

## **Technology Group**

# **LowCVP Technology and Opportunities to Invest in Low Carbon Automotive**

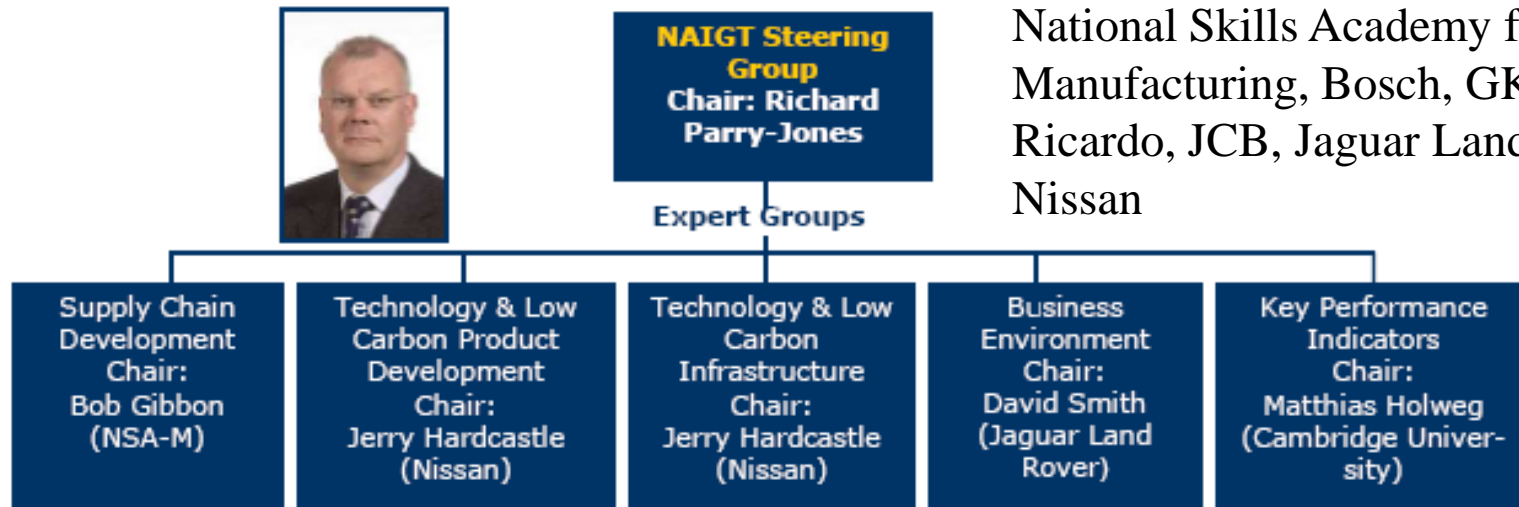
**Tony Harper**

23rd March 2010

# Automotive Council

## NAIGT Organisation and Participants

Cambridge Business School, BMW, Retail Motor Strategy Group, National Skills Academy for Manufacturing, Bosch, GKN, Ricardo, JCB, Jaguar Land Rover, Nissan



