


northwest composites centre

NW Composites Centre

Prof. P.J. Withers, FREng.
Executive Director
NWCC

Northwest REGIONAL DEVELOPMENT AGENCY

INVESTING IN englandsnorthwest

ncn National Composites Network

'The UK will offer a global aerospace industry the world's most innovative and productive location, leading to sustainable growth for all it's stakeholders'

Vision: Dept of Trade & Industry

- UK has 13% of the worlds aerospace market and aims to grow this to 17% by 2020
- NW turns over £6bn & employs 80,000

However…….

- Employment in NW shrinking by 3,000 jobs per year
- A third of NW aerospace industry supports aluminium airframe manufacture
- Commercial aircraft moving rapidly towards carbon…….

Composites: The current picture

- composites market is increasing dramatically
- composites capability within the NW Region is fragmented
- vast gap in the provision of employee skills for the design and manufacture of composites.
- no route for taking new products, processes and technologies from concept to market

NW Composites Study, NWAA 2006

Expected growth in high value composites

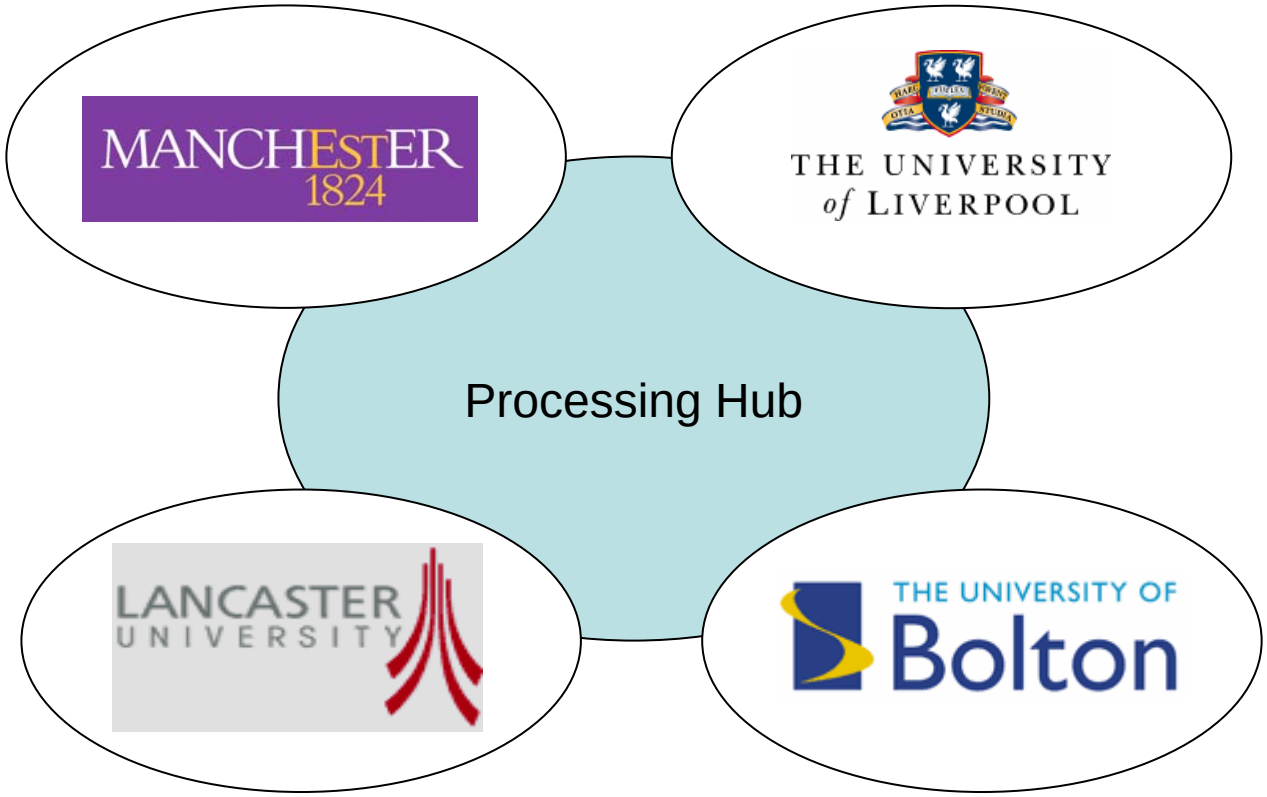
Market segments	2004 (Million kg)	2010 (Million kg)	Total change 2004-2010 (%)	Compound Annual Growth Rate (%)
Commercial	7.33	26.8	266%	54%
Regional jet	1.19	1.28	8%	1.3%
General aviation	2.02	2.23	10%	1.4%
Helicopter	0.50	0.59	18%	2.4%
Defence	1.95	2.82	45%	7.0%
Space	0.85	0.94	11%	1.8%
Total	**13.83**	**34.66**	**151%**	**16.5%**

