Today our society demands a transportation system for greater sustainable personal mobility and for an efficient transport of goods that is environment-friendly, increases safety and security, and faces with a competitive globalised economy while creating jobs and growth.

Customers are asking for personalised vehicles that increase the automation level and become more and more connected among each other and with the infrastructure.

The automotive industry in Europe is a key industrial sector and the EU’s largest investor in R&D, spending over 41.5 billion euros annually, and wants to have its role in tackling societal and industrial challenges, both within Europe and globally.

EUCAR, the European Council for Automotive R&D, groups the fourteen major European automotive manufacturers to strengthen their competitiveness through Strategic Collaborative Research and Innovation.

The Horizon 2020 projects described in this year’s booklet are coherently grouped into four main Pillars that are strategically important for EUCAR collaborative research and innovation: Sustainable Propulsion, Safe & Integrated Mobility, Affordability & Competitiveness, Commercial Vehicles.

These collaborative strategic research projects in the pre-competitive domain leverage the EUCAR members’ R&D investments through the pool of knowledge and key innovative industrial results throughout the whole product value chain.

Key to obtaining high-quality results are the competencies and the passion of the individuals engaged in the research activities. I would like to express my utmost appreciation of the dedication, character, inventiveness and competence of all involved: EUCAR members, the strategic automotive partners: suppliers, research and technology organisations, universities, public authorities, Member States and the European Technology Platforms and common Fora.

Finally, I wish to acknowledge the fundamental role of the European Commission and the people in the Directorates, Units and Agencies for the dedicated support in creating and managing the European Research and Innovation Framework Programmes.

I am looking forward continuing the excellent collaboration with all of you.

Anke Kleinschmit

EUCAR Chairwoman 2015
Vice President Daimler AG, Group Research & Sustainability
Chief Environmental Officer
THE EUCAR MISSION

To strengthen the competitiveness of the European automotive manufacturers through strategic collaborative research and innovation by:

• Driving strategy and assessment of collaborative automotive research & innovation,

• Establishing common work with the European Commission, Member States and other key stakeholders,

• Facilitating the creation of high-quality projects with industrially relevant results.

THE MEMBERS
THE EXPERT GROUPS ACTIVE IN 2015

- Powertrain
- Fuels and Energy
- Battery Electric and Fuel Cell Electric Vehicles

- Safety
- Driver–Vehicle Dialogues
- Automated Vehicles
- Common Off-Board Data Platform

- Materials
- Manufacturing
- Virtual Engineering

- Commercial Vehicles
THE EUCAR STRATEGIC PILLARS OF RESEARCH & INNOVATION

**SUSTAINABLE PROPULSION**
Collaborative automotive R&I towards propulsion systems which are clean and energy-efficient over the full life cycle, with cost-effective technologies while maintaining customer priorities.

**SAFE & INTEGRATED MOBILITY**
Smart and safe vehicles for all purposes, integrated into a secure and intelligent transport system, progressing towards seamless mobility for all, maximum efficiency and ever-fewer accidents.

**AFFORDABILITY & COMPETITIVENESS**
New sustainable approach for developing and producing affordable and competitive vehicles in Europe.

**COMMERCIAL VEHICLES**
An integrated approach for reliable, clean, safe and efficient freight transport and passenger mobility, through dedicated vehicle concepts and effective logistics.
THE PROJECTS

03 SUSTAINABLE PROPULSION
05 Mapping of R&I projects
07 JEC WTW Analysis
09 NoWaste
11 CORE
13 GASON
15 REWARD
17 HDGAS
19 EuroLlion
21 EUROLIS
23 eCAIMAN
25 ECOCHAMPS
27 MotorBrain
29 eCo-FEV
31 ASTERICS
33 FABRIC
35 PHOTOFUEL

37 SAFE & INTEGRATED MOBILITY
39 Mapping of R&I projects
41 PIPER
43 PROSPECT
45 SafetyCube
47 SENIORS
49 DESERVE
51 UDRIVE
53 TEAM
55 AutoNet2030
57 AdaptIVe
59 RobustSENSE
61 ecoDriver

63 AFFORDABILITY & COMPETITIVENESS
65 Mapping of R&I projects
67 ALIVE
69 ENLIGHT
71 MATISSE
73 SafeEV
75 CRYSTAL
77 Know4Car

79 COMMERCIAL VEHICLES
81 Mapping of R&I projects
83 DELIVER
85 SmartFuSION
87 CONVENIENT
89 TRANSFORMERS
91 EBSF_2
93 FOSTER-ROAD

93 SUPPORT ACTION
SUSTAINABLE PROPULSION

Collaborative automotive R&I towards propulsion systems which are clean and energy-efficient over the full life cycle, with cost-effective technologies while maintaining customer priorities.

**ICE BASED POWERTRAIN**

Highly efficient and affordable powertrains with an internal combustion engine as the major propulsion unit, based on most advanced components, system architecture and operation strategies.

**XEV* BASED POWERTRAIN**

Highly efficient and affordable electrified powertrains, based on most advanced components and system architecture.

* xEV includes BEV, FCEV, REEV, PHEV

**FUELS & INFRASTRUCTURE**

Advanced fuels, including electricity, produced sustainably and under efficient processes including required infrastructure.

**VEHICLE THERMAL & ELECTRIC ENERGY MANAGEMENT**

Efficient management of thermal and electric energy flows in the vehicle.
STRATEGIC PILLAR
SUSTAINABLE PROPULSION
MAPPING OF R&I PROJECTS
Sustainable Propulsion

2010  2012  2014  2016  2018

JRC - EUCAR - CONCAWE Well-to-Wheels Analysis

Internal Combustion Engine

NoWaste - Heat Recovery

CORE - CO₂ Reduction

GASON - Gas only ICE

REWARD - Diesel ICE

HDGAS - Powertrains for HDV

Energy Storage

EuroLion - Li-ion Cells

EUROLIS - Lithium Sulphur Cells

eCAIMAN - Li-ion batteries

Hybrids

EUROLIS - Lithium Sulphur Cells

Methods & Tools

MotorBrain - Nanoelectronics

eCo-FEV - Cooperative Platform

ASTERICS - Efficient Simulation

FABRIC - On-road Charging

Fuel Cells

PHOTOFUEL - Fuels from CO₂
**JEC WTW Analysis**

Well-to-Wheels (WTW) analysis of future automotive fuels and powertrains in the European context

**MOTIVATION AND OBJECTIVES**

EUCAR, CONCAWE and JRC (JEC) continue to perform joint evaluations of the WTW energy use and greenhouse gas (GHG) emissions for a wide range of potential future fuel and powertrain options. The objectives of the study are:

- Establish, in a transparent and objective manner, a consensual WTW total / fossil energy demand and GHG emission assessment of automotive energy carriers and powertrains relevant to Europe in 2010 and in the 2020+ timeframe.
- Consider the viability of each fuel pathway.
- Attempt to have the approach and results accepted as a reference by all relevant stakeholders.

**TECHNICAL APPROACH**

The Well to Tank (WTT) evaluation accounts for the energy expended and the associated GHG emitted in the steps required to deliver the final fuel to a vehicle. The Tank to Wheels (TTW) evaluation considers the energy expended and the associated GHG emitted by the fuel application in the vehicle.

Energy use and GHG emissions are associated with both fuel production and vehicle use; hence the WTW integration enables an overall assessment of the combined fuel and vehicle pathways.

The WTW study takes into account induced changes generated by fuel and/or powertrain substitution in Europe. This is particularly important for fuels where careful consideration of co-products is essential for a good understanding.

**ACHIEVEMENTS**

The program has successfully completed several phases:

- 2001 - 2003: Version 1, initial report
- 2004 - 2006: Version 2, revision of fuels & vehicle data
- 2012 - 2014: Version 4, projection towards 2020+ & full integration of electrified vehicles

Results of this work are used by the European Commission (EU Renewable Energy Directive default value methodology; EU Fuel Quality Directive calculation of Fossil Fuel Comparator) and provide input to new initiatives, like the Clean Power for Transport program. Furthermore, it is considered by Technology Platforms like the European Biofuels Technology Platform as well as ERTRAC and recognised by EU member states.