## Developing an Automotive Technology Strategy

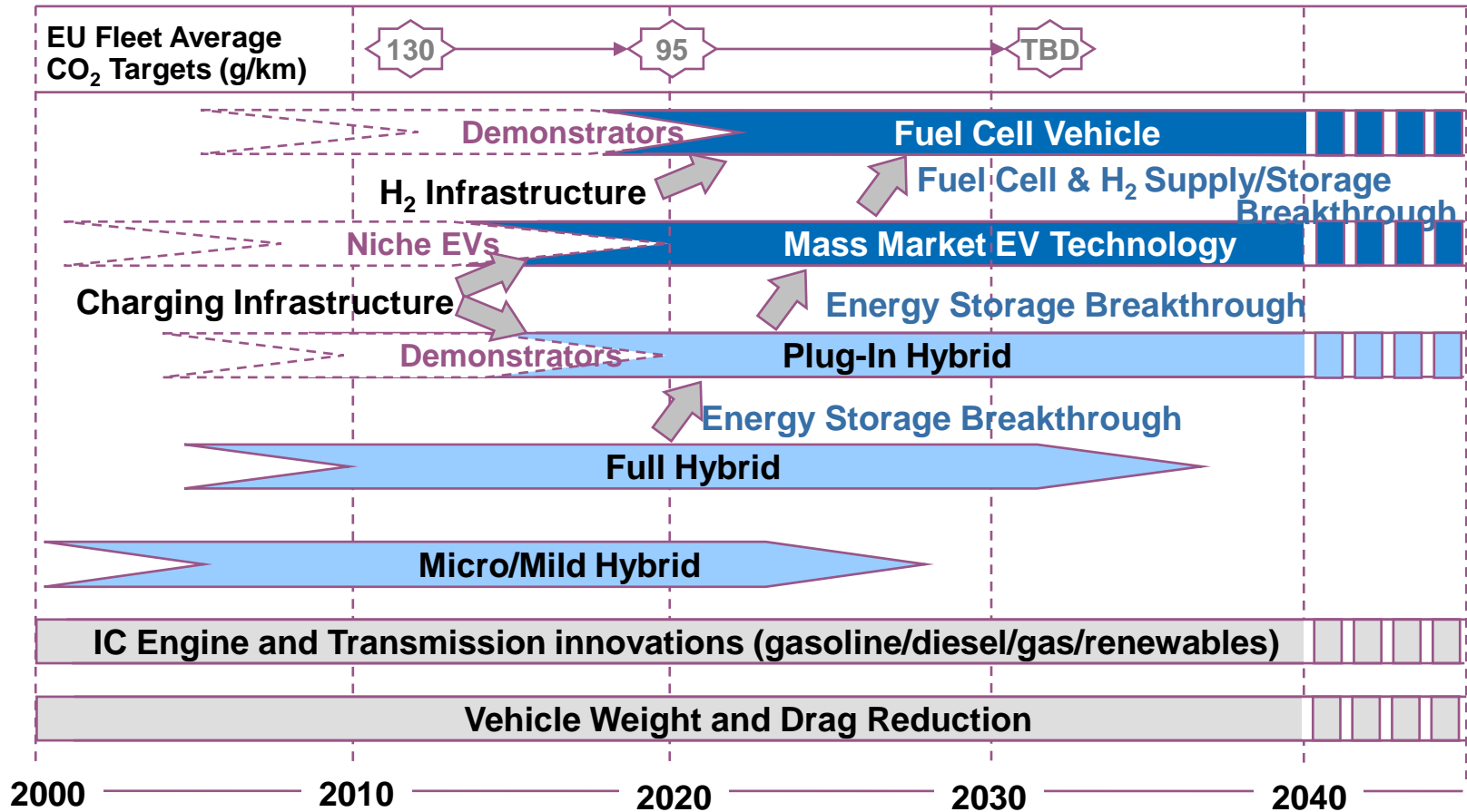
### Phase 1 (Nov-Dec '08)

- Develop a mutually agreed OEM “Product Roadmap” aimed at the reduction of passenger car CO<sub>2</sub> emissions in line with government targets
- Compile a high level Common Research Agenda to deliver the Product Roadmap

### Phase 2 (Mar-May '09)

- Identify technical areas of existing UK strength, weakness and potential for future development
- Identify the activities that should be a focus for R&D investment and make strategic recommendations to UK funding bodies, to maximise the benefit to UK plc

## Product Road Map



The Consensus Product Roadmap describes the future direction to develop Low Carbon technology products

## Product Road Map

- OEMs share a common product technology roadmap and recognise the same technical and commercial barriers.
- Individual manufacturers will implement technologies which best address their own brand values and market sectors.
- In the near to medium term, improvement of conventional powertrains and transmissions can have a significant impact on fleet average CO<sub>2</sub> by providing moderate benefits for a large proportion of the fleet.
- In the medium to longer term it is anticipated that a technology shift to alternative powertrains and transmissions will be required to achieve the CO<sub>2</sub> reduction targets from transport. Supported by alternative fuel delivery including grid electricity and hydrogen.
- Both electrification and fuel cell vehicle technologies rely on the concurrent development of a “clean and sustainable” supply of energy

