

Successful projects from the “IDP11 – Adapting Cutting Edge Technologies” competition

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| Adapting Recycled CF Materials for Mass Produced Low Cost Auto' Structures | GORDON MURRAY DESIGN LTD | ELG Carbon Fibre Ltd and Gordon Murray Design Ltd have combined to create novel carbon fibre materials made from recycled carbon fibre waste that would have otherwise gone to landfill. These new materials are suitable for a whole range of applications which may include Aerospace, Military and Transportation as well as emerging markets that demonstrate a need for low cost carbon fibre reinforcements. Utilizing recycled carbon fibre in Gordon Murray Design's patented iStream® process, for example, has created the opportunity for recycled carbon fibres to be introduced into mass production, low cost vehicle chassis structures. |
| HERCULES "Hydrogen Emissions Reductant for CO ₂ and Ultra Low EmissionS" | ULEMCo Ltd | <p>This project builds upon the work previously carried out in the IDP4 CREO programme, where a concept of emissions and CO₂ reductions using hydrogen was explored. This work demonstrated good reductions in HC and CO emissions when used with an oxidation catalyst, good NOx conversion using a special catalyst formulation, and significant fuel reduction during DPF regeneration. All of these features will allow OEM's to optimise the engines for fuel economy rather than emissions, often conflicting parameters.</p> <p>Using energy recovered from the vehicle overrun to generate Hydrogen, the consortium seeks to develop an integrated system that can demonstrate an effective emissions control system based on the CREO findings.</p> <p>This concept will be highly disruptive to the current emissions control strategies and has the capacity to provide an alternative means of NOx control whilst offering much better control of HC, CO and particulates. This technology could open the path for the next stage in emissions reduction beyond stage VI.</p> |
| Zero Emissions Bus by Range Extension with Fuel Cells and Hydrogen | MAGTEC | This project will develop a zero-emissions bus based on Magtec's innovative EV powertrain adapted from military applications, range extended with Arcola Energy's low power and low cost hydrogen fuel cell system adapted from lightweight passenger vehicles. Using this combination will provide a route for operators and bus OEMs to a bus with zero particulates and NOx emissions and dramatically reduced CO ₂ emissions even on current generation methods for electricity and hydrogen, at a fraction of the cost of the current generation of hydrogen buses. Innovations include the overall system and energy storage optimisation and control, lightweighting, power electronics integration, lifetime extension of the fuel cell in the challenging city environment and hydrogen safety. |
| InnEx - Innovative, Ultra-Lightweight Exhaust Technology | Unipart Eberspächer Exhaust Systems Limited (UEES) | The project will develop a new highly innovative lightweight exhaust system for forced induction diesel and petrol automotive vehicles. This project will deliver cost-effective materials and manufacturing technology, including metrology and CAE methods to enable a step change reduction of 50% of the mass of an exhaust system. It will provide innovative solutions to the manufacturing challenges associated with down-gauging exhaust components in terms of jigging, forming, joining and metrology as well as the overall design methodology. Furthermore, the project will focus on the development of new and innovative material processes for the catalytic hot-end of the exhaust system including the associated manufacturing challenges. The ultimate aim is to significantly reduce the overall system mass, thus for instance giving an annual CO ₂ saving of 325M tonnes, reduced customer fuel bills and a 5% reduction of precious metals being used in catalytic converters. The project brings together 3 industrial and 2 academic organisations in a 2 year project costing £1.59M |