From NW Composites Study 2006 (NWAA)

NWCC Mission

- to undertake applied research into new, cost effective, low energy, low cycle time composite **processing routes** for making real components and demonstrators
- to establish the effect of production routes on composite **structure and performance** and thereby optimise their fitness for purpose
- to act as a **Centre of expertise** supporting, evaluating and introducing innovation in composite manufacture and design

NWCC – a unique collaboration

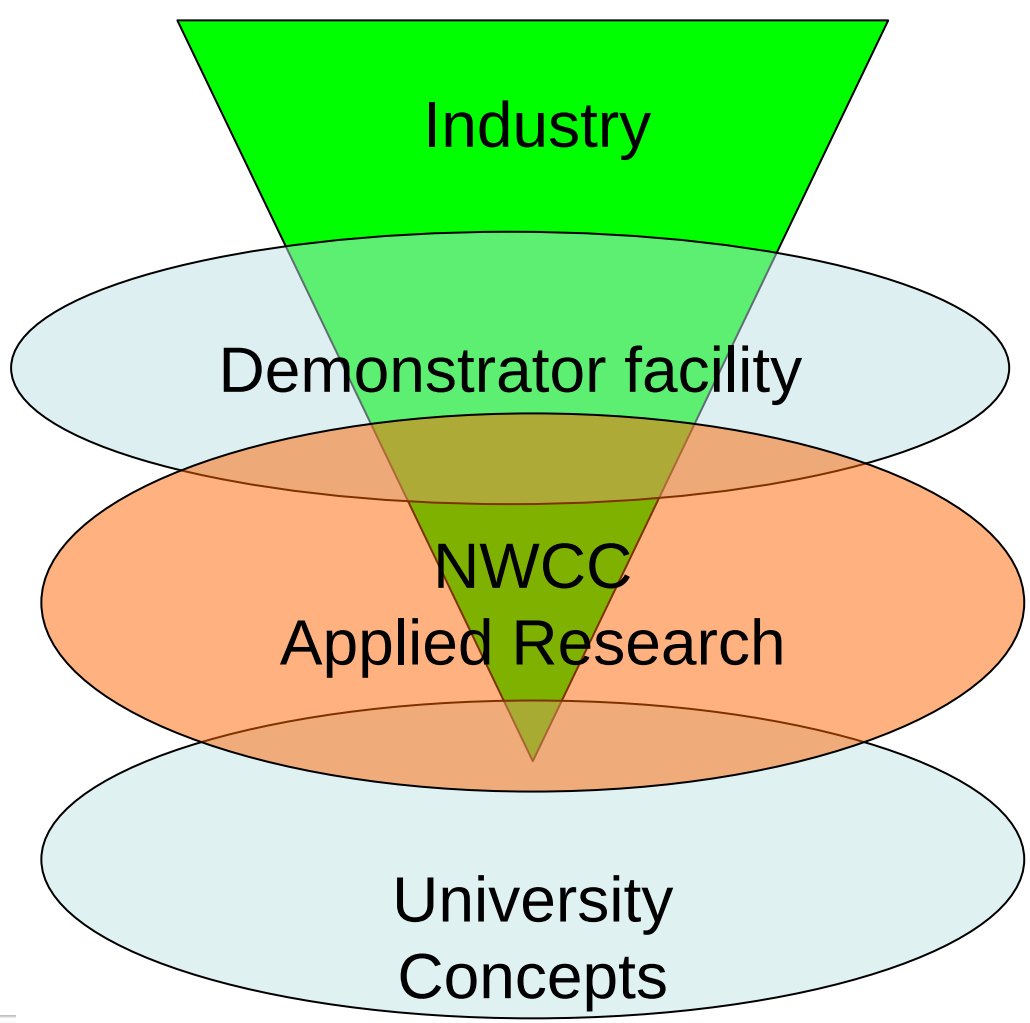


Sectors:

- Aerospace,
- Automotive,
- Marine,
- Rail,
- Construction,
- Petrochemical
- ……

