Environment Template (REF5 Panel B) UoA: 12

1. Overview. The University encourages research across the range of academic activity and across all Faculties and units. In 2009 the University took a strategic decision to focus its research activities into a small number of broad research areas. Four over-arching Research Beacons and three Research Centres were established to support, encourage, nurture and facilitate research, and a significant proportion of the University's QR funding has been allocated to these Beacons and Centres. One of the Research Beacons is Digital Innovation (DI), which includes the ***Energy Efficient and Safe Vehicle (EESV)*** Theme. The Beacons and Centres each have management groups comprised of senior members of academic staff. They provide the context, and agree and manage targets for research grant applications, the strategic appointment of new staff, and the co-ordination and focus of research activity. In addition to the funding allocated to the Beacons and Centres, the University has established a central Research Development Fund which has been used to support individual staff, early career researchers and to fund a small number of research studentships. Research carried out in the EESV theme is within the overall remit of UoA12 and focused in the areas of automotive and manufacturing engineering. Research activities can be categorised into **12** research groups: Advanced Composite Materials; Advanced Maintenance; Chassis Control Systems; Crash Analysis; Engineering Chemistry; Human Factors; Hybrid and Electric Vehicles; Intelligent Robotic Systems; Internal Combustion Engine and Emissions; Strategic Manufacturing Management; System Identification; and Vehicle Collisions and Dynamic Control Systems. Much of our research is carried out in the Institute for Automotive and Manufacturing Advanced Practice (AMAP). AMAP is a research and reach-out centre providing assistance to industry. Our research has always been, and continues to be, applied in its nature and focus, and we support staff in working on projects in collaboration with companies regionally and further afield. Our work is making demonstrable impact within our external stakeholder community.

2. Research Strategy. The University Research Plan reinforces the importance of research, and sets out the context in which units plan their own activities. The fundamental context for research is to underpin the academic standing of the University as a seat of higher learning and scholarship. The University is committed to being research active, with a research active curriculum, undertaking research which both enhances the learning experience of our students, and delivers impact. To guarantee a long-term, sustainable, research strategy, the University retain/attract highest calibre staff/students, secure funding, and establish/strengthen national and international collaboration. The aim is to carry out world-class research into leading edge technologies with novel methodologies and solutions, for successful exploitation with strong regional, national and international, social and economic impact. The Engineering group seeks to benefit society by creating world-leading engineering knowledge that fosters sustainability and prosperity. We share this knowledge and transfer it to industry through publication, teaching, collaboration, and entrepreneurship. By integrating engineering disciplines (Mechanical, Automotive, Electrical & Electronics and Manufacturing) in one division, we can address major challenges and develop complete solutions, serving as an international centre for engineering excellence with the following objectives:

- To ensure that all our research explicitly informs our teaching programmes, and to be recognised by our students as providing them with an excellent academic experience
- To obtain a good level of external research income by creating and applying a rigorous internal review process, and thus submitting high quality project proposals with an improved success rate
- To deliver novel solutions for managing vehicle and associated systems that encourage and enable energy efficiency
- To perform and deliver high quality research into the foundations and applications of low carbon vehicles and zero emission transport systems including hybrid and electric vehicles, lightweight materials, vehicle dynamics control systems, vehicle-human interactions, vehicle and occupant safety, crashworthiness, advanced maintenance and manufacturing

Since the RAE 2008, over 1/3 of the returned staff for Engineering have left the University, including experienced senior staff. Although this has resulted in a drop in research income since the RAE, the main research strengths have been retained and built upon through continued support and

development of the research active staff. The University and AMAP have established a centre of excellence at Sunderland in Low Carbon Vehicle (LCV) technology over recent years. AMAP has created links with regional companies and organisations substantially beyond that within former regional funded projects such as ZMT, GATE, Digital Factory, Engineering Fellows and GRASP.
This has extended the opportunities for collaboration and increased the chances of success over a wide range of contract research funding. Our staff are active in a wide range of R&D projects involving, for example, electric vehicles, hybrid electric vehicle technology, fuel cells, advanced manufacturing in the LCV industry, lightweight materials, vehicle safety and crashworthiness. We worked in close collaboration with One North East (ONE) (*till its abolishment in 2010*) who have been successful in recognising the region as the UK's first Low Carbon Economic Area; AMAP and Sunderland have been key partners in the region's pioneering activities in Low Carbon Vehicle engineering and manufacture. All our R&D projects are collaborative ventures with industrial partners. Although many are linked with leading regional companies - Smith Electric Vehicles are, for example, the UK's leading producer of electric vehicles - we are also working with industrial and academic partners within the national and international Low Carbon Vehicle community.
The main research objectives for the next five years are:

