

# Academic Excellence Delivering Bottom Line Benefit

Coventry and Oxford Brookes Universities

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EVS26, Los Angeles, Sunday 6 May 2012

# Introduction

- Four of the top 10 universities in the QS world rankings are in the UK
- By employer reputation the UK has five universities in the top 10, three in the top 5
- The UK produces about 9 % of the world's papers and receives about 10 % of the world's citations. UK's research productivity and quality remains second only to the US
- Flexible and effective mechanisms in the UK to support industry/academic collaborations
- The following projects undertaken by both universities are examples of some of this.

# Advantage Niche Vehicle Programme



Funded by AWM £2.5M 3 year Programme

Delivered by Cenex

(Centre of Excellence for Low Carbon and Fuel Cell Technology)

Lead Partner – Coventry University

Work commenced in January 2009



# Phase 1 Benchmarking & Feasibility Studies

- Benchmarking Study 1 Aerodynamics
- Feasibility Study 2 Electric and Hybrid Vehicle Technologies
- Feasibility Study 3 Lightweight Chassis Technologies
- Feasibility Study 4 Polymer Body Panel Technologies

Wind Tunnel testing at MIRA

Aerodynamics is a key element of fuel efficiency

12 Niche Vehicles (4 tests per day)

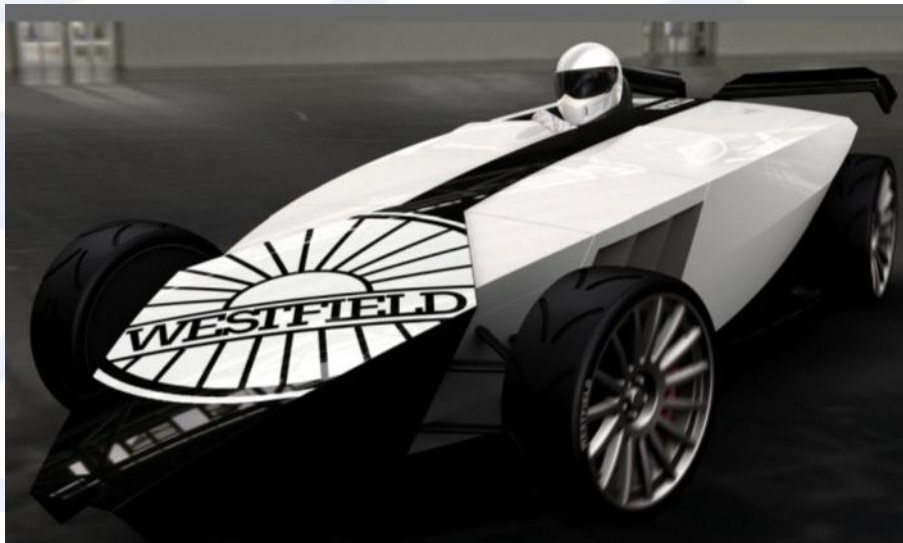
Establish current levels of performance

Act as a catalyst for new projects



# Electric Race Car Project

- Lead Organisation: Westfield Cars
- Project partners: RDM Automotive, Potenza Technology, Delta Motorsport
- Project Partner: Coventry University (Starting Sept 2009)
- New vehicle for race application – launch 2010





# The Low Carbon Vehicle Technology Programme



- Two year programme of applied research into the enabling technologies for low carbon vehicles

- Project partners span from OEMs to academia:

JLR, Tata, Zytec, MIRA, Ricardo,  
University of Warwick, Coventry  
University

- Subsidised with regional and European (ERDF) funding

## Workstreams

1. Batteries
2. Drive Motors
3. Power Electronics
4. High Voltage Electrical Distribution Systems
5. Auxiliary Power Units
6. Vehicle Supervisory Control
7. Lightweight Structures
8. Vehicle Dynamics
9. HVAC and System Cooling
10. Parasitic Losses
11. Energy Recovery and Storage
12. Aerodynamic Performance
13. HMI
14. JLR Validation Vehicle
15. Tata Validation Vehicle

# Coventry University Hydrogen Filling Station and Microcab

- Bringing 8 HFC powered urban cars to the CABLED project (Microcab)
- An integral part of our Low Carbon Vehicle Grand Challenge



