





# Structure

- Why Motorsport
- Green Motorsport
- EcoOne
- WorldFirst
- Other projects
- What now?

# Motorsport

- Unique Engineering and Sport mix
- Motorsport Valley cluster :
  - 2400 businesses
  - 40000 skilled employees of which 25000 are engineers
  - £5 billion to UK economy
  - £3 billion exports to 40 countries
- UK is a global leader.
- BERR R&D scoreboard
  - R&D as a % of sales turnover
    - Engineering <3%
    - Pharma 13-14%
    - Motorsport > 30%
- £100 million R & D Tax credits claimed
- 85% of F1 car is different by end of season
- Culture of Innovation



# Green Motorsport?

- Environmental Impact of motorsport is minimal
- But technologies introduced by the sport have the potential to have a positive impact elsewhere.
- Technology transfer into mainstream industry is often minimal.
- There is an opportunity for green motorsport to be the driving force for innovation in sustainability.

# Green Motorsport?!



# Automotive natural resins

- 1941 - Henry Ford produced Soya bean based resins
- Seen here testing a boot lid
- Every Model A had “a bushel of Soya beans” in it



Where did it all begin?





Formula Student (Formula SAE)  
Undergraduate Engineering Project



**eco one**

Sustainable  
materials

+

Formula student

=

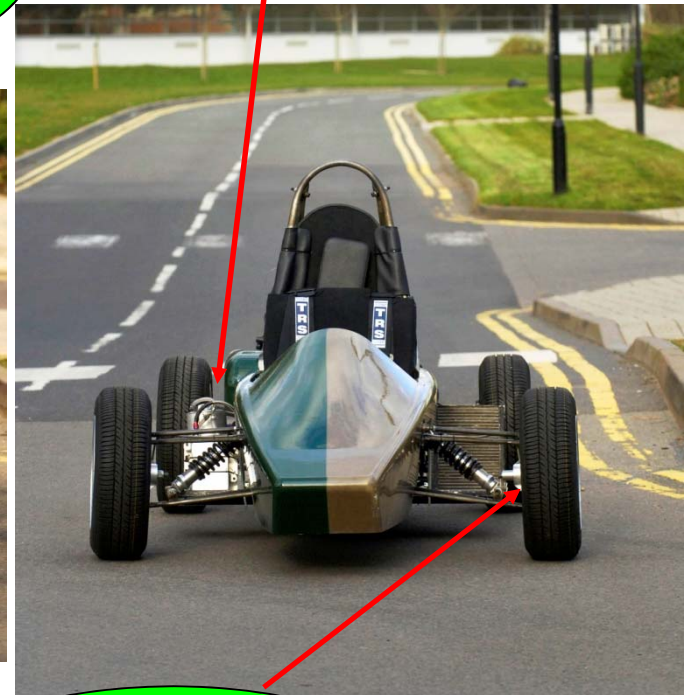
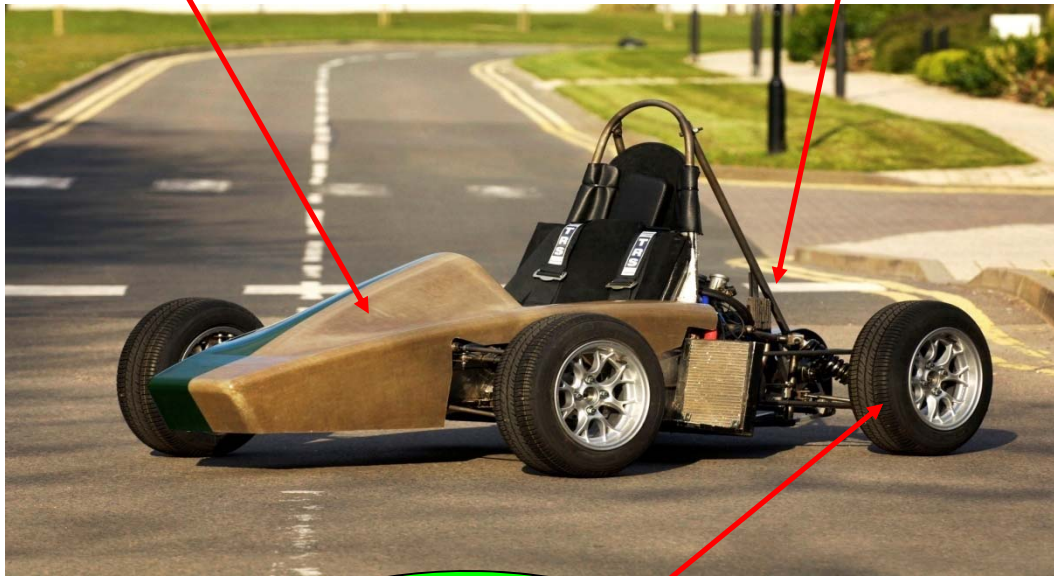
**ecoone**