Scope: Polymer composites, Hybrids and Metallic Matrix Composites

Centre Positioning



Production
TRL 7 -9

Demonstrator
TRL 4-7

Basic
TRL 1-4

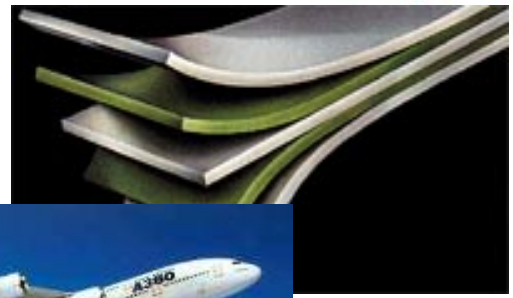
Science programmes

- Basic longer term research programmes
- Short responsive proof of concept, studies aimed at opening up new areas, trialling and optimising new processes

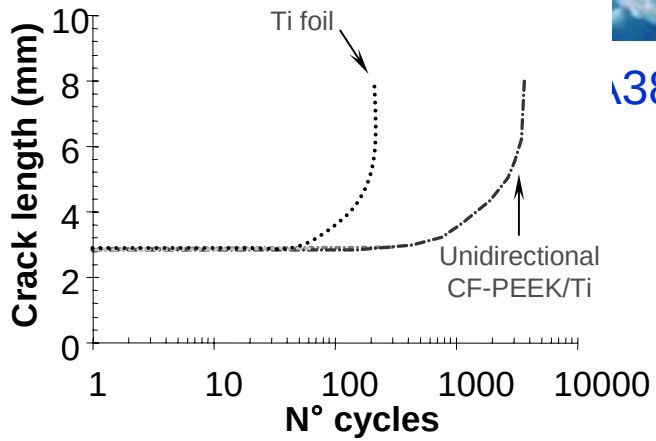
Strengths

- Hybrids
- Pultrusions
- Smart Composites
- Metal Matrix Composites
- Textile optimisation
- Fast cure/low cost out of autoclave processing
- Characterisation and damage monitoring

Liverpool: Impact & Fibre-metal Laminates



FMLs based on reinforced thermoplastics with excellent impact properties

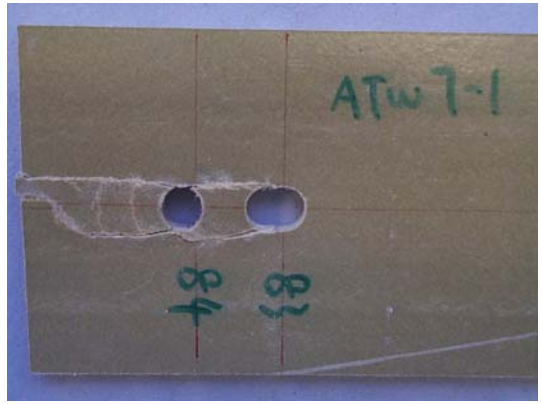


Prof. W. Cantwell et al.

Fatigue lifetimes an order of magnitude greater than plain metal alloys

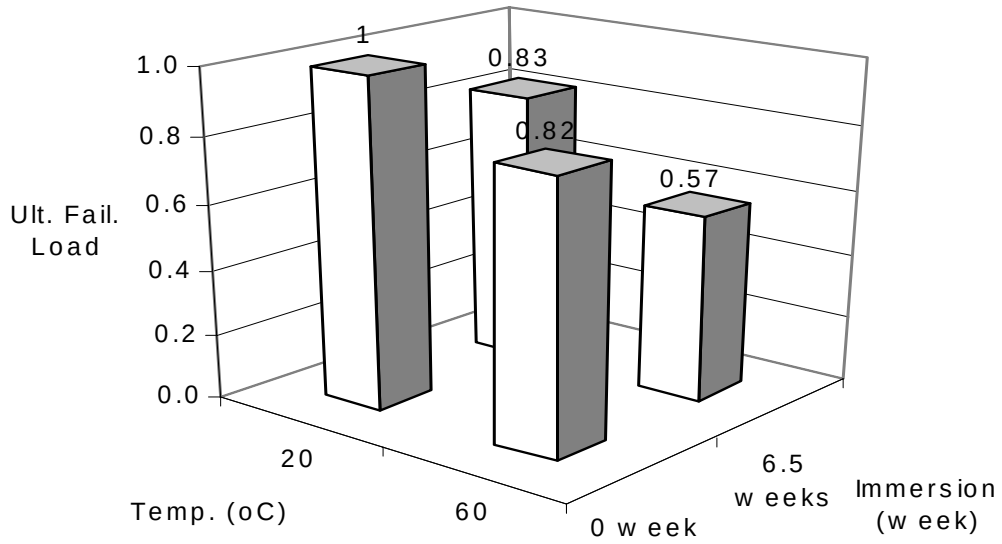
University of Lancaster: Pultrusions

Pultruded GRP Multi-Bolt Tension Joints



Tested after 6.5 weeks
in water at 60°C

- Material property characterisation and test developments.
- Flexural, buckling (and vibration) and failure structural elements (beams, columns, plates, shells etc).
- Behaviour of sub-structures and full-scale structures (eg. footbridges, trusses etc).
- Bolted/bonded joints