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| CLEVER: CLimate control solution for EVs with Extended mileage Range. | Johnson Matthey | <p>Air conditioning in vehicles is very energy intensive. In internal combustion engines up to 8% of the fuel is used, but in EVs there is limited waste heat that can be reused. This means that up to 40% of the energy within the battery can be required, which directly impacts the range of the vehicle. One way to address this is to engage the recirculation mode more frequently, but this has limited use, particularly in vehicles with many passengers, as carbon dioxide (CO₂) levels build up as a result of the occupants breathing.</p> <p>The CLEVER project (CLimate control solution for EVs with Extended mileage Range) aims to show that the air within the vehicle can be actively managed like a bubble, so that on recirculation mode, CO₂ and other contaminants are kept to set levels. This concept has the potential to increase the range of electric vehicles by 25%, whilst simultaneously protecting passengers from external pollutants. It is achieved by using a regenerable CO₂ scrubber, that captures CO₂ from the cabin, and periodically releases it to the outside.</p> |
| ADAPTIVE ELECTRIC DRIVE CONTROLLER | AVL POWERTRAIN UK LTD | <p>The Adaptive Electric Drive Controller is a collaborative project between AVL and the University of Warwick. The aim of the 24-month project is to develop a novel electric traction drive control algorithm, which optimises the performance, efficiency, electromagnetic compatibility or the durability of the electric drive, and demonstrate it on a test rig. The Adaptive Electric Drive Controller will intelligently and seamlessly transition between several drive control methods, depending on the real-time vehicle operating conditions or the driver commands, to extract the maximum potential in Hybrid and Electric Vehicle platforms. The principal benefits of the Adaptive Electric Drive Controller include:</p> <ul style="list-style-type: none"> A. Expected CO₂ reduction of up to 10 g/km for a C-segment EV or PHEV. B. Increased electric drive efficiency and improved overall vehicle performance. C. Smaller power electronics packaging and cooling requirements, reducing cost and improving lifetime. D. Improved end-user experience for a low cost, helping the uptake of HEVs & EVs in the near future. |
| BRAKE-THRU - A Lightweight Automotive Brake Rotor For the Emerging LCV Market | European Friction Industries Limited | <p>BRAKE-THRU is a new type of automotive braking system for future Low Carbon Vehicle’s. The aim is to provide this emerging industry with a lightweight and cost-effective alternative to grey cast iron rotors - the traditional material of choice for over 50 years. In future LCV’s, weight will be critical, where currently, car makers still have to fit cast iron rotors to their vehicles as no economically viable lightweight alternative exists. The weight burden does not merely extend to the rotors themselves [40kg for family saloon], it also forms part of the vehicle un-sprung weight. Unsprung weight reduction is highly beneficial for improving fuel economy and a key enabler that then allows the onward safe reduction of the sprung weight in modern vehicles, where any reduction has a positive effect on acceleration and cornering and also improves the ability of the suspension in maintaining tyre grip. The fuel savings from unsprung weight reduction are far more substantial than achieved by equivalent reductions to the car body. BRAKE-THRU is a 6 partner 2yr initiative, bringing together knowhow from the world of automotive friction materials, car brake system design, and the composites industry.</p> |

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| Intelligent and Efficient Thermal Managed Power Module for Low Carbon Vehicles | Dynex Semiconductor Limited | The advantages brought by Hybrid and Electric Vehicles (HEV/EV) such as being environmentally friendly, less dependent on fossil fuels, cost effective in long term operation etc, HEV/EV has highly focused governments and car manufacturers. Power control is essential in HEV/EV powertrain systems of which the core part is the power IGBT modules. The requirements of modules are strict in electrical and thermal performance, efficiency and reliability. In this project, a power IGBT module incorporating intelligent driver, efficient thermal management concept and advanced packaging technologies for HEV/EV is developed. By combining Dynex Semiconductor's leading expertise in power semiconductors and the University of Nottingham's cutting edge research in enhanced heat transfer and cooling. A new power IGBT module with a flat heat pipe baseplate and intelligent gate driver using advanced bonding and joining technologies such as copper wires, silver sintering and ultrasonic welding will be developed. The module increases heat transfer efficiency by 20% compared with pin fin structures and simplifies cooling system by removing costly, unreliable parts and enhancing efficiency. |
| AuxPaC - Auxiliary Power and Cooling | Dearman Engine Company Ltd | AuxPaC will deliver a cost-effective zero emission auxiliary system for power and cooling, by adapting the cutting-edge Dearman Engine (DE), a rankine-cycle expander powered by liquid nitrogen (LiN), to cut the well-to-wheel CO2 emissions of refrigerated trucks and air-conditioned buses by 35%, with potential for up to 85% if production of the LiN “fuel” is used to absorb wrong-time renewables; the system offers total cost of ownership savings without subsidy. The engine is at prototype stage as a truck refrigeration unit; the AuxPaC project aims to improve efficiency, so that the same cooling or air-conditioning load can be met with a surplus of electrical power for vehicle auxiliary systems, including electric tail-lifts or doors, brake and steering assistance, and lighting, all currently provided by the main engine and often requiring extended idling. The system is also applicable to electric buses and delivery vans, avoiding depleted range, and providing cooling to power electrical systems. The project brings together Dearman, Hubbard refrigeration and Birmingham University, to study improvements to engine & system efficiency, and deliver lab-based hardware validation. |
| iEV CaB FAB = integrated EV Charger and BMS with Fully Active Balancing | Hyperdrive Innovation Ltd | This project brings together five organisations to deliver technology that addresses key factors currently slowing the uptake of Electric and Hybrid vehicles. This will be achieved by integrating and improving the function of the battery management system and the on-board charger. The work to be carried out accelerates the development of an innovative product and takes a significant step in addressing the ‘hollowing out’ of the UK automotive supply chain. Hyperdrive are leading the consortium, applying their technical expertise in Electric Vehicle engineering and drawing on their project delivery capability, gained from many automotive, marine and defence applications. The project is a natural progression of the energy storage and Battery Management System products that Hyperdrive currently supply. The new product will reduce charge time and extend battery pack lifetime, in a smaller, lighter package. iEV CaB FAB will meet all automotive industry expectations of product robustness, manufacturing quality and specific safety requirements. |