- To undertake high quality energy efficient vehicles research in the automotive technology domain that integrates our interactions with the learning community, business, and the wider research community
- Modest growth across EESV research theme through strategic appointments of research-active staff, funded jointly through staff replacements and strategic investment
- Improvement of research facilities, laboratories and infrastructure funded by the university
- Increased support for research-active staff for research students, conference attendance, sabbaticals and industry placements through the Research Support Fund

Critical activities implemented since 2008 include:

- Majority of staff contributing across research themes, and co-location of researchers and reach-out staff to promote cross-fertilisation
- Success in internal competition for SRIF funding (£100k awarded)
- Significant increases in research proposal submission achieved via training in successful techniques for writing research proposals and grant applications
- Provision of both prescribed and optional training programmes/modules for research students.
- Increased collaboration with RAE 5 and 5* national partners (e.g. Warwick WMG), as well as international partners (e.g. ORNL, MIT, NCAC, USA; BMW, Germany; NIMS, Japan)
- Department Strategic Research Fund established via overhead recovery from research and reach-out projects and establishment of Personal Research Accounts (PRAs) for PIs funded through overhead recovery. Funding for and planned advance strategy for conference submissions administered through the research beacon
- A focus on achieving national and international esteem through (e.g.) membership of journal editorial boards, steering groups, conference chairing, etc.
- Ability to access support relating to commercialisation of research ideas (e.g. The Hatchery is a dedicated unit supporting student enterprise)

3. People

i. Staffing strategy and staff development. The success of the research plan depends critically on the quality and engagement of staff. It is desirable that all new academic staff hold a higher degree in an appropriate discipline. New members of academic staff who wish to become research active have the opportunity to discuss their plans and needs with their line manager, and may be supported and mentored to develop their research activities. A range of research training programmes are available within the University. The University fully subscribes to the Concordat to Support the Career Development of Researchers, and is an HR Excellence in Research Award holder. The University values and promotes equality and diversity for staff and students. In line with our strategic aims, we work to ensure that all members of our community treat one another with respect and dignity. The University is an Athena Swan Bronze award holder, holds Investor

in People status, is a Stonewall Diversity Champion, and subscribes to the "two ticks" "Positive about Disability" scheme. In collaboration with the Universities of Northumbria and Teesside, Sunderland developed and piloted a Leadership Foundation funded programme "Leading on Research Excellence", a tailor-made strategic leadership programme for Readers and Professors across the region. Within the unit, a full time administrative assistant (supervised by a senior administrator) is responsible for research support, the research beacon, and the research information database. A research technician and secretarial staff support research seminars, journal and conference organisation, and research infrastructure. In line with strategic objectives of increasing research income, staff have specific responsibilities and workload allocation to support creation of high quality funding applications. Staff with funding knowledge, experience and responsibilities offer monthly surgery sessions.

Further support includes:

- *Mentoring via research student co-supervision:* supervisory teams may comprise established and less experienced academics, who benefit from mentoring from experienced staff, a well-established internal training and certification programme for research student supervision, annual monitoring and examination, and participation in Vitae, UKCGE and Research Council training events.
- Early Career Researcher Support and Development: senior staff mentor new academics, guiding them to develop existing research via funding applications, or involvement in current research projects. Early career researchers participate in the University's Research Student training programme, covering transferable skills and careers-related training.
- Mid-career staff are supported through mentoring from senior staff, formal workload allowances for projects and research students, a positive and supportive approach to research travel, and guidance on funding bids.
- Funding Applications: previously successful applicants support less experienced applicants with proposal preparation. Quarterly research funding training days inform, develop and support staff through internal and external speakers, including from major funding bodies such as the Research Councils.
- Bidding units, collaborate to submit funding applications. Group members discuss bidding opportunities, and share ideas and information on available funding (calls for proposals). Small teams pursue particular proposals, according to interest, academic expertise and background experience.
- Visiting Researchers/Professors: Engineering division host visiting researchers to collaborate with engineering staff and to conduct advanced research of mutual interest. Recently, Dr. Jorge Bonhomme Gonzalez and Dr. Victoria Mollon Sanchez, University of Oviedo, Spain have spent two months at Sunderland working with Prof. Ahmed Elmarakbi on modelling of cohesive elements and progressive failure analysis of composite materials. In addition to Dr. Erkki Jantunen, VTT, Finland, Prof. Diego Galar, University of Lulea, Sweden, and Prof. David Ortega, University of Valladolid, Spain visited AMAP to work on condition based maintenance, manufacturing process and human factors research.

