

# Driving Innovation through Collaboration

EXECUTIVE REVIEW • JUNE 2009



Since 2006, GWR has been forging new relationships between university research groups and between these groups and industry. We have established a very successful model in which we co-fund 130 PhD level research projects with industrial partners allowing all types of companies, including SMEs, access to world class research facilities.

We see activities like GWR as essential in these challenging economic times, if UK businesses are to ensure that they are in a strong position to prosper when the current down-turn is over. Without such initiatives to stimulate research and innovation, businesses can easily fall into the trap of innovation stagnation, leading to a serious risk of potential company failure when they find themselves unable to offer new and innovative products and services in the harsher market conditions of a future global marketplace.

As Lord Drayson said recently: “Based upon what the data tells us about the way in which other countries have successfully dealt with difficult economic environments, actually continuing to invest in science and innovation is the way in which companies can successfully navigate these very difficult times. I believe that market share is won or lost in a downturn to a far greater extent than in good times.”

We have showcased a very small number of our projects in this review, which were supported by our original 5 year project funding from the South West-RDA and HEFCE. I hope that you agree with me that the GWR initiative clearly deserves the follow on funding which we are now seeking, in order to maintain programme momentum, and to continue to contribute to innovation through collaboration between Universities and Businesses.





David Billington  
Executive Director GWR

**More details of our activities are available on our web site [www.gwr.ac.uk](http://www.gwr.ac.uk), and a series of short videos about the project in general and our investments in specific research areas are available at [www.gwr.ac.uk/westminster.htm](http://www.gwr.ac.uk/westminster.htm).**




# Great Western Research (GWR) – portfolio of activities






## Studentships

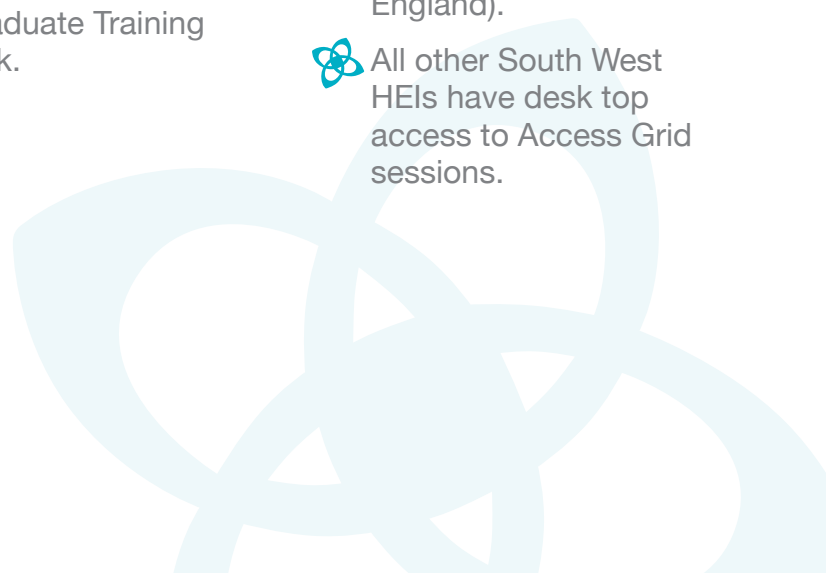
-  GWR currently co-funds 130 PhD studentship projects in six theme areas.
-  Each of our PhD projects has two supervisors at two different South West Universities, thus involving a pair of collaborating academic groups, and is co-funded by a business partner.
-  Projects are rigorously peer reviewed for quality and degree of collaboration both between the academic partners and between the academics and the business partner.
-  Projects must be of demonstrable economic benefit to both the business partner and the overall South West regional economy.

## Research Fellowships

-  GWR fully funds 20 three year Research and Training Fellowships.
-  We have secured a commitment from each host University that their GWR fellow will be offered a permanent academic appointment when the GWR funding ends.
-  Fellows are contracted to give up to 10% of their time to the GWR Postgraduate Training Network.

## Regional Postgraduate Training Network

-  GWR has established a South West Regional Postgraduate Training Network, using Access Grid multi-way video conferencing technology.
-  Five fully equipped purpose-built training facilities have been created (Bath, Bristol, Exeter, Plymouth and the University of Western England).
-  All other South West HEIs have desk top access to Access Grid sessions.



# Robotics

**Elumotion Ltd in partnership with the University of Bristol, the University of the West of England, and GWR PhD Student Craig Chorley.**

Humanity's ability to sense detailed tactile information through its fingertips is fundamental to our ability to interact with the world. If robotics is going to successfully move from the factory floor into the real world, robots must 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 then created and tested prototype layered robotic finger designs and published his results in a paper at the Towards Autonomous Robotics Systems conference in 2008.