# Consulting and CPD

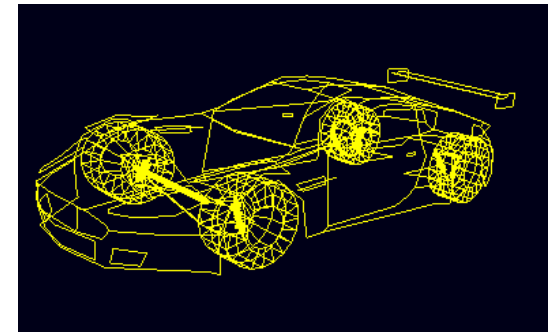


- **Use of Facilities**
- **Support on the Proving Ground**
- **Design/Analysis**
- **Academic Expertise**
- **Short Specialist Courses – Low Carbon Vehicle Technology**
- **Large Accredited programmes (MSc Automotive Engineering)**
- **Specialist Academic Expertise (Vehicle Dynamics -Tyre Modelling)**



# Automotive and Motorsport Engineering Education

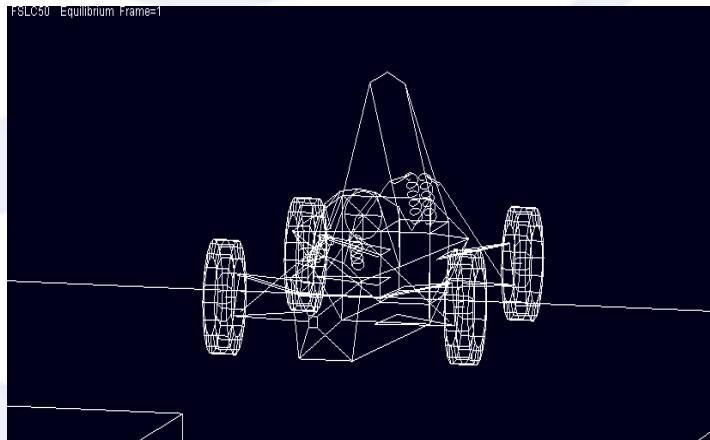
- Undergraduate, Postgraduate Teaching Informed by Research and Commercial Activity
- Real Student Involvement in Activity Led Learning



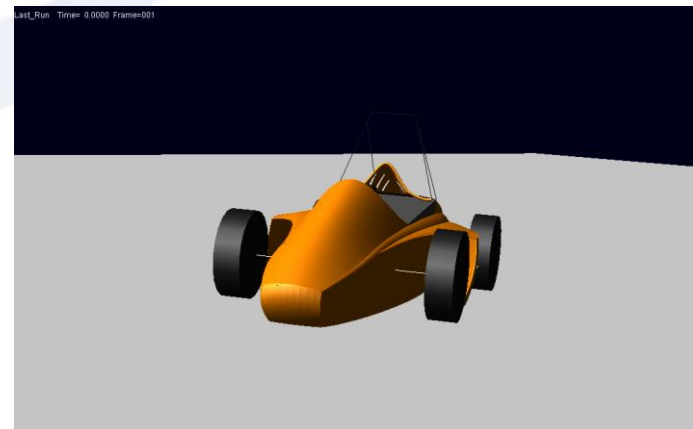
**MSc Vehicle Performance and Dynamics**