# eco one

Hemp & Crop origin PU

Ethanol from Sugar Beet

Rape Seed Oil



Potato Starch

CNSL & Kenaf



# What did we achieve?

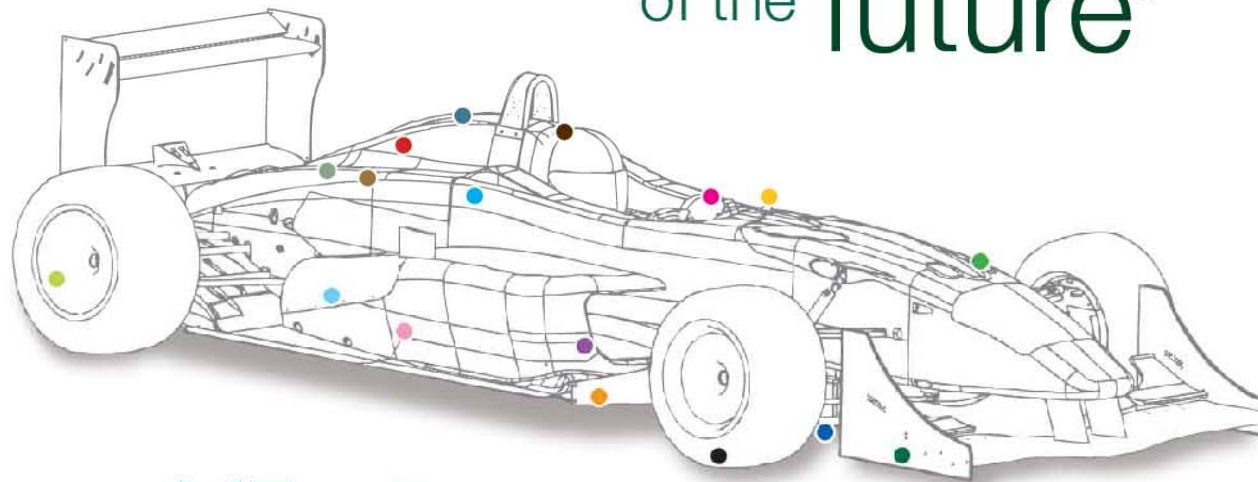
- Leveraged significant public engagement for very little expense...£10k
  - TV Radio, online, printed
  - Schools, International exhibitions, museums....
- Small network of partner companies
- Some interest from other universities.
- WIMRC proposal approval for bigger follow up project...WorldFirst.

# worldF3rst

A force for sustainable motor racing

## RACING

“Welcome to the sustainable racing car of the future”



- **Engine Cover**  
Recycled carbon fibre,  
Milled Carbon and Lola
- **Wiring Loom**  
Lightweight, halogen free  
and incorporating recycled  
materials. Yazaki
- **Barge Board**  
3 dimensionally woven  
natural fibre composite.  
University of Ulster
- **Engine**  
2 litre turbo diesel  
Biodiesel calibration  
by Scott Racing
- **Brakes**  
Non carbon discs with low  
embodied energy. Cashew nut  
shell pads in development.
- **Side Pod Closing Panel**  
Flax fibre and resin from  
recycled bottles.  
Andy Fox and Gray Valley
- **Side Pod**  
Glass fibre with resin from  
recycled bottles.  
Andy Fox and Gray Valley
- **Radiators**  
Coated with a catalyst  
which converts ozone to  
oxygen. BASF PremAir

worldF3rst

A force for sustainable motor racing

## RACING

- **Seat**  
Flax fibre shell, soy bean oil  
foam and recycled polyester  
fabric. Lear
- **Steering Wheel**  
Polymer derived from  
carrots and other root  
vegetables. Cellucomp
- **Wing Mirrors**  
Potato starch core and  
flax fibre shell.  
Biopolymer Network
- **Damper Hatch**  
Recycled carbon fibre,  
Milled Carbon and Lola
- **Front Wing End Plate**  
Potato starch core and flax  
fibre shell. Biopolymer Network
- **Lib**  
Woven flax fibre prepreg material  
Lola and Lineo
- **Tyres**  
Elimination of polycyclic  
aromatics. Avon
- **Lubricants**  
Plant oil based  
lubricants. Fuchs
- **Brand Strategy**  
Team naming, identity and design.  
Lifa