**PROJECT PLAN, MILESTONES AND DELIVERABLES**

Effect of electricity source on energy use and GHG emissions in Plug-in Hybrid (PHEV), Range-Extended (REEV) and Battery Electric Vehicles (BEV), compared to 2020+ Gasoline (ICE) and Hybrid Vehicles (HEV).

**Achievements**

- The program has successfully completed several phases:
  - 2001 - 2003: Version 1, initial report
  - 2004 - 2006: Version 2, revision of fuels & vehicle data
  - 2012 - 2014: Version 4, projection towards 2020+ & full integration of electrified vehicles

Results of this work are used by the European Commission (EU Renewable Energy Directive default value methodology; EU Fuel Quality Directive calculation of Fossil Fuel Comparator) and provide input to new initiatives, like the Clean Power for Transport program. Furthermore, it is considered by Technology Platforms like the European Biofuels Technology Platform as well as ERTRAC and recognised by EU member states.

**Budget**

Self-funded by consortium partners

**Duration**

Continuing

**Coordinator**

H Maas, H Hamje, L Lonza

**Partners**

EUCAR members; CONCAWE & JRC

**Website**


**Start**

2001

**Priority Area**

Renewable energies

**Contact**

hmaas8@ford.com
NoWaste
Engine Waste Heat Recovery and Re-Use

MOTIVATION AND OBJECTIVES
The re-use of the engine waste heat (60% of the combustion energy) can significantly contribute to the overall vehicle energy efficiency increase. The technology is compliant and complementary with a hybrid powertrain where the generated electric energy will be used to power electric auxiliaries or will be stored.

NoWaste aims to demonstrate the feasibility of such a heat recovery system based on a Rankine Cycle.

- Fuel Economy: -7% fuel consumption at vehicle level on a reference mission
- Cost (for the OEM): < 4500 Euro/system
- Weight: < 150 kg

PROJECT PLAN, MILESTONES AND DELIVERABLES
The project is clustered with CORE.
The figure conveniently summarises the major project milestones and outcomes.

TECHNICAL APPROACH
The project key points are:
- Reference mission definition
- Selection of the most appropriate architecture
- Selection of the most appropriate working fluid
- Heat rejection system minimising the cooling drag
- Heat exchangers development to maximise the heat recuperation efficiency
- Integration with the exhaust system
- Validation of the developed system on a test rig and then on a vehicle demonstrator
- Benefit evaluation on different powertrains by means of a model approach

ACHIEVEMENTS
- Study and realisation of two Rankine Cycle System architectures:
  - ORC based on ethanol, mechanical power output use for a thermal engine without EGR (VOLVO-Renault Truck)
  - ORC based on 245fa, electric output use for a thermal engine without EGR (CRF-Iveco Truck)
- ORC systems validation @ engine test bench level
- Control strategy hardware & software development and tuning
- Overall on-board system integration on the demonstrator vehicle (Stralis truck)

<table>
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<th>Funding</th>
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<td>Start</td>
<td>October 2011</td>
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<tr>
<td>DG</td>
<td>Research &amp; Innovation</td>
<td>Contract n°</td>
<td>285103</td>
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<tr>
<td>Coordinator</td>
<td>Andrea Perosino, CRF</td>
<td>Contact</td>
<td><a href="mailto:andrea.perosino@crf.it">andrea.perosino@crf.it</a></td>
</tr>
<tr>
<td>Partners</td>
<td>CRF, Volvo, AVL, Faurecia, Dell’Orto, University of Liège</td>
<td>Website</td>
<td><a href="http://www.nowasteproject.eu">www.nowasteproject.eu</a></td>
</tr>
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</table>
CORE

CO₂ Reduction for long-distance transport

MOTIVATION AND OBJECTIVES

Main objective for CORE is to demonstrate a substantial reduction of CO₂ emissions through improved powertrain efficiency with technologies having the potential to be implemented in production around 2020. The target is a 15% improved fuel efficiency compared to a EURO V engine and at the same time fulfilling EURO VI emission legislation.

PROJECT PLAN, MILESTONES AND DELIVERABLES

<table>
<thead>
<tr>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
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<tbody>
<tr>
<td>Performance simulation &amp; design architecture on sub-system level</td>
<td>Prototype manufacturing &amp; sub-system test</td>
<td>Improved design and optimisation</td>
<td>Concept validation test and final assessment</td>
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<tr>
<td></td>
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<td>Oct. 2015</td>
</tr>
</tbody>
</table>

TECHNICAL APPROACH

The CORE target should be obtained by work in different sub-projects; three of which focus on different engine and powertrain technologies. Major areas for these are: optimising the existing Diesel engine: combustion, air management, aftertreatment and controls, decreasing rated engine speed (“down-speeding”), optimising the powertrain layout (hybrid electric components) and using alternative fuels, namely Liquefied Natural Gas (LNG), combined with variable valve actuation. These three sub-projects are supported by two projects where friction reduction and improvement of low temperature performance of NOx aftertreatment technologies are studied. Accomplished results are adapted on the three engine and powertrain arrangements. Finally in the last sub-project, to ensure knowledge and technology transfer, all results will be assessed by vehicle simulations for final achievement of the fuel economy target.

ACHIEVEMENTS

Current status of achieved results shows that the target will be met in at least one of the investigated engine system concepts, MD engine (8liter) + hybridisation + new Selective Catalytic Reduction (SCR) + new piston rings (lower friction). The blue arrows and figures present the best obtained result in each area.

In process, a 2nd loop of optimisation tests of the different engine systems and integration of Exhaust After-Treatment System (EATS). Based on these experimental results the vehicle simulations are in progress and with further more utilising combination of sub-technologies.

The blue arrows show the current achieved results, up to 16% reduced CO₂ for the best concept combination. There are potentials to improve these figures in the final optimisation of the different concepts.

Budget 17 M€
Duration 48 months
DG Research & Innovation
Coordinator Johan Engström, Volvo
Partners 16 partners amongst them Daimler, CRF, Volvo, Ricardo, IAV
Website www.co2re.eu

Funding 9 M€
Start January 2012
Contract n° SC51-GA-2012-284909
Contact johan.je.engstrom@volvo.com
GASON
Gas-Only internal combustion engines

MOTIVATION AND OBJECTIVES
In order to realise sustainable mobility in Europe, future vehicles for road transport have to be significantly more efficient by 2020+. A considerable contribution to this target has to come from the energy efficiency improvement of the powertrain. On the other hand, a strong de-carbonisation process has been launched to drive the European transport sector to the 2050 target and the use of Low Carbon Alternative Fuels, like Natural Gas, plays a fundamental role to accelerate this process. In this context, the GASON project aims to develop advanced CNG only, mono-fuel engines able to comply with the “2020” CO$_2$ emission targets, claiming the 20% CO$_2$ emission reduction with regard to the current best in class CNG vehicle segment, to fulfil the new homologation cycle and to guarantee a low fuel consumption in real driving conditions.

PROJECT PLAN, MILESTONES AND DELIVERABLES

TECHNICAL APPROACH
Starting from the experience gained in the previous EU FP7 funded INGAS project (www.ingas-eu.org), GASON is based on 3 parallel technology ways that lead to a full development of demonstrator vehicles, all based on the integration of the gaseous direct injection system developed in the project, and focusing on the direct injection combination with the advanced Variable Valve Actuator VVA system (WP2), on an advanced boosting system matched with Variable Compression Ratio (WP3) and addressing a lean burn and/or charge dilution combustion approach and exhaust gas temperature control (WP4). A key issue of the proposal is represented by the development and application of the direct gaseous injection technology to enhance boosting efficiency at low engine speed with benefit both in terms of performance and CO$_2$ emission reduction. Alternative combustion concepts, a quality fuel sensor (WP5) and advanced after-treatment-solutions (WP6) complete the full comprehensive project approach.

