Advanced Composites Centre for Innovation and Science

3rd ANNUAL CONFERENCE

15th September 2010

www.bris.ac.uk/composites
Programme

Introduction and update on ACCIS activities
   **Prof. Michael Wisnom, Director**
Future directions in NDT of composites
   **Prof. Bruce Drinkwater, Professor of Ultrasonics**
ACCIS Doctoral Training Centre
   **Prof. Paul Weaver, Professor in Lightweight Structures, DTC Director**
Developments in composites manufacturing
   **Prof. Kevin Potter, Professor in Composites Manufacture**
Bio-inspired multifunctional composite materials: mimicking Nature's innovation for improved performance
   **Dr. Richard Trask, Lecturer in Multifunctional Materials**
Carbon nanotube based multifunctional composites
   **Dr. Sameer Rahatekar, Lecturer in Composites and Nanocomposites**
Semi-empirical methods for fatigue of composites
   **Dr. Giuliano Allegri, Lecturer in Aerospace Structures**
Morphing composites
   **Prof. Paul Weaver, Professor in Lightweight Structures**

12.30-14.00 Lunch, posters, lab tours
14.00 I-Composites Grand Challenge Event
Advanced Composites Centre for Innovation and Science

- Established in 2007
- Brings together composites research across University
- Based in Engineering, linked to Science and Medicine
- Focus for collaboration between academia and industry
- ACCIS Vision:
  A world leading centre for composites research, combining cutting edge fundamental science with strong industrial links for exploitation and technology transfer

Manufacturing truss rib demonstrator

Carbon nano-tubes and particles
Highlights of year

• ACCIS Doctoral Training Centre
  First cohort of 10 students started October 2009

• Announcement of National Composites Centre, November 2009

  Ministers Ian Lucas and Jim Knight examine composite components in ACCIS laboratories
Academic Staff

- 13 core staff in Engineering
- Two promotions to personal chairs from 1st August 2010:
  - Kevin Potter
    - Professor of Composites Manufacture
  - Ian Bond
    - Professor of Aerospace Materials
- Total of 40 academic staff across the University with an interest in composites
New Appointments

- Two new Lecturers appointed in conjunction with the ACCIS Doctoral Training Centre
- Dr. Richard Trask
  Lecturer in Multifunctional Materials
- Dr. Sameer Rahatekar
  Lecturer in Composites and Nanocomposites
- New academic staff member in Composites Manufacturing currently in process of recruitment
ACCIS Research Themes

- Multifunctional Composites and Novel Microstructures
  - Embedded fibres for sensing, self healing

- Design, Analysis and Failure
  - Predicting damage at notches

- Intelligent Structures
  - Morphing aerofoil

- Composites Processing and Characterisation
  - Fibre waviness in curved composite
New Extension for ACCIS

- New £5.4M extension to Queens Building for ACCIS opened April 2010
- Large increase in both laboratory and office space
- Integration of staff and researchers
- Hot desks for collaborators and visitors
- Tours available after lunch

Ground floor lab extension
Open plan research offices on 2 floors adjacent to staff offices
Industrial Partnerships

- Rolls-Royce Composites UTC renewed for a further 3 years until 2014. Focus on validated analysis methods.
- Partnership with Vestas - 6 researchers working on design and manufacture of composite wind turbine blades
- Airbus Bristol Bath Strategic Alliance in Composite Technologies (ABBSTRACT) New £1.4M EPSRC project on variable angle tow placement to maximise performance, GKN now also a partner.
- GE Aviation - EPSRC SMARTCOMP UTSP (with Oxford University, Dowty Propellers, Hamble Aerostructures)
- Agusta Westland Rotorcraft UTC
New ACCIS PhDs