Final Year BEng Project 2008  
*Courtesy of Dave Wilcock*

# Student Experience

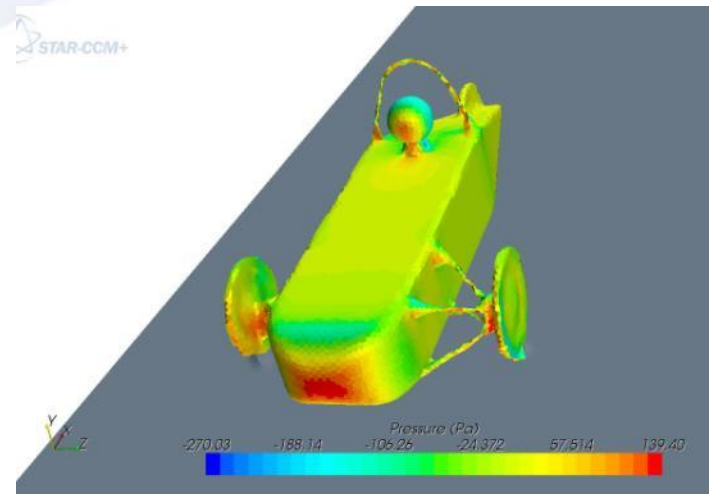
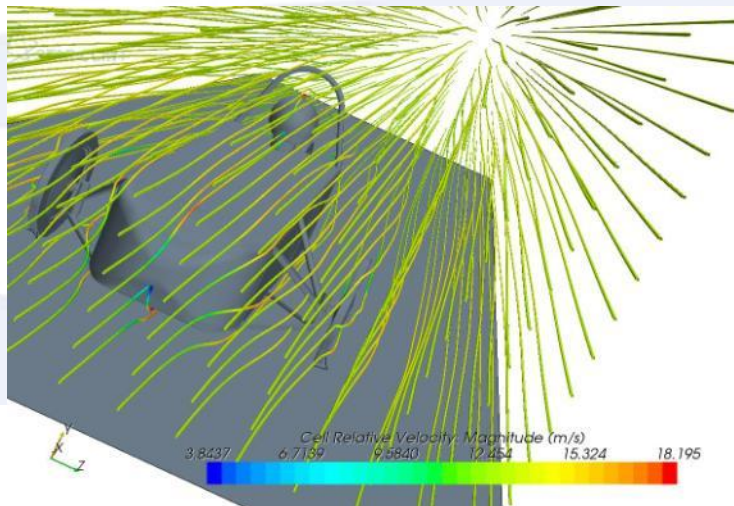
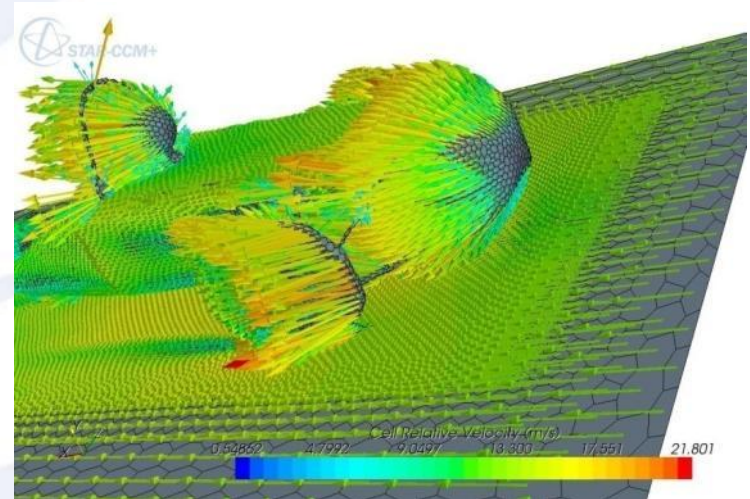


Formula Student Car 2000



Formula Student Car 2009

# Shell Eco Marathon





# Sustainable Vehicle Engineering

**Professor Allan Hutchinson**

**Head, Sustainable Vehicle Engineering Centre**

**Department of Mechanical Engineering and  
Mathematical Sciences**

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



# Teaching and technology transfer

Level	Course Title	Awards
Undergraduate	Mechanical, Automotive and Motorsport Engineering courses	BEng
↓ Postgraduate - taught ↓	Mechanical, Automotive and Motorsport Engineering courses	MEng
	Racing Engine Design Motorsport Engineering Advanced Engineering Design Automotive Engineering	MSc
Postgraduate - research	Research programmes funded by industry, research councils and the university	PhD



# Graduate destinations



Brookes graduates  
at Lotus F1 Team



F1 – Red Bull, Force India, HRT,  
Lotus, McLaren, Williams, etc

OEMs – Audi, Aston Martin,  
Bentley, BMW, Honda, Jaguar  
LandRover, MINI, Nissan, Toyota

Niche/consultancy - motorsports,  
Ricardo, Prodrive, Xtrac

Supply chain – composites,  
materials, components

# Building excellence



Vehicle  
Optimization  
Lightweighting

Motorsports

Oxfordshire  
Electric  
Vehicle  
Partnership



EV trials

LCA  
Energy  
analyses

Oxford  
Brookes

Business  
models

Battery  
recycling

Wireless  
charging

Motor  
technology

European  
projects



# EV research

## (supporting manufacturers' trials)

### MINI E Project UK

*June 2009 – August 2011*

£6m project, part-funded by Technology Strategy Board  
Low Carbon Vehicle Innovation Platform



- BMW, Oxford Brookes, Scottish & Southern Energy, Regional Development Agency, Oxford City and Oxfordshire County Councils
- 40 MINI E for a field trial (2 x 6 months): private, public sector and corporate fleet drivers – real life user experience for > 130 people
- Public and private (home) charging points
- User experience studies
- Vehicle data, energy use
- Business models/market introduction
- Part of BMW's global research to inform development of **BMW*i*** sub-brand





# EV research - Europe



**European Union**

European Regional Development Fund

## EU POWER E-Mobility Accelerator project

*May 2009 – September 2011*

5 partners in 5 countries (UK, Netherlands, Spain, Sweden, Poland)

How to move towards consumer acceptance of electrification of transport through market stimulation and incentives?