ACHIEVEMENTS
Aim of the GASON project is to develop:
- CNG-only mono-fuel engines with improved efficiency and able to comply with post EURO 6 emission targets, the 2020+ CO$_2$ emissions target and new homologation procedures.
- Innovative injection, ignition and boosting system concepts.
- Advanced exhaust after-treatment system.
- Technological solution to detect the gas-quality composition.
- Non-DI CNG lean burn concept, as a possible future efficiency benchmark based on a Diesel engine.
- Advanced storage system to enable higher driving range equivalent to conventional fuel.

Budget 23.4 M€   Funding 16.7 M€
Duration 42 months   Start May 2015
DG Research & Innovation   Contract n° 652816
Coordinator Massimo Ferrera, CRF   Contact massimo.ferrera@crf.it
Partners CRF, Ford, Renault, VW, AVL, CEA, UPVLC, Continental, CVUT, Delphi, EMPA, ETH, FEV, IFPEN, Pierburg, Polito, PUT, Ricardo, Schaeffler
Website www.gason.eu
REWARD
REal World Advanced technologies foR Diesel engines

MOTIVATION AND OBJECTIVES
Emission legislation on engine exhaust pollutants and fuel consumption respectively CO\textsubscript{2} emissions, is becoming more stringent worldwide. The overall objective of the REWARD project is to develop the know-how, intellectual property rights and technical capabilities to adequately and cost-effectively produce cleaner, highly efficient Diesel powertrains and aftertreatment technologies for future cleaner passenger cars and light commercial vehicles (LCVs).

The overall goal is to achieve real driving emissions below upcoming Euro 6 limits, 25% friction reduction in the entire engine, a significant higher lifetime durability and a more than 5% improved overall fuel efficiency.

PROJECT PLAN

TECHNICAL APPROACH
REWARD will use a holistic approach for the enhancement of the thermal efficiency and an improvement of the combustion quality. The energy conversion in Diesel engines can be split into three major items which strongly interact: smooth cylinder charging & gas exchange, efficient and complete combustion, and consistent exhaust aftertreatment. Other important aspects, i.e. control and monitoring as well as friction and wear will also be taken into account in the holistic approach.

ACHIEVEMENTS
REWARD’s objectives, main innovations and targeted key results are:

- To develop and demonstrate advanced exhaust gas aftertreatment concepts.
- To develop and demonstrate advanced friction and wear reduction measures.
- To develop an innovative 2-stroke Diesel engine architecture for B/C class vehicles.
- To develop and demonstrate advanced 4-stroke Diesel engines suited for class B, C, D and E passenger cars and LCVs.

The demonstration vehicles shall prove, by independent testing, a more than 5% improved fuel economy and compliance with stricter post Euro 6 limits under Real Driving conditions, ≥ 3 dB less noise and at least 50% less particle emissions.

Budget 12.6 M€  
Duration 36 months  
DG Research & Innovation  
Coordinator Herwig Ofner, AVL List GmbH  
Partners AVL, Renault, Volvo, CRF, CNR, Johnson Matthey, Ricardo, Schaeffler, LMM, Delphi, Uniresearch, IFPEN, ViF, Chalmers, CTU, UPVLC  
Website www.project-reward.eu  
Funding 9.9 M€  
Start May 2015  
Contract n° 636380  
Contact herwig.ofner@avl.com
LAUNCH OF WEBSITE

As from September 2015 the HDGAS website is accessible online.
www.hdgas.eu
HDGAS
Heavy Duty Gas Engines integrated into Vehicles

MOTIVATION AND OBJECTIVES

The overall objective of the HDGAS project is to develop, demonstrate and optimise advanced powertrain concepts for dual-fuel and for pure Natural Gas (NG) operation engines, perform integration thereof into heavy duty vehicles and confirm achievement of Euro VI emissions standards, in-use compliance under real-world driving conditions and CO₂ or greenhouse gas targets currently under definition.

To realise the full potential of NG powered vehicles, the following technical objectives will be addressed:

• To specify technical requirements and international/European standards of Liquefied Natural Gas (LNG) fueling interfaces and fueling process for heavy duty vehicles (trucks and buses).
• To develop an advanced LNG fuel tank system.
• To develop and demonstrate new generations of exhaust aftertreatment systems and low emission technologies for dual fuel and gas engines allowing real driving emissions below Euro VI limits for heavy duty vehicles.
• To develop and demonstrate advanced ≥ 10% more fuel-efficient direct Positive Ignition natural gas engines and powertrains suited for heavy duty vehicles and integrate the engine and a new fuel system on a vehicle.

PROJECT PLAN

TECHNICAL APPROACH

HDGAS will develop all key technologies (LNG fuel system including High Pressure tank design, compact and insulation in tank, cryogenic pump, aftertreatment systems), and three engines as well as new fuel systems will be integrated into three demonstration vehicles. HDGAS will also prepare a plan for a credible path to deliver the innovations to the market. The exploitation plan will be proportionate to the scale of the project and contains measures to be implemented both during and after the project.

ACHIEVEMENTS

• Advanced LNG vehicle fuel systems and aftertreatment systems/emission control
• Development of Natural Gas engines, Dual Fuel engines and controls
• System integration into Demonstration vehicles
• Evaluation and independent testing
• Market introduction at selected fleet owners and markets
• Further optimisation of components and systems
• Ramp up production of vehicles

Budget 27.8 M€  Funding 19.9 M€
Duration 36 months  Start May 2015
DG Research & Innovation  Contract n° 653391
Coordinator Theodor Sams, AVL List GmbH  Contact theodor.sams@avl.com
Partners 19 partners including Daimler, IVECO, Volvo, MAN, Ricardo, FPT Powertrain Technologies
Website www.hdgas.eu
### Nail Penetration Test of Third Gen 53437 Pouch Test Cells

<table>
<thead>
<tr>
<th>Time</th>
<th>Image 1</th>
<th>Image 2</th>
<th>Image 3</th>
<th>Image 4</th>
<th>Image 5</th>
<th>Image 6</th>
<th>Image 7</th>
<th>Image 8</th>
</tr>
</thead>
</table>

- No explosion.
- Despite cell constraints they show uncritical behaviour.
EuroLiion
High energy density Li-ion cells for traction

MOTIVATION AND OBJECTIVES
Development of a new Li-ion cell for traction purposes with the following characteristics:

- An energy density of at least 200 Wh/kg.
- Low costs: i.e. a maximum 150 €/kWh.
- Meet or exceed safety standards.
- Specific power of at least 1000 W/kg (at normal operation).
- Durability, reflected by a life time of 10 years and a lifecycle of 2500 cycles.
- Operating temperature from -40 °C to 50 °C.
- Use of environmentally friendly and sustainable materials.
- Protecting European technology.

PROJECT PLAN, MILESTONES AND DELIVERABLES
The figure summarises the relevant milestones and deliverables and visualises the current status of the achievements.

TECHNICAL APPROACH

- Formulate, develop, test and optimise electrode and electrolyte formulations.
- Synthesis of electrodes and cells.
- Design, develop and test emerging Li-ion cells based on the above formulations.
- Develop an adequate testing procedure.

ACHIEVEMENTS

WP1 Month 48 – project finished.
WP2 Final technical requirement specification of Li-ion cells for heavy-duty HEVs and test procedures overview.
WP3 Nano-Silicon particles and new binders for Si-based electrodes were defined. Kilograms of Si were delivered. Formulation of negative electrode composition established and passed over to WP6.
WP4 Electrolyte compatibility towards the electrodes was verified.
WP5 Kilograms of optimised LiNi_{0.5}Mn_{1.5}O_4 (LNMO) has been prepared by partners and a commercial supplier according to EuroLiion’s recipe.
WP6 Si/C negative electrodes and LNMO cathodes were prepared and successfully implemented in the 1st Gen cylindrical 18650 test cells and 3rd Gen 53437 pouch test cells, respectively (2nd Gen testcells with EuroLiion electrolyte were not assembled and tested).
WP7 Test procedure for benchmarking. 1st to 3rd Gen test cells were tested.
WP8 Final costs assessment performed on novel EuroLiion materials. Final reviewed Li-ion battery recycling methods evaluated based on their process strategy.