# Technologies - Highlights

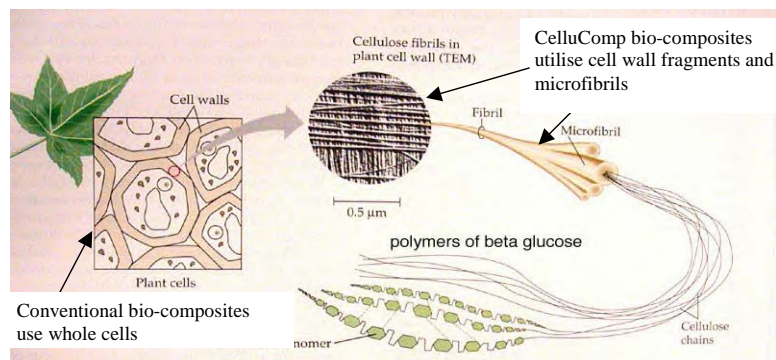
- Use of natural and sustainable materials
  - Potatoes, Carrots, Soya, Flax, Hemp etc.
- Biodiesel engine running on fuel derived from chocolate and vegetable oil
- Use of recycled materials
  - Polymers (PET in the resin)
  - Carbon fibres
- Environmentally friendly wiring loom
- Radiator to 'eat' ground level ozone



# Steering Wheel



- Curran® offers a unique combination of properties which are on a par with CFRP
- It is a composite of cellulose nano fibres and resins
- It is produced in the form of a paste for simple moulding
- It has low quantities of organic solvents in the mixture
- The process offers a low toxicity and a low energy input manufacturing route.



# The World's First Seat



Seat base utilises woven flax fibre prepreg material



This is covered with soya bean derived foam



- Flax fibre is extracted from the skin (bast) of the flax plant stem
- The fibre is soft, lustrous and flexible, stronger than cotton but less elastic
- Best flax is used for linen, courser grades for twine and rope



The environmental advantages of soy-foam include

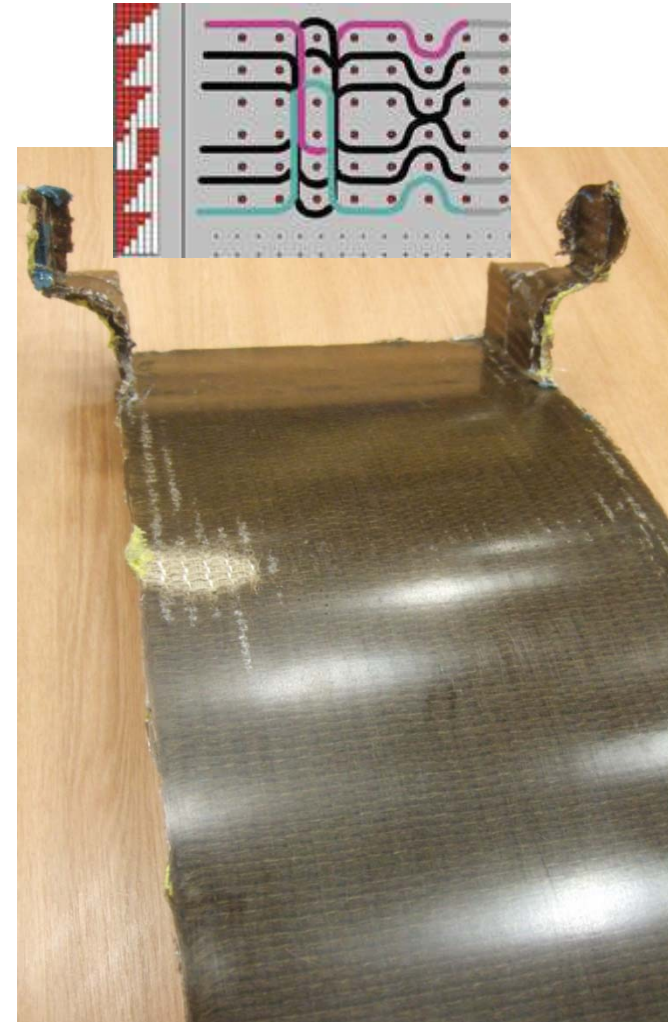
- a reduction of carbon dioxide (CO<sub>2</sub>) emissions when compared to petroleum-based material
- lower energy required to produce the material
- 24 percent renewable content
- reduced dependence on volatile energy markets

# Natural Fibres



Flax fibre prepreg 'BIB'

- Use of natural fibres provided a major challenge - particularly for complex components
- Issues with fibre shape and resin systems