Strength knock down factors for hot-wet conditions

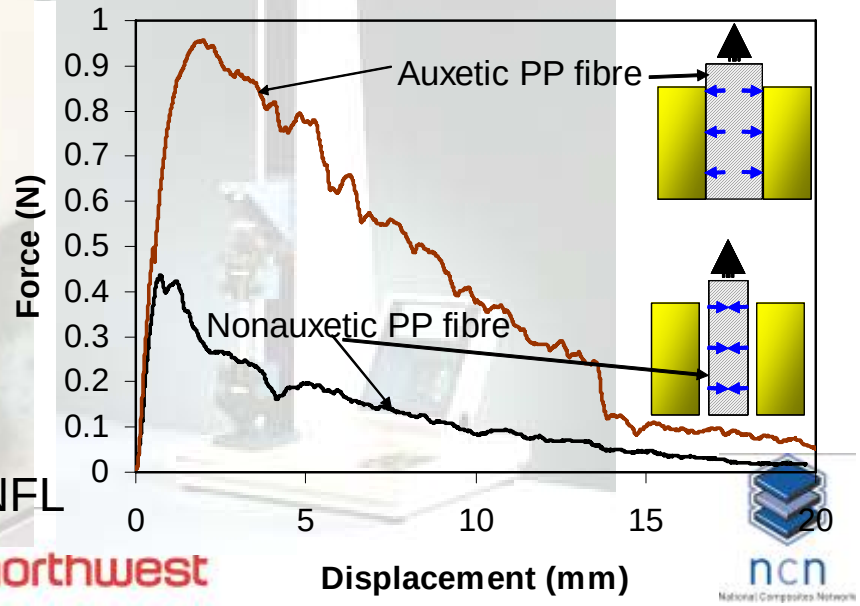
Prof. G. Turvey et al.

Bolton: Smart Composites, Auxetics & Flame Retardants

CAPABILITIES

- Fabrication and processing (cellular solids, microporous polymers, fibres, fabrics, coatings and composites)
- Characterisation (composition, flammability, durability, mechanical properties, microscopy, NDT)
- Modelling and simulation (analytical, finite element, molecular mechanics...)

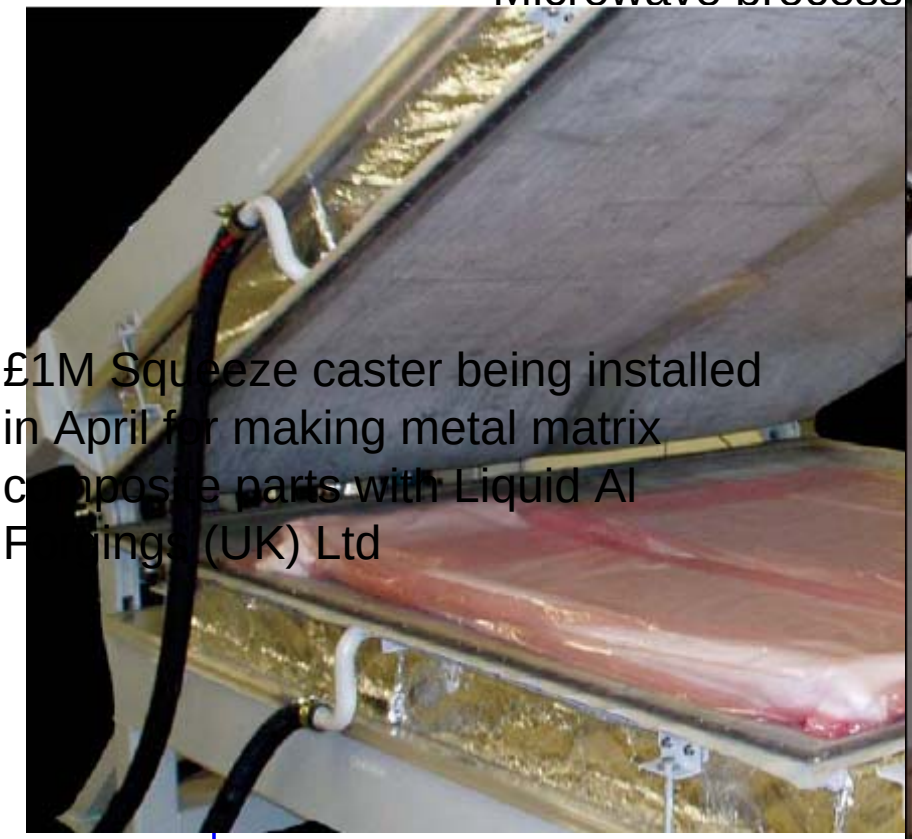
Dr. A. Anderson et al. Movie courtesy of BNFL