Budget 3.95 M€
Duration February 2011
DG Research & Innovation
Coordinator e.m.kelder@tudelft.nl
Partners 13 partners among them 7 Alistore-ERI partners, Volvo, Renault, Spijkstaal, CEA, ZSW and AIT
Website www.eurolalion.eu
ION SELECTIVE MEMBRANES AS SEPARATORS IN LI-S BATTERIES

Polysulphide shuttle is one of the factors influencing Li-S battery life cycle. An effective way to avoid the polysulfide shuttle is the use of ion selective membrane between sulphur cathode and metallic lithium. That can be obtained by using fluorinated (hydrophobic) membranes (interlayers) as a separator. Interlayers prepared by direct fluorination of reduced graphene oxide (rGO) or by chemical modified rGO are capable to stabilise capacity of Li-S battery. XPS study of sulphur compounds on metallic lithium shows reduced amount of polysulphides and Li2S, that corresponds to limited polysulphide shuttle activity.
EUROLIS
Advanced European lithium sulphur cells for automotive applications

MOTIVATION AND OBJECTIVES
EUROLIS is a project which includes basic research on various levels with a focus on the understanding of Li-S battery behaviour in different chemical environments. This will be used for the optimisation and integration of materials into 18650 cells. Three different generations of 18650 cells are applied to be tested for their appropriateness in automotive applications.

The objectives of the project are:
• 18650 Li-S cell configuration with energy density of 500 Wh/kg and power density of 1000 W/kg.
• High cycle efficiency in the entire life cycle in a wide temperature range.
• Durability reflected by a life time required in automotive industry.
• Low cost with sustainable and environmentally friendly approach.

PROJECT PLAN, MILESTONES AND DELIVERABLES
The figure summarises the major project milestones and outcomes:

TECHNICAL APPROACH
The project is focused on the tailoring of Li-S battery components (cathode composite, electrolyte and separator) by using modelling and analytical approach. It includes:
• Development of the cathode composite, by use of mesoporous host structures.
• Modelling of electrolyte (organic solvents and ionic liquids).
• Analytical approach with different post-mortem and in-operando measurements based on the spectroscopic (XPS, XAS, UV-Vis) and electrochemical techniques (4 electrode cell, EIS).
• Benchmarking of other technologies (redox flow, all solid state and Si-Li2S).
• Integration, scale up, testing, life cycle assessment (LCA) and benchmarking of Li-S batteries.

ACHIEVEMENTS
Prototype cells with configuration 18650. Two generations of prototype cells were assembled by SAFT based on the components prepared by different partners and a double side coated cathode prepared by Fraunhofer.

Prototype cells assembled @ SAFT and tested at SAFT and Renault

Cells can be charged by using constant current charge and discharged in different conditions and temperatures including DST macro-cycle as tested by Renault.

Budget 3.8 M€ Funding 2.9 M€
Duration 48 months Start October 2012
DG Research & Innovation Contract n° 314515
Coordinator Robert Dominko, NIC, Ljubljana Contact robert.dominko@ki.si
Partners Renault, Volvo, SAFT, Solvionic, NIC, CNRS, MPG, Chalmers, Elettra, Fraunhofer
Website www.eurolis.eu
eCAIMAN
Electrolyte, Cathode and Anode Improvements for Market-near Next-generation Lithium Ion Batteries

MOTIVATION AND OBJECTIVES
The objective of eCAIMAN is to bring European expertise together to develop a battery cell that can be produced in Europe and meet the following demands:

- Energy density of Lithium-ion batteries (LIB) of ~270 Wh/kg.
- Cost 200 €/kWh.

The project will also:

- Investigate the integration in light, passenger, and heavy duty vehicles.
- Validate safety and reliability of the cells.
- Support the development processes with advanced multiphysical modelling.

PROJECT PLAN, MILESTONES AND DELIVERABLES
The work flow in eCAIMAN is divided into two major parts: “Materials Development & Improvement”, and “Proof of Concept & Prototyping”. The tasks are combined in eight work packages with a synergetic balance between R&D, end user (OEM) demands, and prototyping as depicted in the figure below.

TECHNICAL APPROACH
The objectives will be achieved by:

- Industrialising a 5V high-voltage spinel cathode material.
- Industrialising a high-capacity composite anode material.
- Industrialising a stable high-voltage electrolyte.
- Producing Technical Readiness Level 6 (TRL) large-scale automotive cells applying above materials and technology.

ACHIEVEMENTS

- Reduced battery system cost by applying a scalable modular concept for use in light vehicles, passenger vehicles and heavy duty vehicles and buses
- Slurry engineering: general and highly efficient method to maximise the electrochemical performance for a given active material and minimise the side effects on electrochemical properties
- Reduction of processing cost for electrode preparation will be achieved via aqueous processing
- A new test procedure considering both the approaching high voltage cells as well as the demands from various vehicle concepts (light, passenger, and heavy duty) will be developed. This in a later stage can be used for dissemination and update of current test procedures.

Budget 6.1 M€  
Duration 36 months  
DG INEA  
Coordinator Boschidar Ganev, AIT  
Partners Fiat, Volvo, Piaggio, CEA, Arkema, CERTH, SP, IMERYS, LITHOPS, POLITO, AIT  
Website www.ecaiman.eu  
Funding 5.8 M€  
Start May 2015  
Contract n° 653331  
Contact boschidar.ganev@ait.ac.at  
www.ecaiman.eu
As of September 2015 the ECOCHAMPS website is online.

www.ecochamps.eu
**ECOCHAMPS**

European COmpetitiveness in Commercial Hybrid AutoMotive PowertrainS

**MOTIVATION AND OBJECTIVES**

Even though hybrid passenger cars are already in production, their market penetration is still relatively low and limited to certain vehicle classes. To increase user interest in hybrid vehicles, the ECOCHAMPS project aims to extend their functionality while minimising their cost premium.

The overall objective is to achieve efficient, compact, low weight, robust and cost effective hybrid powertrains for both passenger cars and commercial vehicles (buses, medium duty and heavy duty trucks) with increased functionality, improved performance, comfort, functional safety and emission levels below Euro 6 or VI.

The specific technical objectives, main innovations and targeted key results are:

- To devise a modular pre-standard framework (MSF), for the first time, that recommends standards for electric hybrid drivetrain components and auxiliaries for commercial vehicles.
- To develop a set of electric hybrid components for hybrid powertrains.
- To develop optimised drivelines for the selected vehicle classes.
- To demonstrate the key innovations in two light duty and three commercial vehicles at TRL 7.
- To assess the technology development in terms of its efficiency, cost effectiveness, weight and volume.

**PROJECT PLAN & MILESTONES**

**TECHNICAL APPROACH**

ECOCHAMPS’s overall concept, approach and methodology of the work plan, is based on the following logical steps:

- Target setting.
- Modularisation, standardisation and development of hybrid components leading to cost optimisation.
- Design and build up the hybrid drivelines and vehicles.
- Evaluate the demonstration vehicles, underlying hybrid powertrains, components and technologies.
- Prepare the implementation and exploitation of the results and disseminate the findings.

**ACHIEVEMENTS**

The targeted achievements of ECOCHAMPS are to:

- Improve powertrain efficiency by up to 20% during representative operation.
- Reduce powertrain weight and volume by up to 20%.
- Reduce hybrid vehicles costs, targeting a 10% maximum cost premium.
- ECOCHAMPS will enable a leading European position in hybrid technology. All the vehicles to be developed should be ready for market introduction between 2020 and 2022 and (price-) competitive to the best in-class full hybrid vehicles on the market in 2013.