- **David Baker**: “Design of a morphing aerofoil using compliant structure optimization”, Jan. 2010
- **Stephen Daynes**: “Intelligent responsive composite structures”, March 2010
- **Christophe Thill**: “Corrugated composite structures for morphing wing skin applications”, March 2010
- **Chia-Yen Huang**: “Preliminary study on embedded vasculatures in self-healing FRP composite laminates”, May 2010
- **Michael May**: “New methods for understanding fatigue and damage tolerance of composites - Numerical Modelling”, May 2010
- **Mark Bloomfield**: “Efficient optimisation of laminated composites”, June 2010
- **Wenming Zhao**: “Processing and characterisation of MWCNT composites for aerospace applications”, July 2010
- **Greg McCombe**: “Fibre reinforced plastics with electromagnetic functionality”, July 2010
- **Yusuf Mahadik**: “Investigating 3D Woven Composite Architecture”, Sept. 2010
New Projects

- **MAST-Morphing** – Paul Weaver (QinetiQ)
- **Biologically Inspired Next Generation Outer Body Armour (BINGO)** - Richard Trask, Ian Bond (MOD – DSTL, Centre for Defence Enterprise)
- **In-situ Ti6Al4V Matrix Composites with Network Reinforcement Distribution** – Hua-Xin Peng (Royal Society International Joint Project with Harbin Institute of Technology, China)
- **Reduction of Vibration Levels In Blades Using Novel Materials and Structures (part of SILOET)** - Fabrizio Scarpa (Rolls-Royce/TSB)
New Projects

- MoU signed with JAXA, Japan
  *Dynamic Behaviour of Cup Stacked Carbon Nanotubes* – Hua-Xin Peng

- *Multiscale Reinforcement of Semi-Crystalline Thermoplastic Sheets and Honeycombs (M-RECT)* – Fabrizio Scarpa (EU, EADS Innovation Works, Vectrex plc and IMMG SA)

- *Probabilistic Assessment of Fatigue Delamination Growth in Fibre Reinforced Composite Laminates* – Giuliano Allegri (EPSRC)

- *Tidal Turbine Blades - Maximising Reliability and Performance and Reducing Cost (BMAX)* – Stephen Hallett (TSB)
International Collaborations

• Beihang University, Beijing
  Dr. Merry Li working here with Kevin Potter on manufacturing defect control and optimal design based on understanding of constituent materials

• Fabrice Pierron, ENSAM ParisTech, France
  Cedric Devivier - joint PhD study on Full Field Methods for Damage Detection

• AFRL – David Mollenhauer and Endel Iarve
  Working with Stephen Hallett on notched failure
Vision for composites

- Last July we presented our vision for a linked up series of activities covering research, education & training, and knowledge transfer.
- There was a gap in strategic manufacturing research and an opportunity to set up a Centre in the South West.
- Now coming to fruition through the creation of the National Composites Centre.
National Composites Centre

Purpose built 7000m² facility on Bristol Science Park with workshop space, open-plan offices, meeting rooms and teaching facilities.

It will be equipped to focus on optimised-design, analysis, rapid manufacture and testing.

An independent, open-access National Centre to deliver world-class innovation in the design and rapid manufacture of composites that will enable widespread industrial exploitation.

The Centre will form an internationally leading hub, linking activities across all sectors of the UK in research, education and training, technology transfer and incubation of new enterprises.
National Composites Centre Role

- Led by industry and the University of Bristol
- Main focus is at TRL 4-6
- Linked to Universities for research at TRL 1-3
- Companies can use facilities to support work at TRL 7-9
ACCIS and the NCC

- ACCIS will remain on UoB campus
- Principal focus is TRL 1-3
- Close links via:
  - Hot desks
  - Exchange of staff
  - Use of facilities
  - Joint programmes
  - Events, seminars
- NCC will provide a focus for new research problems and applications
Future Opportunities

- Strong academic and industrial collaborations
- Major new research programmes through TSB, MoD, EPSRC and FP7 initiatives
- Exciting opportunities for blue skies PhDs, EngDs and initial studies via DTC or undergraduate projects
- Knowledge Transfer Partnerships
- Collaborations through the National Composites Centre