NWCC Processing Hub

NWCC Processing Facilities

Microwave process



£1M Squeeze caster being installed in April for making metal matrix composite parts with Liquid Al Castings (UK) Ltd

0 10 20

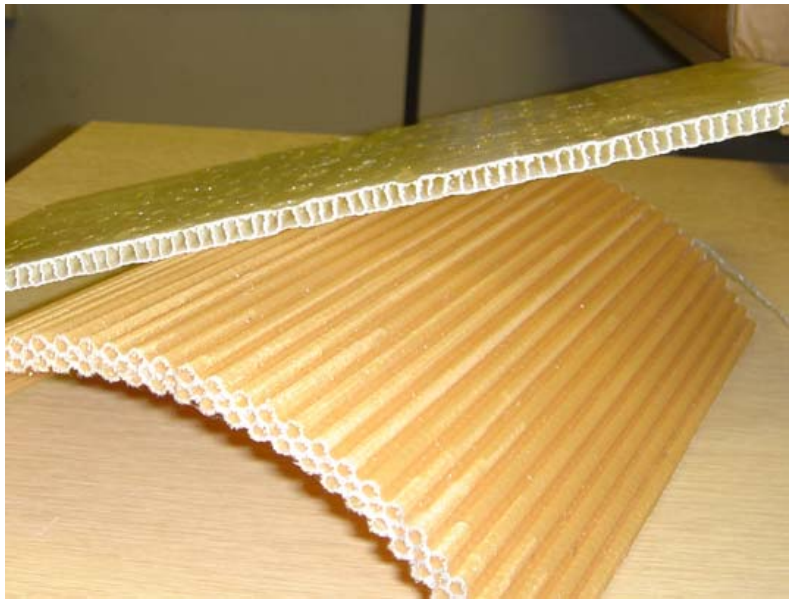
Time /min

Quickstep process plant and Centre of Excellence £700k investment by Quickstep

NWCC Textiles Capability

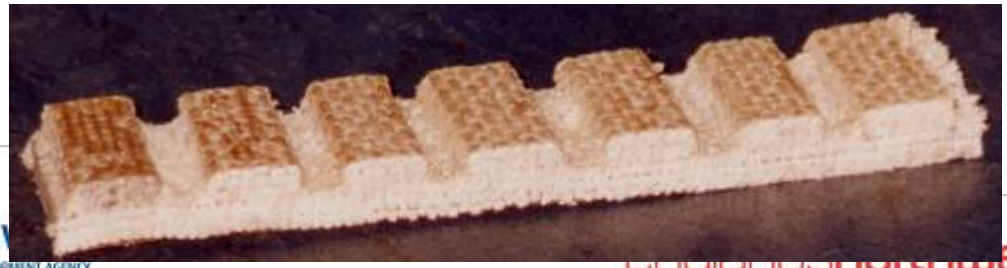
Harnessing one of the largest & most comprehensive textile facilities in Europe for yarn formation, weaving, braiding, knitting, non-woven textiles