•Business cases and videos: <http://bit.ly/nhgW6Z>



## EU BATTERIE project

**Better Accessible Transport to Encourage Robust Intermodal Enterprise**

*February 2012 – January 2015*

14 partners in 5 countries (UK, France, Ireland, Portugal, Spain)

•Inter-modality considerations for all potential forms of transport

# (EV) research and consultancy

## Knowledge transfer partnership with *Yasa Motors*

Optimization of lightweight motor construction through materials technology

## Induction (wireless) power transfer with *Qualcomm-Halo*

Evaluation of system boundaries and efficiency

## Battery recycling concepts with *Axeon*

## Testing of batteries and motors (various companies)

## Whole life energy evaluations of products and systems

➤ *Performance testing and optimization of vehicle systems, IC engines, emissions analysis, etc*



# Materials technologies (working in multi-partner projects)

## Composites and lightweighting



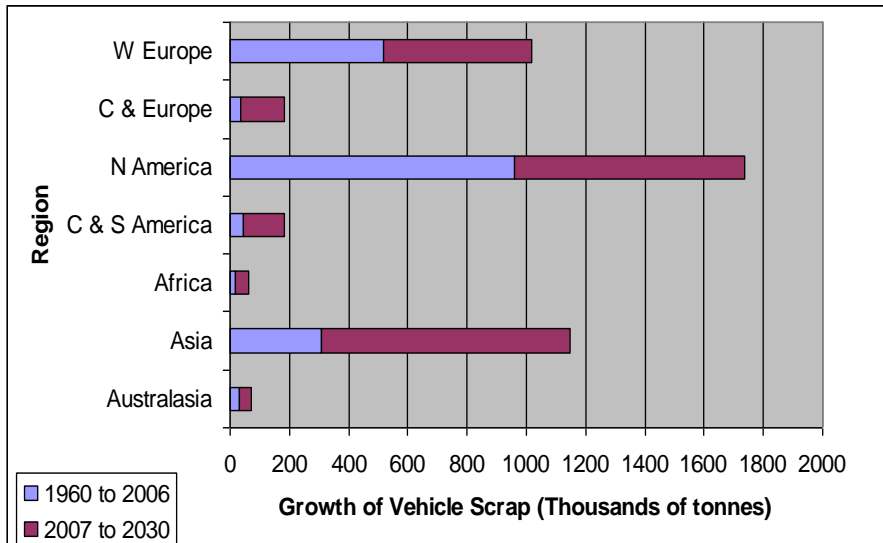
- Composites – materials and surface treatments
- Composite structures – design and analysis, optimisation – with **Bentley**
- Structural adhesive bonding of composites to themselves / other materials
- Composite hydrogen storage vessel
- NVH treatments for autobodies – with **Ford**

## ELV, EoL and materials recovery

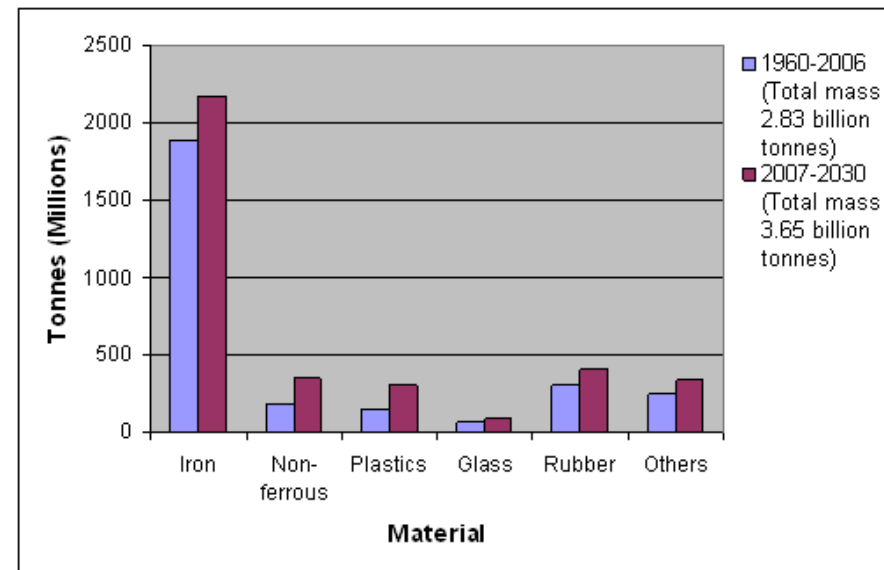
- ELV legislation
- Pyrotechnic devices
- EoL reality and ATFs
- Active disbonding of adhesive bonded joints using chemical and physical foaming agents