**Budget**

28.5 M€

**Duration**

36 months

**DG**

Research & Innovation

**Coordinator**

Guus Arts, DAF Trucks

**Partners**

26 partners, including CRF, DAF Trucks, Daimler, FPT, IVECO, MAN, Renault and JRC

**Website**

www.ecochamps.eu

**Funding**

21.1 M€

**Start**

May 2015

**Contract n°**

653468

**Contact**

guus.arts@daftrucks.com

**Website**

www.ecochamps.eu
MOTORBRAIN DEFINED A NEW STATE-OF-THE-ART IN ELECTRICAL POWERTRAIN

- The fundamental redesign of the interface between motor and inverter enables the integration into one single unit: This leads to 50% reduction of inverter weight and 30% reduction of costs.
- The integration of power semiconductors, sensors and control units helps to reduce complexity of the redundant multiphase motor.
- The multiphase design offers better power density and 7% cost savings, fewer passives are needed.
- The newly engineered active and passive components contribute to improved powertrain losses. Powertrain losses were reduced by more than 24%, which corresponds to an increase of driving range by 30-40 km.
- The novel control and sensor architecture uses redundancies which make aviation safety standards affordable.

MotorBrain provided a benchmark for robust, intrinsic failsafe and highest power density in propulsion systems and paved the way to demonstrate that adding complexity in electrical systems can reduce complexity in mechanical systems. This is leading to cost savings and higher efficiency. It also demonstrates that the next generation of powertrain developments should focus on system level approaches.

Follow-up projects (started in June 2015)
- H2020 ECSEL 3Ccar Integrated Components for Complexity Control in affordable electrified cars
- H2020 OSEM-EV Optimised and Systematic Energy Management in Electric Vehicles
MotorBrain
Nanoelectronics for Electric Vehicles
Intelligent Failsafe PowerTrain

MOTIVATION AND OBJECTIVES
The intention of the MotorBrain project was to develop sustainable drivetrain technologies and control concepts / platforms for inherently safe and highly efficient Electric Vehicle (EV) powertrains of the 3rd Generation.
The objective was to develop a powertrain which is not dependent on rear earth magnets, having highly competitive dimensions, with substantial material savings, which is fault tolerant due to built-in redundancy, which is safe due to utilization of ISO 26262 concept, coming with better than state-of-the-art efficiency and lowering down its overall cost by 25 percent.
MotorBrain aimed to achieve mechanical simplicity by increasing electrical complexity. The proposed methodology was planned to be well suited to support automotive ASIL D certification.

PROJECT PLAN, MILESTONES AND DELIVERABLES
The progress of work followed the V-cycle systematic based on the matrix structure of work packages and supply chains. Therefore the time line of the project plan, milestones and deliverables were driven by the needs of the value chains led by OEMs and Tier 1 Suppliers.
The project was subdivided into six technology related work packages. And another two dedicated on standardisation, dissemination and exploitation as well as project management.
The MotorBrain project planned to develop electronic components and hardware to support four main application areas: motor and inverter, battery system, sensors and control platform. These application areas inspired the 8 supply chain definitions with their unique demonstrators.

TECHNICAL APPROACH
The technical approach was based on the expertise of 32 partners among the whole value chain in order to develop smart miniaturized electronic systems including subsystems, and vehicle demonstrators. The cross functional team enabled research on all powertrain system layers. The top priority goals were set on increasing energy efficiencies, system compactness, reliability and safety combined with significant cost reductions and opening up of the standardisation potentials for different levels of control.

ACHIEVEMENTS
• 15kWh battery pack with advanced electronics
  Based on commercially available cells, volume reduction.
• Angle sensors
  Two different types of sensors were developed and delivered, one end-of-shaft and a second one out-of-axis.
• Current sensor
  Hall-based sensor in integrated form having dimensions of common ICs, 50 A range, investigation of 200 A sensor.
• Torque sensor
  Development of a new torque sensor which fulfills requirements of automotive applications.
• Multicore control unit
  Based on a newly developed Infineon TriCore AURIX TC27x, software written according to ISO26262.
• 9 phase inverter design
  A lower phase currently enables design of a less complex PCB and utilisation of low cost connections without screws.
• Five concepts of propulsion systems:
  - Modulated pole machine based on SMC,
  - Electric powertrain based on AC induction motor,
  - Smart integrated electric vehicle powertrain,
  - Electrical Variable Transmission (EVT),
  - Synchronous reluctance motor based powertrain with inverter integrated charger.
THE ECO-FEV FINAL EVENT

The eCo-FEV final event on May 22nd, 2015 in Grenoble, France provided comprehensive results to leverage the mass market introduction of FEVs. eCo-FEV successfully demonstrated the supply of ICT services to a real user under real conditions and on public domain. Keynotes, presentations and an exhibition informed about the project achievements.

In particular, driving demonstrations provided the opportunity to gain hands-on experience of the eCo-FEV systems. Participants there could experience co-modal trip planning by the eCo-FEV back end on a real trip by an electric car. The trip was affected by two traffic events: a closed road and congestion. As a result, the eCo-FEV back end re-planned the trip two times, booked a charging station for the vehicle and dynamically proposed a new multimodal route by express bus line, all in real-time. At the end of the demonstration, participants could travel back to Grenoble by express bus line which can take a dedicated shared lane to bypass congestion.

The eCo-FEV demonstration story
eCo-FEV

efficient Cooperative infrastructure for Fully Electric Vehicles

MOTIVATION AND OBJECTIVES

After 33 months of joint efforts, eCo-FEV has developed an open and flexible architecture taking fully electric vehicles (FEVs) one more step towards a mass market penetration. The project created a general architecture for the integration of FEVs into cooperative infrastructure systems. This includes new solutions for charging, such as contactless modes.

The project further promotes:
- A smart cooperative infrastructure for telematics services,
- An efficient multi-mode innovative FEV charging,
- Urban co-modal mobility,
- Environmental protection.

eCo-FEV successfully completed the project and carried out the final event on May 22nd, 2015 in Grenoble, France.

TECHNICAL APPROACH

For integration of FEVs with different infrastructure systems, eCo-FEV designed, developed and integrated the following subsystems: a road side system, an in-vehicle system and a back end. This further includes innovative technologies like Charge While Driving, energy management and management of the whole charging process.

- Road side system: The road side unit in eCo-FEV includes communication hardware (e.g. Wi-Fi, UMTS), application unit hardware and potential gateways to interface with the road side infrastructure or with different charging infrastructures.
- In-vehicle system: An on-board unit is integrated into the FEVs, providing telematics services and charging assistance for FEV users.
- eCo-FEV back end: This platform provides data collection and data aggregation functionalities, and it provides FEV services to customers.

ACHIEVEMENTS

- One electromobility platform, combining existing infrastructures relevant for advanced FEV-related services
- This platform is mutualising and exploiting information from EVs and from independent EV-related infrastructures.
- Smart concept design integrating energy management and multimodal urban mobility planning
- Improvement of energy provision via reliable wireless communications
- Support of different charging modes (including Charge While Driving)
- Successful tests of platform and use cases at the Italian (Susa) and French (Grenoble) test sites
- Development of a potential business model and elaboration of an exploitation plan

Budget 4.3 M€  Duration 33 months  DG Connect  Coordinator Massimiliano Lenardi, Hitachi Europe  Partners Hitachi Europe, CEA, EICT, POLITO, Renault, TU Berlin, TECNOSITAF, CRF, BlueThink, FACIT, Le Département de l’Isère, EnerGrid, IERC  Website www.eco-fev.eu  Funding 3 M€  Start September 2012  Contract n° 233826  Contact Massimiliano.Lenardi@hitachi-eu.com
ASTERICS
Ageing and efficiency Simulation & TEsting under Real world conditions for Innovative electric vehicle Components and Systems

MOTIVATION AND OBJECTIVES
The overall objectives of the ASTERICS project are:
• To develop a systematic and comprehensive approach for the design, development and testing phases of E-drivelines in Battery Electric Vehicles (BEVs).
• To reduce the overall development time and testing efforts for BEVs and BEV components by 50% compared to the current time and efforts.
• To enable improvement and optimisation of the overall efficiency and performance of electric vehicles by at least 20% compared to existing and known concepts.