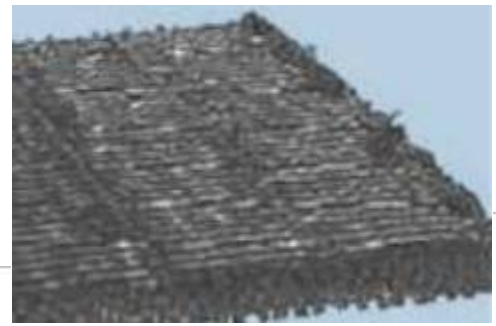
3D open structures



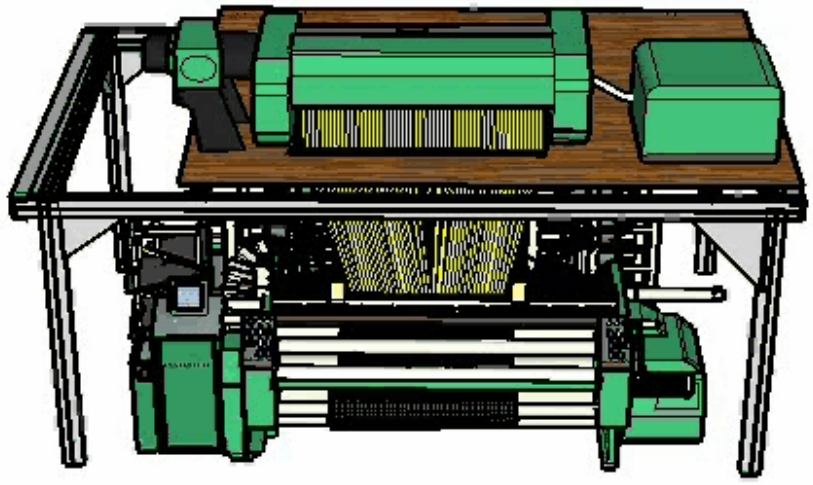
3D shells

3D solid woven structures

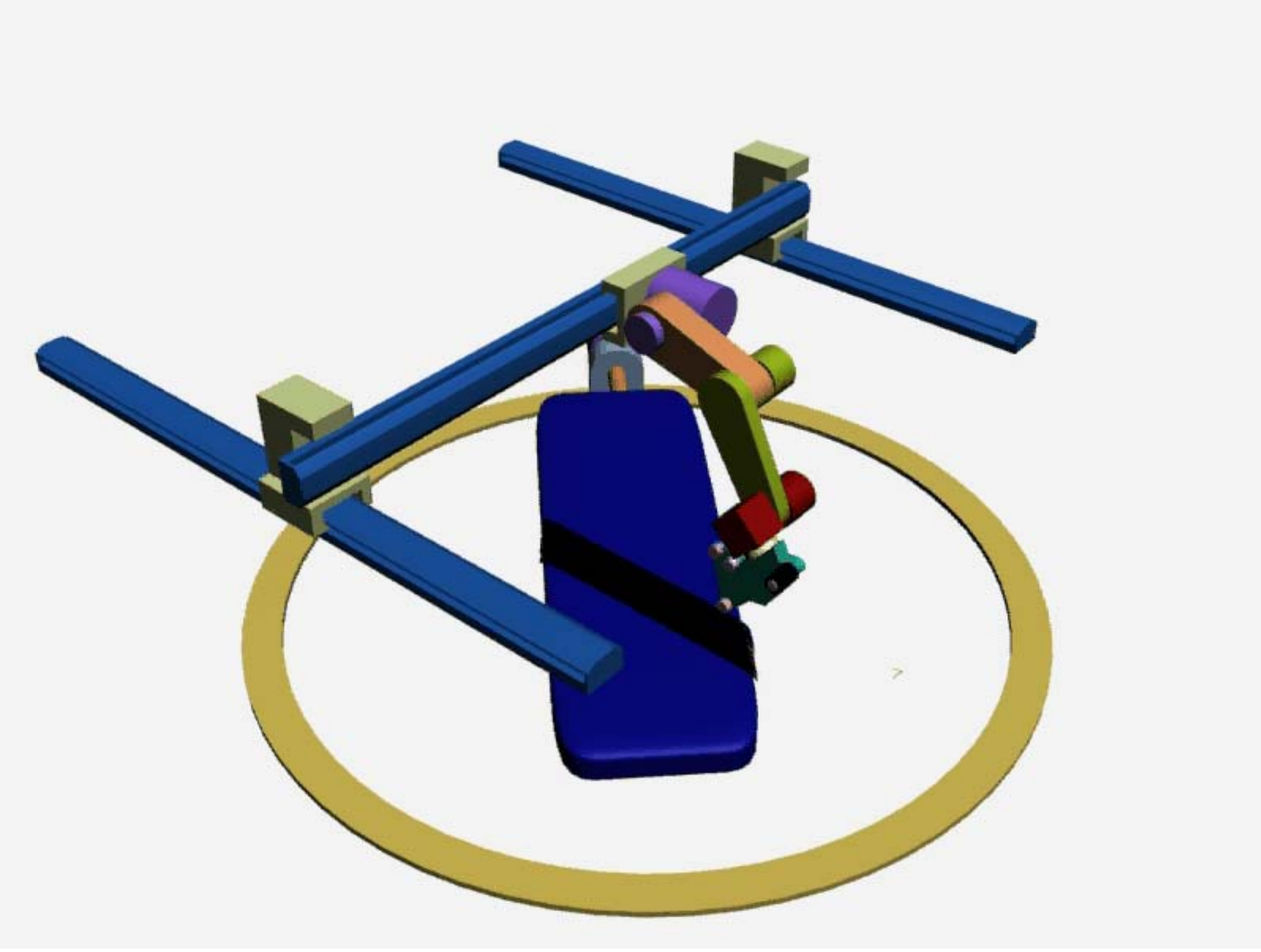




NWCC New carbon weaving facility



New robotic tow placement



MANCHESTER 1824

The University of Manchester

Composite characterisation and damage monitoring