Flax fibre 3D woven Barge Board



# Recycled Carbon Fibre

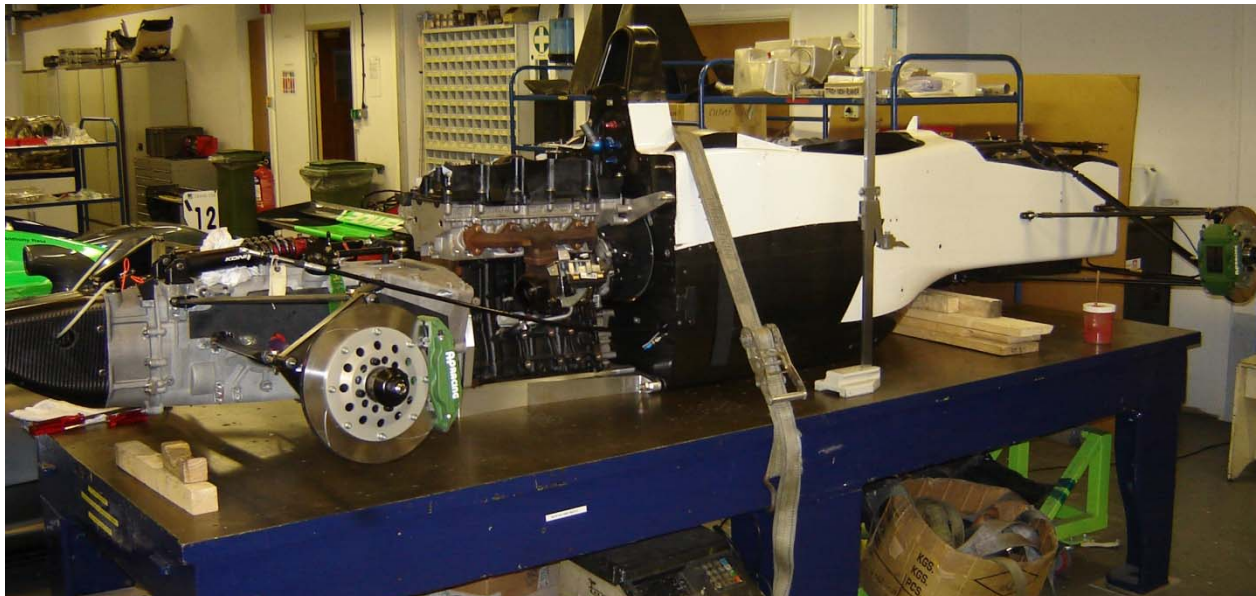
- Enormous quantities of scrap Carbon fibre from industry e.g. aerospace and motorsport
- Boeing 787 over 50% composite materials
- Virgin CF highly energy intensive to produce
- Recycled typically by pyrolysis
- Recyclate turned into powder, chopped strand or long fibres
- Recycled woven fabric used in WorldFirst race car



**Milled Carbon Ltd**  
SPECIALISTS IN RECYCLED CARBON FIBRES

# Fuel

- Biodiesel for the engine is derived from waste chocolate (or any waste fat such as used cooking oil, cocoa butter, beef tallow etc.)
  - Liposuction fat!!
- Methanol – Methyl Esters – cheapest, commonly available
- Bio-Ethanol – Ethyl Esters – wine leftovers, cheese production



# Wiring Loom

- Use of recycled materials
- Designed for recycling
  - Material marking
  - Easy disassembly
- Halogen free materials
  - Polyolefins instead of polyvinylchloride for insulation materials
- Lightweight
  - Use of aluminium in place of copper



Eco friendly wiring loom for WorldFirst



# Radiators

- Coated with BASF Prem-Air catalyst
- As air passes over the radiator the catalyst converts Ozone to Oxygen
- Minimal effect on cooling performance
- Already fitted to over 3 million road cars



# Is It Credible?









# So What?

- More demonstrators: materials and power train
- 2 PhDs on use of waste cocoa for paints
- 2 PhD on biofuels
- 1 PhD on bio-resins
- Crash Structure work on recycled carbon fibre and natural fibre composites
- Demonstrating new 'digital' opportunities to industry