Research students. The University aims to continue to ensure that our Postgraduate Research (PGR) students enjoy an excellent student experience, that their work is of the appropriate standard, and that they achieve their qualification within an appropriate time period. In 2012 the University undertook a review of the PGR provision at all levels which highlighted our strengths and identified areas for action. Central Graduate Research Support provides administrative support for PGR students, their supervisors and procedural aspects. Central Academic Services provide a comprehensive offering of PGR student training programmes which spans the VITAE researcher development framework. All PGR students are required to attend this programme, and annual reviews of their progress. Recent PRES surveys have shown good scores for student satisfaction with their skills development, ranging from 73% for transferable and research skills to 85% for analytical and project management skills and 87% for independent learning. The recent university-wide PGR review identified this as "a comprehensive skills training programme." Engineering researcher facilities are modern and up to date, housed on one floor of the purpose-built Media

Centre providing round the clock access to laboratories, meeting rooms and office space. The co-location of researchers also enables interaction and collaboration with other researchers. Research students are located by research group and are provided with a desk and cupboard space as well as their own PC and software. The library is adjacent and carries a wide range of relevant journals and books in electronic and paper formats.

Since RAE 2008, there have been several research students undertaking PhD research projects. Our research and reach-out institute, AMAP has contributed strongly to researcher numbers, employing longer-term research/reach-out assistants to support its activities. A Reader at DCET acts as Research Student Manager to oversee recruitment, training, resourcing and monitoring of all research students. Facilities are complemented by a full time administrative assistant (responsible for scheduling annual progress reviews and supporting the research student manager) in the Faculty as well as a research technician and a departmental research manager responsible for all aspects of research student provision. The central, university Graduate Research Section oversees all research within the University and offers a research skills training programme covering induction, methodology and general research skills for students and other courses for staff, including certification. The department provides additional high quality, subject-specific training including induction, writing skills and subject specific methodology support. Specific training for researchers wishing to undertake part-time teaching is provided by central academic services.

Recruitment. Detailed information is available on the research section of the University's website. Advertising is used to promote a number of fully funded places. Enquiries are channelled via the Faculty's research administrator to the research student manager, this allows for tracking at the first point of contact. All applicants are interviewed by a panel (comprised of the research student manager and the two potential supervisors). Successful applicants will then be offered a place via the Graduate Research Section. Research students are supervised by a main (Director of Studies) and at least one co-supervisor (designed to complement expertise and experience, as needed). Supervisors are all research active, subject experts and recognised nationally, and internationally. Research student consultative committees are regularly held in order to field any issues that arise and the faculty research student group monitors student progress and examination arrangements.

4. Income, infrastructure, and facilities. Central support for research is provided by an experienced Research Support team, within Research, Innovation and Employer Engagement. This team provide support for postgraduate research students, for research active staff, research project managers, and senior management through the provision of management information. Central support is also provided for the identification of funding opportunities, and bid writing and submission.

Research Infrastructure. Between 2008 and 2013 continued investment in the physical infrastructure for automotive and manufacturing engineering research proved an important factor in our success. A dedicated sum of £100,000 was acquired from The Science Research Investment Fund (SRIF) funds through competitive internal competition. SRIF is a joint initiative by the UK Office of Science and Technology (OST) and the Department for Education and Skills (DfES). The purpose of SRIF is to contribute to higher education institutions' (HEIs) long-term sustainable research strategies and address past under-investment in research infrastructure. Modern, state-of-the-art facilities for integrated research and reach-out activities have recently been provided within the St Peter's campus and the Industry Centre on Hylton Riverside. In terms of engineering research equipment and hardware, we lead the region in many instances with our state of the art equipment. Examples of some relevant equipment resources include: *Zwick Z010* 10kN (screw-driven), *Dartec HC 10* 10kN, *Dartec HA 100* 100kN, *Instron 8033* 500kN (all servo-hydraulic, digital control), *Avery Dennison 7104CCJ* 1000kN (hydraulic) Universal Mechanical Testing Machines; 2 x *MTS* Constant stress creep machines; Zwick *Z5113* Pendulum Impact Tester; *Vickers HTM* (1kg to 120kg), *ESE VM* (2.5kg to 120kg) Hardness Testing Machines; *Zwick 3115* (Shore A) and *Zwick 3117* (Shore D) Hardness Testers; *TA Q10* DSC Thermal Analyser; *RayRan* 6-Station HDT/Vicat testing machine; *Porpoise P9* Twin Capillary Intelligent Extrusion Rheometer; *Bohlin CVOR* Rotational Rheometer; Wide range of optical and electron microscopes; Electric Fan Units; Bearing Test Rig; Multi Purpose Vibration and Dynamics Rig; CNC Machining facilities; Prototype hydrogen