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New C scan Facility

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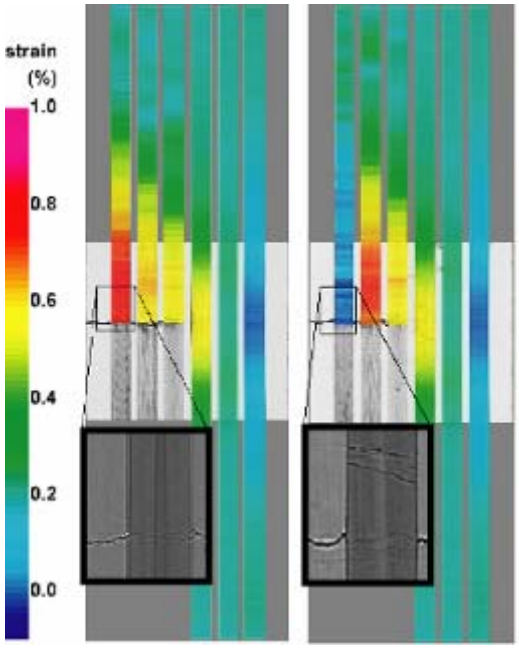
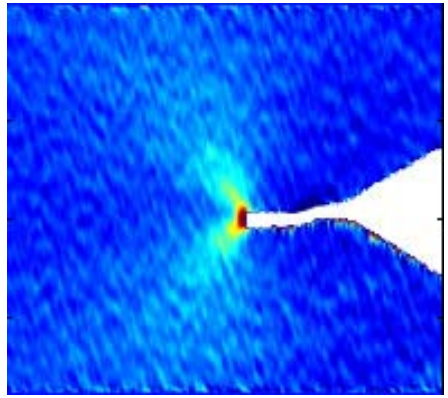
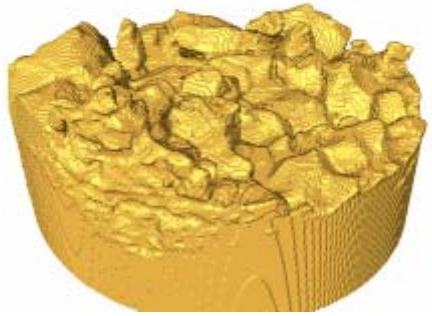
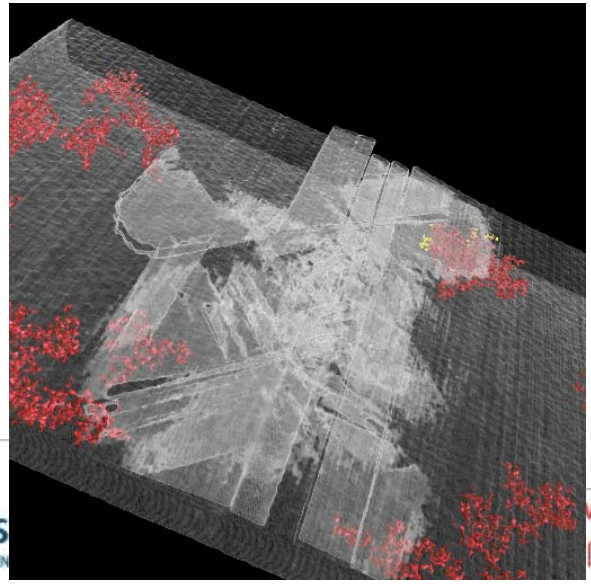
Damage monitoring