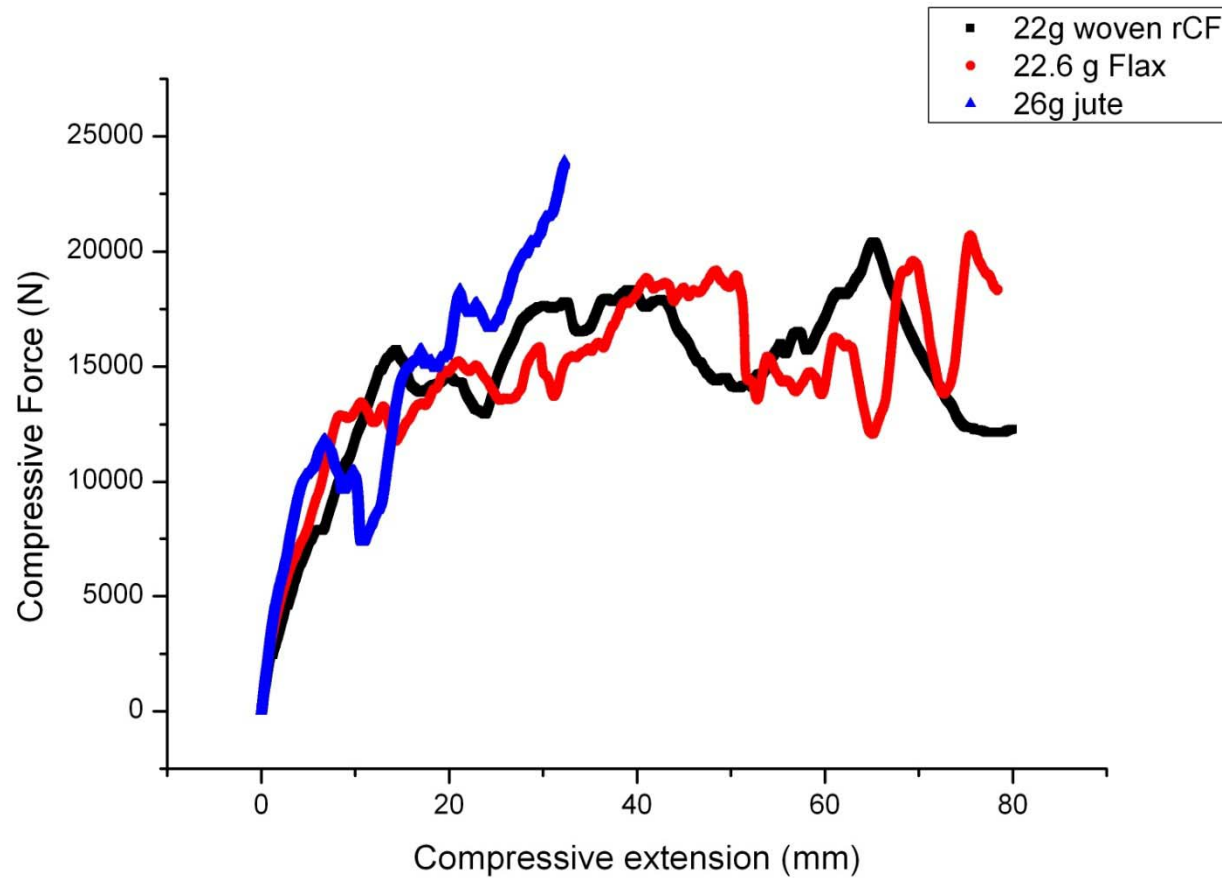


# Natural fibre crash structures

- Natural fibres may be suitable for energy absorbing structures in motorsport
- More environmentally friendly especially at end of life



# Comparison of natural fibre versus rCF



- Flax and Jute are able to match the static performance of woven rCF

# What do we want to do next?

- Centre of Excellence for Sustainable Motorsport
  - Exploit project success to create academic impact
  - Further High Impact Projects – with industry
  - Cross Sectorial Fertilisation of Ideas
  - EngD and PhD projects
  - Inputs into UG, MSc and Post Experience teaching
- See us at the Gadget Show Live in April

# Summary

- Motorsport reaches people
- Provides a high impact ‘vehicle’ for public engagement that is more effective than more apposite contexts
- Motorsport has the potential to be a driving force for sustainable technology development and exploitation.
- We have an opportunity to exploit success of WorldFirst by creating a Centre of Excellence.



# Our thanks go to

**EPSRC**

Engineering and Physical Sciences  
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**SOGEFI**

**YAZAKI**

**LOLA**

THE UNIVERSITY OF  
**WARWICK**

**LEAR**  
CORPORATION

**Life**

**SR**  
SCOTT  
RACING

**paceproducts**

**BASF**  
The Chemical Company

University of  
**ULSTER**

**HEWLAND**  
ENGINEERING LIMITED

**LINEO NV**  
Flax Fibres Impregnation

**CelluComp**  
sustainable materials

**AP**  
RACING

**Milled Carbon Ltd**

**Biopolymer**  
NETWORK

**CRAY VALLEY**