In September 2008 GWR funded a research trip for Craig to Japan, and he returned with the ideas and inspiration for a sensing system which should capture the best sensing abilities of human skin.

One of the benchmark test and trials Craig hopes to put his prototype through is to see if his design can be made to read Braille!



Elumotion Ltd is one of the small companies to take advantage of GWR research funding. Based in Bath, Elumotion specialises in the development of robotic hardware which aims to replicate human or biological motion. From the outset of Craig's research, Elumotion has encouraged Craig to make use of his independent thinking to create new concepts and designs that would feed into new designs and directions for them.



**Those who build the present in the image of the past, will miss the challenges of the future.** WINSTON CHURCHILL

# GWR – Driving Innovation through Collaboration



- ✿ GWR will fund over **140** years of research effort in 2009.
- ✿ GWR funds research projects at **10** Universities across the South West.
- ✿ GWR studentships involve over **100** Business partners in co-funded projects.
- ✿ GWR funds research projects with **41** SMEs across the South West.
- ✿ GWR business partners have invested over **£3.5M** in the program.
- ✿ GWR has been instrumental, through its funded research and new collaborative relationships, in attracting over **£12M** of additional new research funding into the South West since 2006.
- ✿ GWR funds **36** PhD Studentships and **4** Research Fellows in Sustainability and Renewable Energy research.
- ✿ GWR funds **45** PhD Studentships and **5** Research Fellows in advanced Materials Science research.

# Aerospace

**Airbus UK in partnership with the University of Bath, the University of Bristol, the University of Exeter and GWR PhD students Peter Giddings and Alberto Pirrero.**

The large changes in aircraft wing profile necessary during take-off, landing and high-altitude flight are generated by complex hydraulic systems operating flaps etc from within an aircraft's wing.

There may be a better way in future aircraft designs however, as significant weight reduction and improved aerodynamics are just two of the expected advantages of using so-called "smart materials", materials which are able to change their basic shape on demand.

Smart materials is an emerging technology which is now being applied to produce aerodynamic control surfaces in aircraft which can radically change their shape on application of an electric field. The development of this technology is taking place through a partnership between leading aircraft manufacturer, Airbus UK Ltd and the Universities of Bath, Bristol and Exeter, through PhD programs co-funded under the GWR initiative.

**FACT The UK has the second biggest aerospace industry in the world, and needs to maintain its position through innovative research.**



The collaborative approach promoted by GWR has brought together world-class expertise in areas such as novel materials, composites and piezo-electrics in aerospace groups at departments in Universities across the South West of England. With promising initial results in hand, Airbus now have a firm basis for future research into the design and use of these smart materials. Spin-off ventures in other industrial applications should occur with smart materials technology already showing potential applications in areas such as fluid flow and valve design.

**Airbus UK in partnership with the University of Bath, the University of Bristol and GWR PhD student Andrew Rhead.**

GWR PhD Student Andrew Rhead, in partnership with Airbus UK, is seeking to establish a new understanding of how composite structures fail when damaged.

Composites are made up of long fibres of eg glass or carbon which are held together in a resin matrix. The material is shaped when the resin is soft before being hardened by applying a combination of heat and pressure over several hours - similar to the production of a laminate.



The composite material is light, strong and stiff, and therefore attractive for use in aircraft manufacture, and may one day supersede aluminium as a lighter, more durable alternative.

One basic characteristic of composite materials is however that you can't see cracks – unlike aluminium where you can easily spot them.

Airbus want to better understand the damage tolerance of composites to to assess their suitability for replacing eg wing parts in their aircraft. Replacing metal components with composites could lead to weight reductions of up to 40%. Even small structural changes could prove to be significant, as a reduction of total wing weight by just 0.5% can substantially reduce fuel consumption.

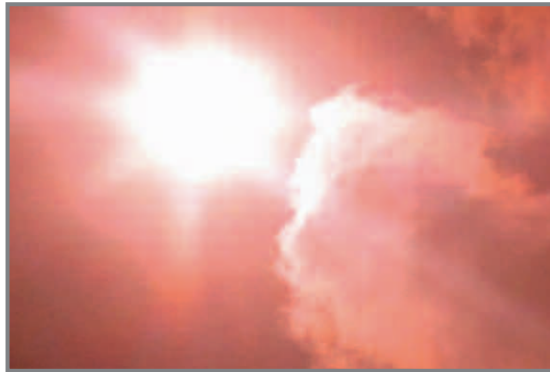
Reducing fuel consumption would not only lead to improvements in economy of the aerospace industry but would also have beneficial effects on the environment by lowering carbon emissions.