powered vehicle; Fuel cell vehicle demonstrator; Engine test dynamometer for testing internal combustion engines, electric vehicle drive motors and power load testing for electric vehicle batteries Driving simulator suite.

These resources support mechanical and electrical engineering research. In addition, as our rheological analysis facilities and expertise are comprehensive and internationally known, we are able to attract market-leading process simulation software companies, such as *Moldflow* (Injection Moulding) and *Compuplast* (Extrusion), both have presented research seminars at Sunderland University. In the area of Advanced Maintenance, test machinery currently installed and commissioned includes a range of test rigs (e.g. amulti-purpose vibration and dynamics rig). *MAINTelligence* Computerised Maintenance Management Software is utilised to fully integrate monitoring, inspection and asset management technologies within a single database. The CMMS system allows the user to perform typical maintenance tasks for Advanced Maintenance Scheduling, Purchasing and Inventory, Vibration Analysis, Lubricant Analysis and Equipment Inspections.

AMAP houses our driving simulator suite (£154k investment). It possesses a 180° field of view and is backed up with comprehensive ancillary equipment (e.g. eye-tracking) in support of research in Human Factors. Such establishment could not have happened without the extremely strong synergy which exists between our research and reach-out activities. This confirms the effectiveness of our stated research aim to exploit such synergies wherever possible.

Development of the University of Sunderland Cluster Computer USCC. The DCET have been successfully operating a large cluster computer since May 2007. In order to maximise its usage from the outset it was determined that the cluster should be a general purpose machine and not designed solely for a specific area of application. The University of Sunderland Cluster Computer was purchased with the support of the SRIF fund. A dynamic finite element package (LS-DYNA) has been installed on the USCC. Researchers in AMAP are now able to accurately analyse how a vehicle deforms in the event of a crash. A 3D animation can be produced which graphically shows how a model is deformed during a vehicle crash. An important goal of this work is to design improved structures that help to protect passengers in the event of an accident. The USCC significantly reduces the time required to solve this type of FE analysis problem. Several students and researchers have been using the cluster computer to support their program of research work.

5. Collaboration and contribution to the discipline. Staff in the engineering division interacted with and established a number of fruitful regional, national and international collaborations and worked closely with a number of highly respected researchers and Engineers in world-leading laboratories and organizations to deliver real impact of the research carried out in Engineering at University of Sunderland. We have established strong links with international industry, including: Oak Ridge National Laboratory (ORNL) and the National Transport Research Center (NTRC), Mascotech Co., Chryslers, USA; Engineering Service Inc. (ESI), **Canada;** Applus IDIADA Automotive Technology, **Spain;** Nissan, AVID Vehicles, Hyperdrive, HilTech and Tallent Automotive Ltd. Gestamp Automoción, Sevcon, Atlantic Water ltd., Parker Hannofin, Inova Power Ltd, Elecscoot Ltd, **UK;** BMW and Fraunhofer LBF, **Germany;** and Fiat, **Italy.**

Moreover, we do have strong research interactions with world-class academic institutions, in different subject areas and interdisciplinary research in automotive and material engineering, including: Massachusetts Institute of Technology (MIT), and National Crash Analysis Center, George Washington University, George Mason University, University of Cincinnati, and University of Washington (Automobili Lamborghini Advanced Composite Structures Laboratory), **USA**; Kyoto University, Institute for Material Research (IMR), Space Structure Laboratory, Tohoku University, Chiba University, Wassedia University and NIMS, **Japan**; Laboratory for Advanced Computational Engineering, University of Maribor, **Slovenia**; Vibration and Computational Dynamics Laboratory, University of Toronto and Ryerson University (NCE Auto21), **Canada**; Lancaster, Leeds, Warwick and Canfield University, **UK**; University of Oviedo, **Spain**; politechnico di Torino, **Italy;** Hunan, Jilin, Shanghai Jiaotong and Zhejiang University, **China**; and University of Sao Paulo, **Brazil** . As a result of that, we have published a number of prestigious papers and built on a strong base for future investments in research. The University of Sunderland is the UK Government's nominated representative body for the International Energy Agency (IEA) Implementing Agreement on

Advanced Materials for Transportation (AMT). Executive Committee for this IA and was instrumental in negotiating and securing UK involvement. A new research theme on developing the use of carbon fibres in automotive applications has been accepted by the relevant IEA Executive Committee.

