich**  
Promoting Sustainable Behaviour: Toward an Integrated Social Psychological Approach; Tom Postmes, Exeter; Bas Verplanken, Bath

**Hartmut Erzgraber**  
Modelling and nonlinear dynamics of optical nanodevices: nanolasers and photonic nanocircuits; Sebastian Wieczorek, Exeter; Bernd Krauskopf, Bristol

**Neil Fox**  
Wide-band gap nanomaterials for optoelectronic devices: A focus on diamond and ZnO; M.N.R. Ashfold, Bristol; R. Jones, Exeter

**Paul O’Neil**  
Locating the Producers: Towards a Definition of Best Practice in Commissioning the Visual Arts; Claire Doherty, UWE; Antonia Payne, Dartington

**Andrew Dent**  
Advanced Fabrication of Multifunctional Ceramics; C.R.Bowen, Bath; Chris Smith, Exeter

**Fraser Milton**  
The Impairment of Memory in Epilepsy: the TIME project; Adam Zeman, Exeter; Paul Brooks, Plymouth

**Melina Freitag**  
Numerical weather prediction: multiscale methods and data assimilation; C. J. Budd, Bath; J. Thuburn, Exeter

**Natasa Vasiljevic**  
Novel nano-magnetic and nano-optical materials; Walther Schwarzacher, Bristol; Roy Sambles, Exeter

**David Barton**  
Modelling MEMS devices for power scavenging; Alan Champneys, Bristol; Chris Budd, Bath

**Guy Jean-Pierre Schumann**  
Sustainability of coastal flood defence policy under climate change, sea level rise and socio-economic change; Paul Bates, Bristol; Adrian Winnett, Bath

**Pavlo Ivanov**  
Advanced Surface-Emitting Semiconductor Lasers with improved Static and Dynamic Properties; Judy Rorison, Bristol; Federica Causa, Bath

**Marcelle McManus**  
Bio energy futures - The Prospects for the South West of England; Geoffrey Hammond, Bath; Michael Winter, Exeter

**Neal Hinvest**  
The neural basis of economic decision making; Alan Lewis, Bath; Tim Hodgson, Exeter

**Andrei Sarua**  
High band gap AlGaN/GaN field-effect structures and chemically interactive materials for sensor applications; Martin Kuball, Bristol; Tony James, Bath

**Matt Lobley**  
Sustainability policy, social capital and land use; Stephen Wilks, Exeter; Geoffrey Hammond, Bath

**Martin Genner**  
Fish populations and climate change; Julian C Partridge, Bristol; David Sims, Plymouth

**Xiaosong Yang**  
Retargeting Animated Human Characters; Jian J Zhang, Bournemouth; Philip Willis, Bath

**Paul Clarke**  
Performing the Archive: the future of the past; Simon Jones, Bristol; Nick Kaye, Exeter

**Christopher Kent**  
The role of working memory in encoding into long-term memory, Klaus Oberauer, Bristol, Tim Perfect, Plymouth
Investing in teaching

As part of the GWR project, HEFCE provided capital funding of £1.2 million to set up the South West Regional Postgraduate Training Network. GWR took the decision to invest in Access Grid (AG) technology to allow multi-way video conferencing between sites in the South West to deliver postgraduate training in an efficient and environmentally sensitive manner.

Additional benefits were the ability to use AG for GWR research supervision meetings, for research collaboration meetings with international partners, and the ability to participate in AG events worldwide over the internet.

The following facilities were created:

In Bath, a purpose built facility (100M 2) containing a full multi-camera AG node seminar room with seating for 40-50 and a single camera system break-out room with seating for 8-12 in board room style were built and equipped.

In Exeter, a purpose built facility (175M 2) containing a full multi-camera AG node seminar room with seating for 60-80 and a single camera system break-out room with seating for 12-15 in board room style were built and equipped.

In Bristol the GWR facilities were integrated with the University’s core AG development programme. In Physics, a new 20 seat seminar room containing a full multi-camera AG system was installed which complements the existing facilities. In Engineering, an additional small 20 seat seminar facility was built integrating with the new EngD facility which was under construction (EPSRC funded, joint with Bath University). Additionally two full multi-camera AG nodes were installed and integrated with the lighting rigs in the Wickham Theatre venue, one in the main performance space and one in the rehearsal space.

Sufficient funds were available within the overall capital budget to extend the core facilities beyond the Bath-Bristol-Exeter triangle, to include facilities at the University of Western England, Plymouth University and the Tremough campus in Cornwall.

On the Tremough campus in Cornwall, a seminar room (80m 2) containing a full multi-camera AG node with seating for 30-40 was completed. These new facilities have allowed multi-way video conferencing between the institutions in the South West, and have seen widespread use both within and outside the core GWR training programme.

The Access Grid nodes in Bath, Bristol, Exeter, UWE and Plymouth, have been used to deliver a range of seminars and taught courses in Applied Maths, Sustainability, Materials and Psychology as part of the GWR training Network. The training network has drawn upon expertise across the research-active HEIs in the South West, and included high-quality training in areas such as research methods, ethics, internationally important research results and local/regional research. The training is made available to all HEIs in the region and has established a basis on which to build sustainable, collaborative, discipline-specific training for South West graduate students.
Applied Mathematics

Applied mathematics lectures are being delivered to Exeter University research students via the MAGIC consortium. www.maths.dept.shef.ac.uk/magic/index.php. Based on the GWR investment in AG technology, Exeter has been part of this consortium since October 2007 and has received Applied Maths lectures and courses since that date. Some 400 hours of lectures have been booked and made available to Exeter Mathematics students, with an average of 15hrs per week available. Exeter University also deliver lectures to students via the MAGIC consortium using the GWR AG system (Prof. Peter Ashwin).