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| Non-venting liquid natural gas/bio-methane fuel tanks for HGVs | T Baden Hardstaff Limited | This project will deliver a step change in capability for the storage of Liquid Natural Gas and Liquid Bio-Methane. Unlike other fossil fuels such as Liquid Petroleum Gas, butane and propane, Methane cannot be compressed to a liquid at ambient temperature. This has significantly restricted its use for road transportation as storage as a compressed gas is limited to 200-300Bar reducing range and increasing refuelling time. LNG Dual fuel HGVs are increasingly seen as the only viable alternative to diesel. It offers not only significant cost savings with Return On Investment as little as two years but also results in a 20-30% reduction in CO ₂ emissions. Liquified Bio-Methane can reduce CO ₂ emissions by up to 70% (100% with bio-diesel). A conventional LNG fuel storage system is a self-pressurising cryostat modified for road use. LNG boils-off and vents with safety and environmental implications. An innovative non-venting cryostat will be produced which is 25% larger, increasing range accordingly. |
| Development of Lightweight Composite Suspension Components | Tinsley Bridge Limited | The objective is to design and manufacture a range of high performance lightweight suspension components for heavy commercial vehicles. Use of composite materials unlocks the potential for significant weight reduction compared to existing steel designs. This project aims to deliver strong technical and environmental benefits such as components with increased strength and durability in addition to significant weight reductions which lead to improved vehicle performance, fuel efficiency and a reduction in carbon emissions. Low weight, high performance products are becoming increasingly essential for commercial vehicles, as the drive for increased payloads and greater fuel economy continues. The project aims to demonstrate innovative designs of lightweight suspension components as a commercial alternative to steel parts. |
| IBRANCH | HiETA Technologies Limited | The project will deliver an Exhaust Energy Conversion unit that will convert some of the waste energy in the exhaust gases of an internal combustion into useable power, either electrical or shaft. The unit is based on a modified Brayton cycle that uses readily available turbomachinery components in a novel arrangement, together with a heat exchanger that will be designed for rapid manufacture using selective laser melting, a form of additive manufacture that processes metal powders. Initial 1-D modelling suggests that at full power the fuel savings and CO ₂ emissions reductions can be 10-12% using standard turbocharger components at reasonable pressure ratios. Considerably higher performance can be achieved with higher efficiency components and high pressure ratios. The partners are HiETA Technologies Ltd (lead), the University of Bath, and Axes Designs Ltd. |

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| Development of Lightweight Composite Tieblade-Knuckle for a Wheel Suspension | Ford Motor Company -- Dunton Technical Centre | <p>The automotive industry is being driven towards weight reduction as a means of achieving ever more demanding emissions (CO₂ and fuel economy) requirements. Lower weight solutions for traditional steel and aluminium components are failing to deliver the step improvements required. This project focuses on the development of a wheel suspension component of composite materials to save weight via not only a step reduction in material weight but also via reduction of parts and interfaces.</p> <p>An essential part of the project is the selection and development of a reliable, cost effective composite manufacturing process since a rapid process is key to accelerate the use of composites for mass production vehicles. The aim of the project is to achieve a 50% weight saving over the existing steel component at no more than 10\$ oncost for each kg weight saved.</p> |
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| Mechanically Decoupled Electric Turbocharger for Optimal IC Engines Efficiency | Aeristech Ltd | <p>The project will develop a novel energy recovery and boosting system for internal combustion engines, leading to a step change in vehicle energy efficiency, fuel consumption and CO₂ emissions. Aeristech’s Full Electric Turbocharger Technology (FETT) is a mechanically decoupled turbocharger and comprises of 3 elements; (1) an electric turbine generator recovering exhaust heat energy, powering (2) an electric compressor to boost the engine on demand, through (3) a power management unit. Jaguar Land Rover Limited, Advanced Design Technology Limited, Bath University and Aeristech will match the FETT concept to JLR’s Ingenium engine family, and the FETT development will be supported by an extensive simulation phase at system/engine level, as well as vehicle level for an optimised vehicle energy efficiency. This simulation, led by JLR and Bath University will provide Aeristech and ADT with a detailed FETT target specification. ADT will focus on the design of optimised turbomachinery, for a decoupled turbine and compressor, whilst Aeristech will concentrate on the design of electric machines and power management device with best-in-class efficiencies.</p> |

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