PROJECT PLAN, MILESTONES AND DELIVERABLES

<table>
<thead>
<tr>
<th>MS1</th>
<th>MS2 Kick-off meeting</th>
<th>MS3 Report on SoA and model building</th>
<th>MS4 Real-world data sets available</th>
<th>MS5 Test Bench for E-Motor and data</th>
<th>MS6 Use cases defined</th>
<th>MS7 Battery usage &amp; stress model</th>
<th>MS8 E-Motor sim. models</th>
<th>MS9 E-Motor emulator av.</th>
<th>MS10 Test Bench for E-Motor</th>
<th>MS11 Battery models</th>
<th>MS12 Report testing E-Motor</th>
<th>MS13 All models available</th>
</tr>
</thead>
</table>

TECHNICAL APPROACH
The four building blocks, their features and the major innovations are:
• Real world environment and conditions based drive cycles.
• Advanced testing methodologies and models for E-driveline components.
• Descriptive/predictive models for battery subsystem, power electronics and electric motor.
• Total system (E-driveline and fully electric vehicle (FEV)).

ACHIEVEMENTS
Driving Cycle
An ASTERICS Driving Cycle (DC) was developed by performing three case studies with light and heavy vehicles. Additionally, an ASTERICS tool was developed, which allows simple DC data management. It can be used to build new DCs from raw data or to combine existing and newly generated cycles. Batch simulations using different DCs for each simulated event significantly reduces setup time.

Battery Parameters
Battery parameters with electrochemical impedance spectroscopy (EIS) at different states of battery ageing were identified and fitted an electric equivalent circuit (EEC) model to the measured impedance, which were then used to compare results of the lifecycle test.

Inverter Systems
Inverter arms models in Amesim and CRUISE were developed which include conduction and switching loss estimations based on semiconductor’s static characteristics at different assumption levels.

E-Motor
New Switched Reluctance Motor (SRM) and Permanent Magnet Synchronous Motor (PMSM) dynamic models based on the reluctant network approach as well as an improved methodology for integrating results from magneto-static and transient finite element analysis into system models for accurate loss calculation of SRM models were developed. The impact of different control strategies on losses and torque ripples has been studied.

Integration
A complete vehicle model for EV applications, including different models of the electric powertrain, such as battery, inverter and electric machine was created. For this different simulation tools such as AVL Cruise, LMS AMESIM, Per-FECTS, GSP were used in one environment to maximise the synergy with the other tools. The integration in a co-simulation environment through the Functional Mock-up Interface (FMI) or Mat-lab/Simulink allows to share libraries that are included in a common database between all partners.

Budget
4.3 M€

Duration
36 months

DG
Research & Innovation

Coordinator
Horst Pfluegl, AVL List GmbH

Partners
AVL, CRF, Siemens, Volvo Trucks, University of Florence, FH-Joanneum, University of Lubljana, Thien eDrives, Gustav Klein

Website
www.asterics-project.eu

Funding
2.7 M€

Start
October 2012

Contract n°
2012-314157

Contact
horst.pfluegl@avl.com
FABRIC
Feasibility analysis and development of on-road charging solutions for future electric vehicles

MOTIVATION AND OBJECTIVES
FABRIC assesses the technological feasibility, economic viability and socio-environmental impact of dynamic charging of electric vehicles (EVs).

The basic project objectives can be summarised as follows:
• Development and testing of advanced ICT and charging solutions,
• Sustainable integration with road and grid infrastructure specifications,
• Long-term socio-economic impact and feasibility studies for large scale electromobility implementation.

PROJECT PLAN, MILESTONES AND DELIVERABLES
Overview of the FABRIC R&D timeline and major milestones:

TECHNICAL APPROACH
In order to assess the technological feasibility and long term viability of EV wireless dynamic charging solutions and the large scale deployment of electromobility, adapted EVs, ICT and wireless power transfer solutions, road and grid infrastructures will be integrated in three FABRIC test sites in Italy, France and Sweden. Testing and validation of prototypes will be performed to feed a thorough feasibility analysis and impact assessment with respect to the users, the society and environment.

ACHIEVEMENTS
• State-of-the-art and benchmarking of ICT and EV charging solutions; Market readiness study.
• Collection of requirements from road authorities, vehicle manufacturers, and distribution system operators.
• FABRIC use cases.
• Preliminary development of prototype EV wireless stationary and dynamic charging modules.
• Study of the electromagnetic safety aspects.
• Grid and road impact assessment for on-road charging solutions.
• Analysis of renewable energy sources and energy storage systems integration.
• ICT infrastructure design including load balancing for dynamic EV charging.
• Preliminary feasibility study for the large scale implementation of dynamic charging solutions.
• Contribution towards standardising the definition of EV charging modes.

Budget 9 M€ Duration 48 months DG Research & Innovation Coordinator Angelos Amditis, ICCS Partners ICCS, CRF, ERTICO, TRL, KTH, Volvo, Scania, TNO, VeDeCom, CIRCE, QIE, IREN, FKA, TECNOSITAF, ENIDE, POLITO, UNIGE-DITEN, SAET, Sanef, CEA, ATA, AMET, MECT Website www.fabric-project.eu
PHOTOFUEL
Biocatalytic solar fuels for sustainable mobility in Europe

MOTIVATION AND OBJECTIVES
The motivation is to promote the development of high quality, low impact transportation fuels. The challenge is to advance the base technology of microalgae cultivation in closed bioreactors by enabling phototrophic algae or cyanobacterial microorganisms to produce alkanes and alcohols, which are excreted to the culture broth for direct separation without cell harvesting. This thereby turns the microbial cells into self-reproducing biocatalysts allowing the process to directly convert solar energy, water and CO₂ into engine-ready fuel instead of being used to form biomass, as shown in the figure. Objectives are:

- Development of advanced biocatalysts for the direct production of solar fuels.
- Upscaling of cultivation volume and raw fuel production.
- Upgrading/purification to fuel for blending and engine tests.
- Analysis of risks, economics and environmental impact of the pathway.

PROJECT PLAN, MILESTONES AND DELIVERABLES
The final goal is to advance the solar fuel technology towards highly sustainable production of drop-in fuels on arid or marginal land. Economically and environmentally sustainable large-scale systems for geographically independent conversion of solar radiation into chemical energy would support rural communities and substitute significant shares of fossil energy for the benefit of Europe and many other regions.

TECHNICAL APPROACH
WP2 Biocatalyst development on base of two cyanobacterial strains and one microalga. Targeted fuel compounds are butanol, medium chain alcohols and alkanes, sesquiterpenes. The best performing strain(s) are selected by the PHOTOFUEL consortium and jointly improved in the last 18 months of the project.

WP3 upscales cultivation volumes and assesses the biocatalyst. The final volume is 5m³ for outdoor production of fuel compounds. A control strategy and fuel separation process is developed. Options to recycle water, nutrients and energy as well as sanitation are studied.

WP4 analyses and upgrades the crude biocatalyst products from WP 3. These are blended with fossil fuels and other biofuels to on-spec, engine-ready solar diesel and gasoline fuels.

WP5 studies the engine performance of solar fuel blends, prepared in WP 4 according to expectations of both WP on the composition of fuels in the future. Tests are performed in gasoline- and diesel engines of the EURO6 norm, representing passenger vehicles and trucks.

WP6 assesses the techno-economic risks, economical performance and environmental impacts of the PHOTOFUEL pathway for comparison to other existing or developing processes for the production of fossil and renewable fuels.

WP7 summarises the project results for the preparation of a business development plan.

WP1 disseminates the project results in press, on conferences and workshops and includes project management and administration.

ACHIEVEMENTS
A biocatalytic pathway to solar transportation fuels ready for pilot scale application.

Budget 6 M€ Funding 6 M€
Duration 48 months Start May 2015
DG Research & Innovation Contract n° 640720
Coordinator Hilke Heinke, Volkswagen AG Contact hilke.heinke@volkswagen.de
Partners VW, CRF, Volvo, IFPEN, UU, UniBi, Imperial, UniFi, A4F, Neste, KIT, SYNCOM
Website www.photofuel.eu
# Safe & Integrated Mobility

Smart and safe vehicles for all purposes, integrated into a secure and intelligent transport system, progressing towards seamless mobility for all, maximum efficiency and ever-fewer accidents.