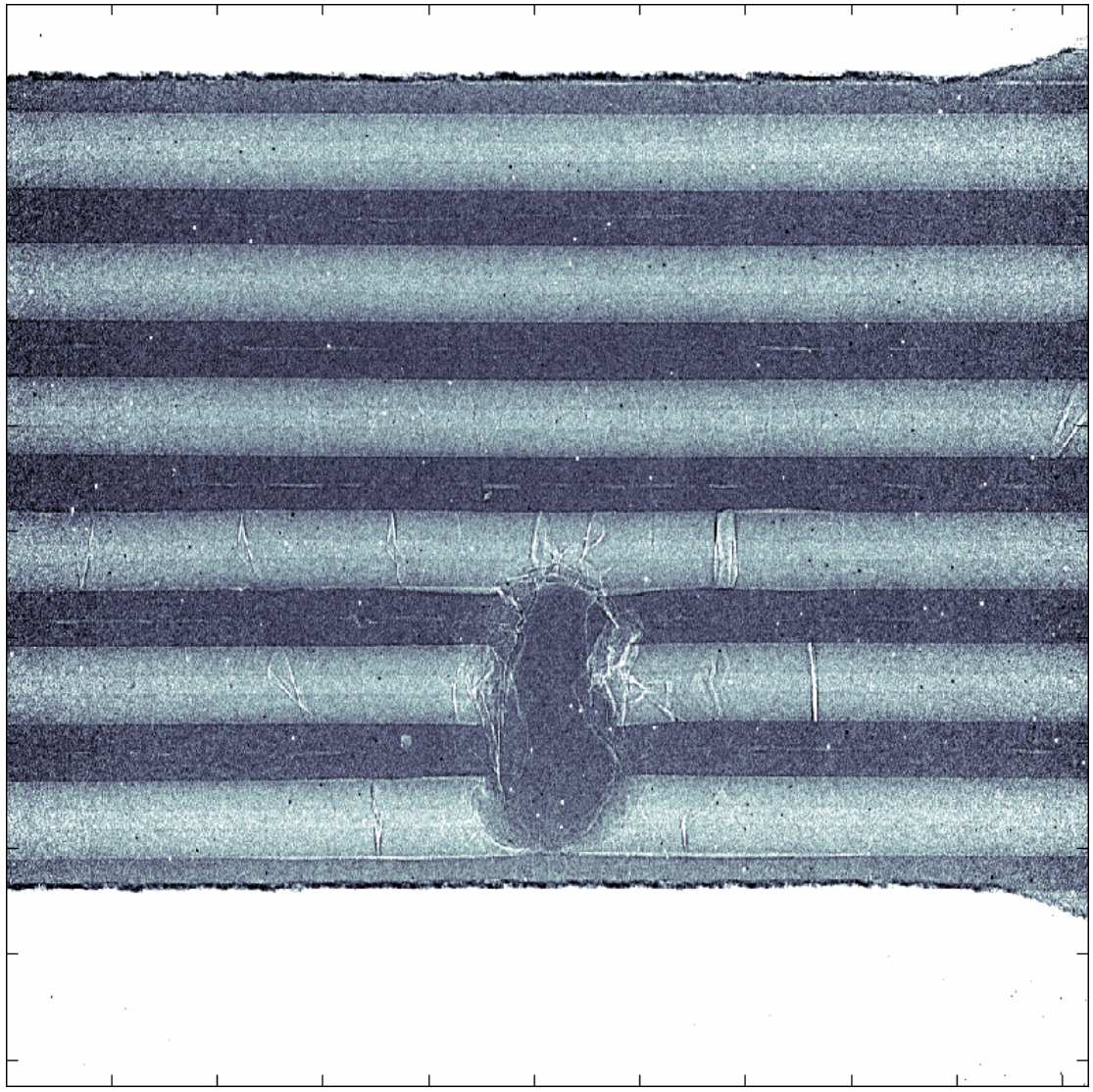




Courtesy systegration



Damage monitoring



Industrial collaborators to date…

FEDERAL MOGUL

FOTHERGILL ENGINEERED FABRICS

sigmatex
material innovation

BAE SYSTEMS

KOLBENSCHMIDT PIERBURG

Holdings plc
Brookhouse

CYTEC
Technology ahead of its time™

AIRBUS

HEXCEL

Hyde Group

ARR REINFORCEMENTS LIMITED

Rolls-Royce

SPIRIT AEROSYSTEMS ™

Spirit AeroSystems (Europe) Limited

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Project Schedule & Achievements

Dec 2005: Membership of National Composites Network

Feb 2006: US-UK DTI/OST Award of £1.5M collaboration with Univ. of Washington, Seattle

March 2006: £2.1M NWCC NWSF Grant started

March 2006: £700k Collaboration Agreement with Quickstep

April 2006: £1M Squeeze casting MMC Facility Installed at DACMAC

May 2006: £1.2M from CCLRC to work with Daresbury on imaging

May 2006: NWCC Processing Hub launched

Sept 2006: NWCC Reception & Office suite to be completed

Final Remarks

- Massive increase in take up of composites predicted
  - Great demand for trained graduates/post graduates
  - Requires capability support **NOW** if UK/Region to take up the challenge
- In response to this urgent need we have established NWCC as quickly as we could
  - we are now ‘open for business’
- Launch marks the start of our journey; ambitious plan to further develop capability and Centre
- Need to move applied research into a demonstrator capability

NWCC is just the start…….

NW Composites Study recommended:

- a prototype / demonstrator design, production and evaluation facility is needed aimed at stimulating and accelerating the introduction of novel carbon fibre production technologies for medium sized components into the aerospace and related sectors

NWCC lays the foundations – we must build on this at the earliest opportunity