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## Common Research Agenda

	<b>SHORT TERM</b> 5 – 10 years from production	<b>MEDIUM TERM</b> 7 – 15 years from production	<b>LONG TERM</b> 10 – 20 years from production
	<b>INDUSTRY</b>		<b>UNIVERSITIES</b>
<b>Propulsion</b>	<ul style="list-style-type: none"> <li>IC engine optimisation</li> <li>Boost systems for downsizing</li> <li>Flexible valve/actuation for engines/transmissions</li> <li>Low cost compact e-motors</li> </ul>	<ul style="list-style-type: none"> <li>Higher efficiency IC engines</li> <li>Capacitive boost systems</li> <li>All electric actuation systems</li> <li>Optimised range extender engine</li> <li>Lower cost e-motor</li> <li>Heat energy recovery (e.g. E-turbine)</li> </ul>	<ul style="list-style-type: none"> <li>Super high efficiency motors (superconducting)</li> <li>New IC engines with 70%+ thermal efficiency</li> <li>Advanced heat energy recovery (e.g. thermoelectric)</li> <li>Motor/Fuel Cell materials</li> </ul>
<b>Energy Storage</b>	<ul style="list-style-type: none"> <li>Improved quality / durability 200+ Wh/kg &amp; \$800/kW.h cost battery systems</li> <li>Low cost power electronics</li> </ul>	<ul style="list-style-type: none"> <li>Next gen batteries 300+ Wh/kg and \$500/kW.h cost</li> <li>Flexible power elec. modules</li> <li>Other forms of energy recovery (mechanical/chemical etc)</li> </ul>	<ul style="list-style-type: none"> <li>3<sup>rd</sup> gen batteries 400+ Wh/kg &amp; \$200/kW.h cost</li> <li>New low cost solid state power conversion systems</li> <li>Hydrogen storage technology</li> </ul>
<b>Vehicle Efficiency</b>	<ul style="list-style-type: none"> <li>Lightweight structures and interiors</li> <li>Low rolling resistance tyres / brakes</li> </ul>	<ul style="list-style-type: none"> <li>New vehicle classes and configurations</li> <li>Combination of function to reduce weight / cost</li> <li>Minimised weight / losses</li> </ul>	<ul style="list-style-type: none"> <li>Flexible re-configurable multi-utility vehicle concepts</li> <li>50% weight reduction from 2008</li> <li>Advanced aerodynamic concepts</li> </ul>
<b>System Control</b>	<ul style="list-style-type: none"> <li>Information enabled control (Topology, V2V, V2I, traffic etc.)</li> <li>Optimised vehicle energy mgmt.</li> <li>Intelligent thermal management</li> </ul>	<ul style="list-style-type: none"> <li>Advanced information enabled control</li> <li>Intelligent P/T and HVAC mgmt.</li> </ul>	<ul style="list-style-type: none"> <li>Autonomous P/T and vehicle control integrated with active safety</li> </ul>
<b>Energy + Fuel Supply</b>	<ul style="list-style-type: none"> <li>Optimised 1<sup>st</sup> gen biofuels processes</li> <li>New 2<sup>nd</sup> gen biofuel processes</li> </ul>	<ul style="list-style-type: none"> <li>Intelligent energy / re-fuelling infrastructure (e.g. fast charge)</li> <li>Industrial scale demonstration of new 2<sup>nd</sup> gen biofuel processes</li> </ul>	<ul style="list-style-type: none"> <li>3<sup>rd</sup> gen biofuel processes</li> <li>2<sup>nd</sup> gen industrial scale biofuel production infrastructure</li> </ul>
<b>Processes + Tools</b>	<ul style="list-style-type: none"> <li>Process + delivery tool development and connectivity</li> </ul>	<ul style="list-style-type: none"> <li>Auto-optimisation methods using virtual systems</li> </ul>	<ul style="list-style-type: none"> <li>Artificial Intelligence to deliver complex multi-criteria system optimisation</li> </ul>

## Developing an Automotive Technology Strategy

### Phase 3 (Jun-Oct '09)

- Automotive Technology Working Group  
“underground” activity to establish Technology Council direction
- Start process of identifying strategic technology direction for “Automotive UK plc”