**FACT** The next generation of aircraft will need to see composite material usage rise to more than 30 per cent of the total structure, in order to meet operational cost savings and environmental targets. The UK has the opportunity to lead in this important area.

# Renewable Energy

**Dr Neil Fox, GWR Senior Research Fellow at the University of Bristol and GWR PhD student Tomas Martin.**

The solar power industry, has taken great leaps forward in recent years. Dr Neil Fox, GWR Senior Research Fellow at the University of Bristol, has sought to accelerate this progress by combining elements of the emerging CPV (concentrated photovoltaics) technology with thermionics (conversion of heat into electricity) to give a new generation of solar cells. It is anticipated this research strategy will lead to a research hub for the commercial exploitation of solar power generation technology.



**FACT** In 2007 Germany installed 130,000 new PV solar power systems, the UK installed 270. We need to increase the efficiency and reduce the price of PV installations, and GWR research is leading the way.

Neil's work has already drawn significant international attention, due to its potential to convert heat to electricity at efficiencies much higher than traditional solar cells, by using an emerging nano-technology approach which exploits microscopic diamond parts.

An important partnership with Bristol based industry leaders Wind Prospect, provided the necessary matched funding for a GWR PhD studentship project which allowed Tomas Martin to join Neil's team. Neil has subsequently been awarded 1 million Euros by the energy utility supplier E.ON, based in Düsseldorf, Germany to further develop his research ideas.

Recently, Neil's team was short listed in their bid for a Carbon Trust award, working alongside The University of Bath and MIT, based in Boston, USA.

With two more years of GWR research funding, and the guarantee of a permanent academic post when the GWR funding expires, the future for the South West as a centre of world class research into solar power generation seems bright.

# GWR = Leverage and Gearing



- ✿ The GWR PhD partnership model matches £ for £ public funding with funding from Industry partners.
- ✿ GWR has been instrumental in attracting over £12M of additional research funding into the South West since 2006.
- ✿ GWR partnerships allow even very small SMEs access to University research groups and GWR meet 50% of the cost of their research project.
- ✿ GWR Studentships and fellowships create critical mass in important areas, leading to additional funding applications and investment.
- ✿ GWR Research Fellows have a guarantee of a permanent post at their host University when the GWR funding expires.

# Natural Environment

**The National Lobster Hatchery working in partnership with the University of Plymouth, the University of Exeter and GWR PhD student Carly Daniels.**

The National Lobster Hatchery was set up to focus on the long term re-introduction of lobsters back into the ocean to revitalise lobster fishing in an economic, environmental and socially sustainable way.

The NLH & Great Western Research came together to jointly fund a PhD project to research into increasing the culture success and survival rates 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 strong link between better gut health and the successful metamorphosis of larvae into adult lobsters.

Her work has looked at optimising gut health of larvae by putting friendly bacteria (Probiotics) and complex sugars (Prebiotics) into their food to enhance gut development thus improving the animals immune and digestive capabilities, a similar approach to the probiotic supplements available to humans in many of our health food stores and supermarkets.

Carly's research has improved our understanding of how such dietary supplements function in lobsters and Carly aims to shortly produce a comprehensive food in pellet form which will improve growth and limit disease by improving larval gut health, and ensure that baby lobsters have a better chance of surviving when released into the wild.

**FACT** The NLH releases over 10,000 young lobsters a year back into the wild, with improved survival rates due to Carly's GWR funded research, thus helping to re-establish our lobster fishing industry.



# GWR = Sustaining the Momentum

- ✿ GWR's original five year project funding was from the SW-RDA and HEFCE.
- ✿ Businesses have invested a further £3.5 by co-funding GWR PhD projects.
- ✿ The GWR studentship model is a very effective and efficient means of driving innovation through collaboration between Universities and Businesses.
- ✿ The GWR fellowships have pump-primed important research areas in the South West.
- ✿ GWR is now seeking follow-on funding to maintain the momentum.



**GREAT WESTERN  
RESEARCH**



**Great Western Research  
University of Exeter  
Kay Building  
North Park Road  
Exeter EX4 4QF  
Telephone: 01392 269104  
email: support@gwr.ex.ac.uk**

**[www.greatwesternresearch.ac.uk](http://www.greatwesternresearch.ac.uk)**



When you have finished with  
this publication please recycle it

**100% recycled**

This publication is printed  
on 100% recycled paper



**South West of England  
Regional Development Agency**



**herda<sup>sw</sup>**  
The Association of Higher Education Institutions in the South West



**HIGHER EDUCATION  
FUNDING COUNCIL  
FOR ENGLAND**

Great Western Research is jointly funded by the SWRDA, HEFCE, and the Universities of Bath, Bristol and Exeter and is supported by HERDA-SW.