## Safety
Vehicles that protect their passengers, avoid accidents and dialogue safely with their drivers. Communications that enable cooperative safety for all road users. Safe application of increasing vehicle automation.

## Transport / Travel System
An integrated system that provides comprehensive real-time actionable data, facilitates modal transitions and manages traffic for maximum mobility, efficiency and optimum use of infrastructure.

## Traffic Efficiency
Substantially increased efficiency of passenger and goods traffic measured by time available for other purposes, consumption of individual vehicles and whole-system efficiency.

## Value-Added Customer Services
Highly valuable services, available to drivers and customers, that enhance the driving and mobility performance and experience, and provide additional business opportunities.

## ICT & Telematics
Vehicles that are integrated with the electronic information cloud, enabling a complete system approach for smart vehicles and intelligent transport.
STRATEGIC PILLAR
SAFE & INTEGRATED MOBILITY
MAPPING OF R&I PROJECTS
Safe & Integrated Mobility

2010

2012

2014

2016

2018

Passive Safety

Integrated Safety

Efficient Mobility

Automated Driving

Methods & Tools

PIPER - Advanced Human Body Models

PROSPECT - Proactive safety

SafetyCube - Safety benefits

SENIORS - Safety for ORU

DESERVE - Safe & Efficient Drive

UDRIVE - Driving & Riding Infrastructure

TEAM - Adaptive Mobility

AutoNet2030 - Co-operative Systems

AdaptIVe - Automated driving applications

RobustSENSE - Environment Sensing

ecoDriver - Behaviour
OPEN SOURCE TOOLS TO POSITION AND CHANGE THE SHAPE OF HUMAN BODY MODELS FOR CRASH SIMULATION

- Open source (GPLv3)
- Modular, model and code neutral
- Interactive postural change
- Data driven shape change to simulation population targets
- Public release on April 2017
PIPER
Position and Personalize Advanced Human Body Models for Injury Prediction

MOTIVATION AND OBJECTIVES
In passive safety, advanced Human Body Models (HBM) based on the Finite Elements method have the potential to represent the population variability and improve injury predictions. However, they are underutilised in R&D. Reasons include difficulties to position HBMs – typically available in only one posture – in vehicle models, and the limited representation of the population variability (size, weight, etc.).

The main objective of the PIPER project is to develop new “user friendly” tools to position and personalise these advanced HBMs. By facilitating the generation of population and subject-specific HBMs and their usage in production environments, the tools will enable new applications in industrial R&D for the design of restraint systems as well as new research applications.

PROJECT PLAN, MILESTONES AND DELIVERABLES
The following figure provides a simplified overview of the project expected timeline for the tools development, model improvement and surrounding applications.

TECHNICAL APPROACH
• Definition of specifications with future industrial and academic users
• Development of a modular, human body model neutral framework to facilitate future evolutions, availability under an Open Source exploitation strategy and extensive dissemination driven by the industrial partners
• Combination of proven approaches and innovative solutions transferred from computer graphics, statistical shape and ergonomics modeling
• Extensive evaluation in actual applications with several adult and improved child models (WP1), development of predictors of posture and shape (WP2) to help drive the new personalisation and positioning tools (WP3)

ACHIEVEMENTS
WP1 Survey to determine priorities for the future tools (results on the website), work on child models improvements (e.g., a new neck and shoulder)
WP2 Evaluation of segmentation approaches (e.g., b) trunk skeletal shapes) to support statistical shape descriptions and the preliminary shape database
WP3 Evaluation of state-of-the-art methods to position and personalise (e.g., c) a thorax shape change) and internal release of the first version (d) Child and GHBMC models)

Budget 4 M€ Funding 3 M€
Duration 42 months Start November 2013
DG Research & Innovation Contract n° SCP3-2013-605544
Coordinator Philippe Beillas, University Lyon 1 Contact philippe.beillas@ifsttar.fr
Partners LAB PSA Renault, PDB, CEESAR, INRIA, SOTON, TU Berlin, IIT Delhi, KTH, LIP
Website www.piper-project.eu

Illustration of some activities: a) child model improvements: neck and shoulder; b) trunk skeletal shape modeling; c) thorax shape change; d) Child and GHBMC models
PROSPECT
PROactive Safety for PEdestrians and CyclisTs

MOTIVATION AND OBJECTIVES
Accidents involving pedestrians and cyclists still remain a pending issue for road safety. Pedestrians and cyclists fatalities account for 28% of road fatalities in the EU. This fact shows the magnitude of the problem.
The first Autonomous Emergency Braking (AEB) systems that avoid and mitigate Vulnerable Road Users (VRU) accidents have been recently introduced in the market. The PROSPECT project aims to improve the effectiveness of active VRU safety systems compared to current systems by expanding the scope of accident scenarios addressed and improving the overall system performance.

TECHNICAL APPROACH
PROSPECT will pursue the following approach:

- Better understanding of relevant VRU scenarios by means of statistical accident studies and naturalistic urban observations.
- Improved VRU sensing using enlarged VRU sensor coverage as well as improved sensor and situational analysis.
- Advanced system control strategies such as combined steering and/or braking and advanced actuator concepts.
- Project demonstrators that integrate the previous concepts.
- Validation in realistic traffic scenarios, user acceptance tests and test methodologies that will be proposed to Euro NCAP for standardisation.

ACHIEVEMENTS

- New sensor concepts and operation modes for AEB VRU systems
- New generation of AEB VRU systems fitted into passenger cars
- Test and assessment methods for Euro NCAP AEB VRU systems
- Test tools for AEB VRU development and testing

Budget: 6.9 M€
Funding: 6.9 M€
Duration: 42 months
Start: May 2015
DG: MOVE
Contract n°: 634149
Coordinator: Andrés Aparicio, IDIADA
Contact: aaparicio@idiada.com
Partners: IDIADA, Audi, BMW, Daimler AG, BAS, Continental, Chalmers, Budapest University of Technology and Economics, IFSTTAR, TNO, Bosch, VTI, The University of Nottingham, Toyota, University of Amsterdam, Volvo, 4activeSystems
Website: www.prospect-project.eu
SafetyCube
Safety CaUsation, Benefits and Efficiency

MOTIVATION AND OBJECTIVES

- Evidence based road safety policies are becoming more common and there is much better availability of national data and state-of-the-art knowledge.
- Effective road safety policies need good information about accident risk factors and about measures.
- SafetyCube will meet this need by generating new knowledge about accident risk factors and the effectiveness of measures relevant to Europe.
- It will structure this information so it can be incorporated in the European Road Safety Observatory.

PROJECT PLAN, MILESTONES AND DELIVERABLES

- Project Dissemination Plan
- Crash cost estimates for European countries
- Methodological framework for the evaluation of road safety measures
- Accident Analysis, Risk factors, knowledge gaps and state-of-the-art on road user behaviour, vehicle and infrastructure models
- Efficiency assessment of key measures, detailed outcomes
- Identification of measures and their safety effects – vehicles
- Inventory of assessed vehicle risk factors and measures
- Practical guidelines for the registration and monitoring of serious road injuries
- Clearing-house of road safety risks and measures

TECHNICAL APPROACH

ACHIEVEMENTS

- New coordinated methodology to assess cost effectiveness of measures
- New systematic evaluation of risks and measures relating to the road user, vehicle and infrastructure
- New clearing-house of road safety measures

Budget 5.8 M€
Duration 36 months
DG Grow
Coordinator Pete Thomas, Loughborough Uni
Partners Lough, NTUA, IBSR/BIVV, SWOV, KfV, IFSTTAR, SAFER, TOI, ERF, CTL, ASPB, MHH, AVP, LAB, CEEAER, CIDAUT, DEKRA
Website www.safetycube-project.eu

Funding 5.8 M€
Start May 2015
Contract n° 633485
Contact safetycube@lboro.ac.uk
SENIORS
Safety ENhanced Innovations for Older Road userS

MOTIVATION AND OBJECTIVES

A reduction of almost 48% of total fatalities was achieved in Europe in the past years due to efforts that were put into road safety. This includes also a reduced number of elderly fatalities due to road accidents. However, among all the road fatalities, the proportion of elderly is steadily increasing.