### Phase 4 (Nov '09 on)

- Establish Technology Group within Automotive Council
- Identify strategic technology direction for “Automotive UK plc”
- Set short term objectives to drive technology development towards the Product Road Map

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## Technology Working Group Members

Vehicle Manufacturers	Technology Specialists	Institutions
General Motors	Ricardo	SMMT
Nissan	Logica	TSB
Ford	Intelligent Energy	ETI
SAIC	BP	EPSRC
Toyota	GKN	Greater London Authority
Lotus Engineering	Mahle	Greater Manchester Auth.
Bentley	Millbrook	Cenex
Jaguar Land Rover	ARM Holdings	OLEV
TATA	Elektromotive	UKTI
Morgan	Infracharge	University of Bath
Optare	MIRA	BIS
Caterpillar	Axeon	Scottish&Southern Energy



## Technology Working Group Mission

- Identify opportunities to provide a more compelling investment proposition for automotive R&D in the UK versus other countries
- Agree on the technology roadmaps for low carbon vehicles and fuels, and exploit opportunities to promote the UK as a strong candidate to develop these technologies
- Develop a stronger supply base through joint research on focused areas driven by a common agenda and by brokering collaboration opportunities

## Principles for identifying priority activities

- What is needed for the UK to remain an important player?
- What do we continue doing?
- What do we need to start doing?
- Which technologies do we focus on?
- What do we see as the next big challenge?
- How do we get value added activity from the high ROI activities?
- Where do we need inward investment or external funding?

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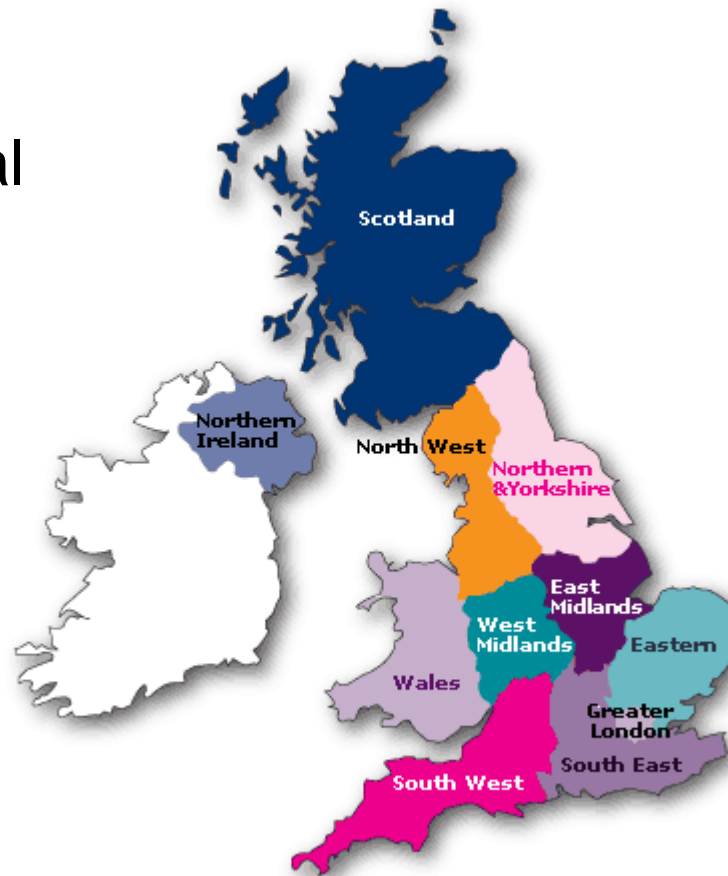
## Test Bed UK Concept