Staff in Engineering have strong national and international reputation, well involved in professional activities, and contributed to the wider research base. The following shows examples of the staff professional activities and leadership in the academic community:

Dr. David Baglee: Published 45 journal and conference papers; Guest Editor for the international journal of strategic asset management; Reviewer for IEEE; Expert Reviewer for FP7; Managed 3 European funded Projects ; Managed a number of local and national projects; Member of A-Mest. Industrial and academics maintenance experts in Europe; Member of Euronseam. Maintenance experts in Europe; Member of the l management and technical committee for COMADEM; Member of the international society for condition monitoring; Visiting Professor at Lulea University, Sweden and Maryland, USA; Organizing committee for International Conference on Maintenance and performance measurement and management (MPMM); Invited speaker at MPMM Finland 2013.

Dr. Kevin Burn: Over 40 refereed publications; CEng, MIMechE; AMIMA; PI EPSRC Grant GR/M06062/01(£52k); CI North East Coast Engineering Trust Grant (£19.7k); Consultant for endoscope analysis and characterisation (2010); Paper reviewer for numerous international Engineering and Computing Journals; Book reviewer (Institute of Measurement and Control; Oxford University Press); PhD internal and external examiner; Programme Committee, International Conference on Informatics in Control, Automation and Robotics (ICINCO), 2004 – present; Reviewer for the 2013 International Joint Conference on Neural Networks (IJCNN 2013).

Mr. John Davis: Many years of experience in industry; Involved in manufacturing training, end of line testing, diagnostics; consulted on the Nissan Leaf manufacturing project; Consulted for Smith Electric Vehicles, and produced the diagnostic and repair manuals for Edison and Newton vehicles; Developed prototype electric vehicles and drivetrains; Involved in research into electric and hybrid vehicle safety and developed the training packages for the emergency services; Prepared all of the UK qualification in Electric vehicle service and repair, including those accredited by IMI, ATA, and BTEC, and authored several training courses; Member of the SMMT electric vehicle committee; Fellow of the Institute of the Motor Industry (IMI).

Mr. Derek Dixon: Co-author within an HE STEM project 'supporting engineering diploma student transition to University'- recipient of HE STEM funding; Many years of experience in industry in emerging vehicle technology, and hybrid and electric vehicle design.

Professor Ahmed Elmarakbi: CEng, MIMechE**,** Leads group of several PhD/DProf/researchers; Published over **100** Journal and conference papers; Book Editor - Advanced Composite Materials for Automotive Applications: Structural Integrity and Crashworthiness, Wiley, UK (2013); Over **40** invited talk and seminars world-wide; Expert Reviewer for FP7; EPSRC Reviewer; Founding Editor-in-Chief of International Journal of Automotive Composites; Editor-in-Chief International Journal of Vehicle Engineering; Regional Editor for Europe: International Journal of Vehicle Systems Modelling and Testing (2010-2013); Guest Editor: Int J Vehicle Structures and systems; Editorial Board member of Int J Vehicle Structures and Systems, Int J Mechanical Systems, and Int J Engineering and Technology; Reviewer for numerous highly impacted international journals; International Advisory Committee Member: MECHCOMP2014, USA, First KIIT2013, India, ScieTech2013, Indonesia, ICMAAE 2011, Malaysia; Session Chair: ASME Mech. Eng. Cong. 2011, USA, 14th II IEEE-ITS2011, USA, FISITA2006, Japan, FISITA2004, Spain, IBEC 2003, Japan; EESV theme leader; Member FISITA, SAE, JASE, CSME, ASME; Awarded several grants, fellowships and awards including: EPSRC (£200k), ZET (£350K), JSPS research grant (£18K), NSERC/JSPS (£80K), NSERC-IRF (£35k), NSERC-PGS B (£22k), OGS (£17k), and several fellowships (£29k); Only researcher selected to represent Canada in the world automotive contest held in Spain in 2004; Collaborator with many world-class laboratories, companies and universities.