# End of life / whole life vehicle waste streams



Increase in scrap by region



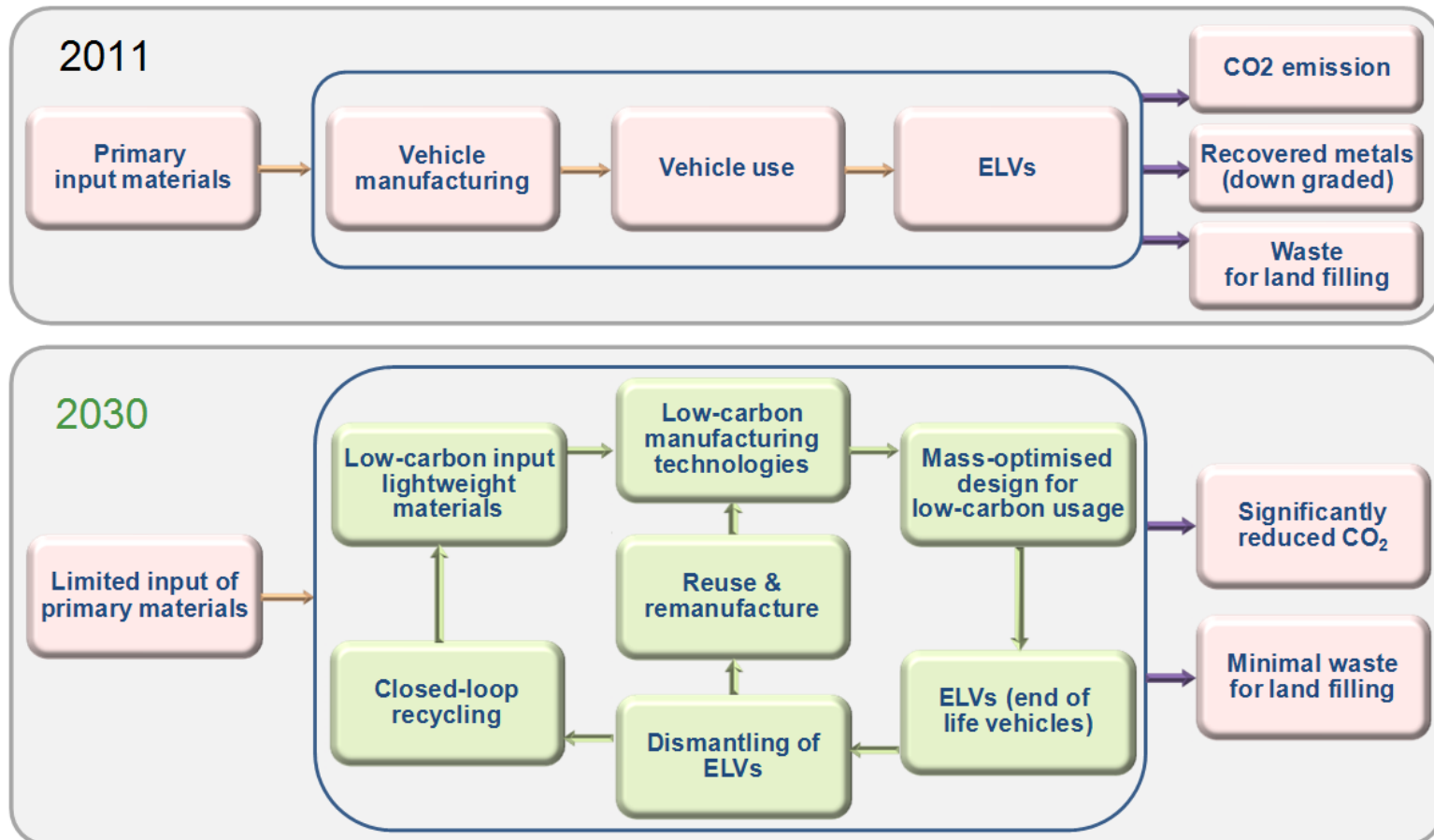
Increase in scrap by material

➔ Design for closed-loop recycling



# EPSRC: Towards Affordable, Closed-Loop Recyclable Future Low Carbon Vehicle Structures (TARF-LCV)

4 years, 8 universities (inc. Coventry and Brookes), \$8 million



# Summary

- UK universities are open for business
- Engagement with industry works both ways
- Strong national push to support strategic (TSB) market-driven, industry-led research with specialist academic input
- Universities are agile and responsive
- Universities provide independent, objective, information and verification
- University staff generally add value through technical interest and broadening the scope
- Changing student landscape
- Interaction can be U/G project ideas, placements, consultancy, training, CASE Industrial awards, KTPs, collaborative research projects, Networks, seminars and conferences