Government –  
Local and central

Finance sector

Infrastructure  
Providers

Consumers



Automotive  
OEMs

Academic &  
Technical  
Institutions

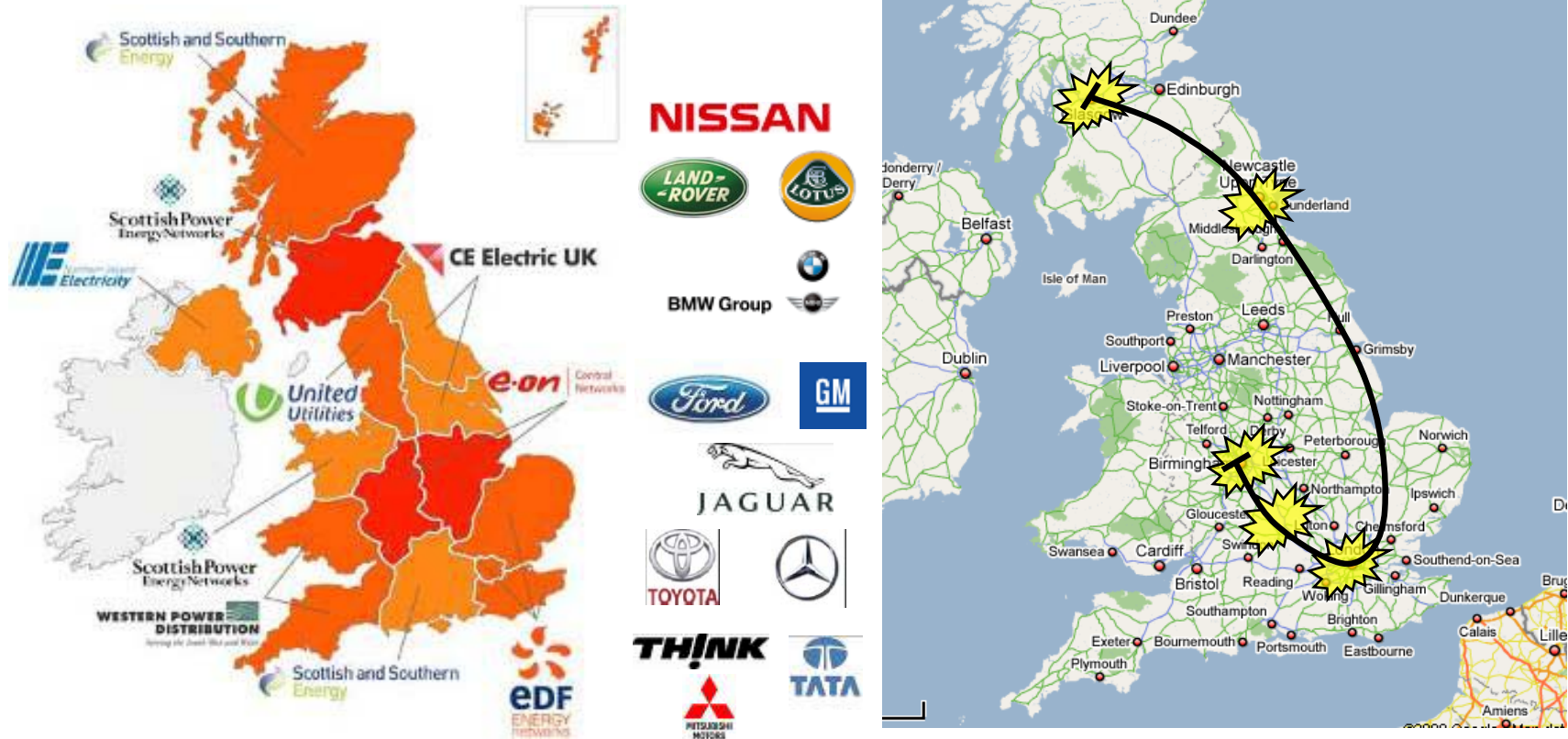
Suppliers

## Test Bed UK

- To create a formal partnership mechanism between automotive manufacturers, infrastructure providers, regulators and consumers
- Business model innovation is at least as important as technology innovation
- Need to lead the development of new customer/user behaviours to get best out of new technologies
- Gives UK Ltd a voice in advanced technology development e.g. standards, regulations
- Potential to become skills centre
- Outlet for research institutes to demonstrate capability to industry
- UK transport market is distinct and separate from other European markets and so has the potential to lead Europe in development of new transport models
- Allows UK to collaborate with other global "demonstrator" projects
- Promotes partnerships that do not currently exist

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## UK Low Carbon Vehicle Demonstration 2009



Integrated approach promoted by TSB, ETI, OLEV, CENEX

**Thank You**