Mr. David Knapton: Many years of experience in automotive industry; Involved in VA/VE design and management of large scale (cockpit modules), injection mouldings, and Engines design; Involved in several reach-out activities; collaborator with Nissan, Black and Decker and Husqvarna.

Dr. Mike Knowles: MIET; Published 41 peer reviewed papers; Invited speaker at events organised

by a number of organisations including the IET, MIRCE Academy, Institute of Marine Science, Engineering and Technology (IMarEST); Member of IET Automotive and Road Transport Systems Network Executive Team; Guest Editor of Neural Networks Journal (2009); Affiliate of Institute of Asset Management; Organising Committee for NCAF conference (2009) and 2nd ICMPMM (2012) and several national/international workshops; Member of review panel for four international journals; Reviewer for several international journals; Former Associate Editor for Gestalt Theory Journal; Member of Cranfield University/EPSRC Centre for Through Life Engineering Services-Research Think Tank.

Professor John MacIntyre: Board Member of the North East Productivity Alliance (NEPA); Board Member of the Biosystems Informatics Institute (BII); National Committee Member of the Natural Computing Applications Forum; Editor-in-Chief, international scientific journal Neural Computing and Applications (Springer Verlag); Editorial Committee member for international scientific journals: Pattern Analysis and Applications (Springer Verlag), Condition Monitoring and Diagnostic Engineering Management; Conference Technical Committee Member for AIAA,2005, 2006 and 2007, IJCNN,2007, COMADEM (1996 to 2002); EPSRC Peer Review College Member since 1996; Joint EPSRC/BBSRC Panel Member 1997-2001.

Mr. Adrian Morris: Leads a group nine staff including two post-Doctoral researchers and one PhD student working in the field of advanced maintenance and electric vehicle development: Published over 20 conference and journal papers; Collaborator with several national and international companies and institutions; Awarded several grants for technology development including: HEFCE Centre of Knowledge Exchange funding 2004- 2008, RDA funding for EV and Fuel Cell development, GRD with collaborating SME.

Dr. Ken Robson: Many years of experience in industry, strategically and commercially aware professional, with proven track record in manufacturing management.

Mrs. Helen Scott (previously Middleton): Invited Collaborator & Presenter – (i) Driving Assessors Accreditation Course, DfT, MAVIS, Crowthorne, 2005: (ii) MEDRIL, Medical Aspects of fitness to drive, Brussels, 2005: (iii) Jilin University, China, 2006: (iv) Shanghai University, China, 2006; Member of the National Strategic Development Board for Driver Referral Courses; One of panel of three experts in the field delivering consultancy and development of driver referral courses nationally on behalf of The Association of Chief Police Officers; Leading the development and implementation of the new National Driving 4 Change Course which now runs nationally across all UK local authorities; Involved in the development of the National Driver Alertness Course and Who's Driving Us? (WDU) course on behalf of The Association of Chief Police Officers - these courses now run nationally across all UK local authorities; Invited Key Note Speaker at The Association of Chief Police Officers (ACPO) Annual Conference in Manchester, UK, 2012; Invited Key Note Speaker at The Association of Industrial Road Safety Officers (AIRSO) Annual Conference in Leicester, UK, 2012; Invited speaker at Road Safety Expert Workshop, Stirling, Scotland, 2013; Full member of the British Psychological Society; Associate member of the IET.

Dr. Rob Trimble: IET role in Manufacturing Technical and Advisory Network - Panel member since 2005; Conference Chair, FISITA 2004, 23-27 May 2004, Barcelona.

Professor Alan Wheatley: Invited collaborator: US DoE/ORNL/NTRC Low-cost Carbon Fibre Programme; Invited Speaker: “Lightweight Materials for Transportation” International Energy Agency (IEA); Executive Committee, National Physical Laboratory, Teddington, UK, 2006; UK Government representative on, and Secretary of, Executive Committee of the International Energy Agency (IEA)-Advanced Materials for Transportation Applications; UK Technical representative for Compuplast “Virtual Extrusion Laboratory” FE/FD extrusion simulation software; Over £1m of consultancy contracts; Managed over £2m of reach-out-related projects in the last 15 years; Numerous appointments as expert witness in litigation work; Led a steering committee for the harmonisation of global standards for the production and supply of carbon fibre Under the IEA banner; Visiting professor at Oak Ridge National Laboratory, USA; Collaborator with the US Dept. of Energy, the US Office of FreedomCar and the US Automotive Composites Consortium.