Sustainability

Sustainability lectures and seminars have been co-ordinated from Exeter University and started broadcasting on in 2008. The series is coordinated by Dr Stewart Barr and Dr Matt Lobley (GWR Fellow). In total, there have been over 50 hours of seminars attracting over 1000 students and academics. Content has been diverse, as the broad theme of ‘Sustainability’ would suggest, including sessions on sustainable fish stocks; budget airline strategies; CAP reform; and the future of bio-energy production in the South West. All four Sustainability Fellows have delivered at least one seminar. Sessions are recorded and made available to students and academics www.gwr.ac.uk/sustainability.php) for streaming from the GWR web site.

Psychology

Psychology lectures and seminars began broadcasting in 2008 and are coordinated from Bath University. The series is coordinated by Prof. Alan Lewis and Dr Neal Hinest (GWR Research Fellow). In total 35 hours of seminars attracting c.500 students and academics have been delivered and content has been diverse. All four GWR fellows have delivered sessions and GWR has recorded many sessions and made them available online www.gwr.ac.uk/psychology.php

Materials

Materials seminars began being broadcast in 2009, and are coordinated from Bristol University. The series is coordinated by Prof. Geoff Allen. The Seminar series is branded as ‘New frontiers in Materials’ and aims to expose postgraduates to a range of high-impact, world changing research. 35 hours of seminars were delivered throughout 2009-11 with the 5 GWR fellows each contributing to the programme.

Generic Training

In addition to discipline specific postgraduate training, GWR are involved in generic postgraduate training activities. For example, a workshop on the viva examination “viva la viva” which is run by Exeter University is regularly made available over the Access Grid. Workshops on effective postgraduate supervision for new academic staff are also delivered over the AG system and facilitated by the GWR director.

The GWR Director was chairman of the steering group for the Bath-Bristol-Exeter PGR E-Skills project “Researcher Development Online” which aimed to make generic PGR skills material available to students in the South West both electronically via the internet and by using the Access Grid for delivery. Ten modules are now available on-line in this series.
The future for GWR

With the positive support of the partner Universities, the Research Councils, the European Union and the original funders, GWR is now building on the many successes of the original program and carrying this innovative initiative beyond the original project funding end date of 2011. Projects include:

- Creating and managing a research and training program involving 40 PhD studentships at the partner institutions of the Combined Universities in Cornwall, financed by the European Social Fund.

- Working with the newly established ESRC South West Doctoral Training Centre to facilitate the establishment of up to 16 new co-funded collaborative PhD studentships, per year, at the Universities of Bath, Bristol and Exeter.

- Working with individual Departments, Schools and Colleges in the partner Universities to deliver co-funded collaborative studentships.

We believe that by facilitating the co-funding of innovative PhD programs using our well proven model, GWR can continue to prove effective in developing further the close links forged between the partner Universities in the South West, and between these Universities and a wide range of research active businesses and organisations.
GWR Impact Award 2011

In recognition of the success of the GWR Studentship programme, GWR organised the ‘GWR Impact Award 2011’ competition. The Impact Awards provided an opportunity to showcase research undertaken by students and academics to University senior managers, funding bodies, potential new collaborators, government departments, and the wider public. Many shortlisted candidates have had their nominated research written up as case studies, and published in this report.

Award entries were judged by the Executive Director of GWR, and a shortlist of 10–15 projects drawn up. The final decisions was made by the GWR Strategy and Management Board, which consists of the pro- and deputy vice-chancellors responsible for research at the Universities of Bath, Bristol, Exeter and the University of the West England.

The 13 shortlisted projects, from a total of 106 entries, were:

- **Safety of Critical Engineering Components in Transport and Energy Systems**, David Smith, Bristol
- **Long range inert tracer experiments and NAME dispersion modelling**, Dudley E Shallcross, Bristol
- **Integration of climate change and local air quality management at a regional and local level**, James Longhurst, UWE
- **The Potential Contribution of Utility and Leisure Cycling to the Sustainable Development of Integrated Transport and Tourism**, Graham Parkhurst, UWE
- **Novel Materials for fracture fixation devices**, Philippe Young, Exeter
- **A critical evaluation of community rail policy and practice on rural railways in the South West**, Jon Shaw, Plymouth
- **Developing the use and understanding of biotic supplements in Homarid lobster culture**, Simon Davies, Plymouth
- **Thermosetting Auxetic Foams for structural integrity, damping and dynamics applications: modelling, manufacturing and testing**, Fabrizio Scarpa, Bristol
- **Sustainable Agriculture - Biological control of crop plant diseases as a credible alternative to synthetic chemical pesticides**, Christopher Thornton, Exeter
- **Microbial Fuel Cells for water treatment applications**, John Greenman, UWE
- **Fuel metering using active materials**, Andrew Plummer, Bath
- **The Influence of Loading History on the Reliability of Welded Structures**, David Smith, Bristol

The GWR Strategy and Management Board selected Philippe Young’s project ‘Novel Materials for fracture fixation devices’ as the winner in an extremely hard-fought contest.