In an ageing society, the SENIORS project aims to improve the safe mobility of the elderly, and obese persons, using an integrated approach that covers the main modes of transport as well as the specific requirements of this vulnerable road user group.

Thus, this project will primarily investigate and assess the injury reduction that can be achieved through innovative and suitable tools as well as safety systems in the automotive sector targeting the protection of the elderly (and obese persons) as car occupants and external road users (pedestrians, cyclists, e-bike riders) being involved in a crash.

PROJECT PLAN, MILESTONES AND DELIVERABLES

The figure provides a simplified overview of some expected results during the project runtime. Many other deliverables, information on workshops etc. can be found on the SENIORS website.

TECHNICAL APPROACH

The SENIORS project contains four technical Work Packages which interact and will provide the needed substantial knowledge throughout the project.

WP1 Accidentology and behaviour of elderly in road traffic
WP2 Biomechanics
WP3 Test tool development
WP4 Current protection and impact of new safety systems

Publications of results are aimed at conferences and in journals in short term. The transfer of knowledge and results will also be guaranteed through cooperation with regulatory, industry, consumer and insurance entities by the means of public workshops. An Advisory Board will monitor the project’s overall quality standards and give advices e.g., regarding the methodology.

ACHIEVEMENTS

• Identified distinctions in kinematics of road users by age in pre-crash and crash phase
• Identified anthropometric and injury mechanism particularities of elderly, and also obese persons, compared to younger people
• Customised R-scripts package for the calculation of injury risk curves
• Developed and optimised test tools, procedures and assessment methods in the area of passive vehicle safety with special regard to elderly and obese users

Budget 2.9 M€
Duration 36 months
DG INEA
Coordinator Marcus Wisch, BASt
Partners Autoliv, Fiat Chrysler Automobiles, Ford, Humanetics, IDIADA, LMU Munich, Transport Research Laboratory
Website www.seniors-project.eu
DESERVE project has the pleasure to invite you to join the final event, where the achievements of the past years will be shared. This will take place at Daimler Premises in Ulm, Germany on 16th of December 2015.

During the day, an overview of the activities carried out within the project will be presented and a roundtable specifically focused on the topics of the project will be organised to put into evidence the highlights of the project and its achievements as well. Furthermore several demos are planned to show the project results.
DESERVE
DEvelopment platform for Safe and Efficient dRiVE

MOTIVATION AND OBJECTIVES
DESERVE aims at developing a Tool Platform for embedded Advanced Driver Assistance Systems (ADAS) to exploit the benefits of cross-domain software, standardised interfaces, and easy and safety-compliant integration of heterogeneous modules to cope with the expected increase of functions complexity and reduction of costs.

The main objectives are:

- Design and build an ARTEMIS Tool Platform based on the standardisation of the interfaces, software reuse, development of common non-competitive software modules, and easy and safety-compliant integration of standardised hardware or software from different suppliers.
- Build an innovation ecosystem for European leadership in ADAS embedded systems, based on the automotive R&D actors, with possible applications in other industrial domains.

PROJECT PLAN, MILESTONES AND DELIVERABLES

<table>
<thead>
<tr>
<th>Kick-off meeting</th>
<th>Platform Specification</th>
<th>Integrated Platform</th>
<th>ADAS functions developed</th>
<th>Vehicle Prototypes</th>
<th>Final Event</th>
<th>Project Closure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep 2012</td>
<td>2013</td>
<td>2014</td>
<td>2015</td>
<td>Feb 2016</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TECHNICAL APPROACH

- Apply a holistic approach, which foresees the easy integration of different software and hardware solutions as well as the validation of each function as a module and as a part of the entire system.
- Allow the design, implementation and integration of brand-new components and embedded modules for the consistent interpretation of the vehicle’s surroundings and the driver’s behaviour.
- Provide methods and tools to implement a dynamic adaptation of sensor fusion modules and HMI systems.
- The design of the validation framework will be based on consolidated methodologies (such as the well known V-model) to test and develop new embedded components.

ACHIEVEMENTS

- Implementation of requirements and specification for a common software platform for the selected embedded automotive modules
- Design of development tools and development of software of the main components
- Definition of HMI concept and of driver model
- The design of the functionalities of the four prototypes (two passenger cars, two heavy good vehicles) is the major on-going work

Budget: 25 M€
Funding: 4.2 M€ (EU), 7.2 M€ (National)
Duration: 42 months
Start: September 2012
DG: ECSEL Joint Undertaking
Contract n°: 295364
Coordinator: Matti Kutila, VTT
Contact: matti.kutila@vtt.fi
Partners: 24 partners from 8 countries, among them CRF, Daimler, Volvo Technology
Website: www.deserve-project.eu
UDRIVE

European naturalistic Driving and Riding for Infrastructure & Vehicle safety and Environment

MOTIVATION AND OBJECTIVES

Naturalistic Driving is a research approach that provides insight into driver behaviour during everyday trips by recording details on the driver, the vehicle and the surroundings through unobtrusive data gathering equipment and without experimental control. Special equipment allows to gather information about vehicle movements (acceleration, deceleration, position on the road, driving speed), the driver (eye, head and hand movements) and the direct surroundings (traffic densities, time headway, road and weather conditions). This allows to assess the link between driver/rider, vehicle, road and traffic in normal situations, in near crashes and in actual collisions.

PROJECT PLAN, MILESTONES AND DELIVERABLES

The work plan follows five steps: Study Design, Data Management, Data Collection, Data Analysis, and Impact Analysis.

The design of the naturalistic driving study includes the definition of research questions, driving performance indicators and the establishment of procedures for complying with relevant legal regulations. Data collection will take place in six EU Member States: France, Germany, Poland, Spain, the Netherlands, and the United Kingdom.

TECHNICAL APPROACH

The collected data includes Controller-Area Network (CAN) data, vehicle data, seven camera views inside and outside the vehicle and a smart camera (MobilEye).

All data will be collected continuously to bring knowledge in the various research areas beyond the current state-of-the-art.

ACHIEVEMENTS

After a piloting phase, UDRIVE Operational Sites are ramping up to start data collection. Some are recruiting more participants but most vehicles across the Operational Sites are already on the road and will collect data for a period of 12 months.

The collected data will be used to gain new insights in driving behaviour in relation to crash causation factors, distraction, interaction with cyclists and pedestrians and eco-driving.

The overall objective of these analyses is to gain understanding of where, when and why drivers fail to perform the driving task safely.

Based on the new insights, UDRIVE aims to provide recommendations for safety and sustainability measures related to regulation, enforcement, driver awareness, driver training and road design.

The UDRIVE results may lead to improved driver behaviour models and risk functions which can be used for traffic simulations. After it is concluded, the project will offer access (within the bounds of legal and ethical restrictions) to the collected data. This will enable the exploitation of the data beyond the scope of the UDRIVE project.

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<th>Budget</th>
<th>10.5 M€</th>
<th>Funding</th>
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<tr>
<td>Duration</td>
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<td>October 2012</td>
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<td>DG</td>
<td>Research &amp; Innovation</td>
<td>Contract n°</td>
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<tr>
<td>Coordinator</td>
<td>Nicole van Nes, SWOV</td>
<td>Contact</td>
<td><a href="mailto:nicole.van.nes@swov.nl">nicole.van.nes@swov.nl</a></td>
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<tr>
<td>Website</td>
<td><a href="http://www.udrive.eu">www.udrive.eu</a></td>
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</table>

UDRIVE is collecting naturalistic data on passenger cars, trucks, and scooters.
THE EURO-ECOCHALLENGE

During this Europe-wide mobility experiment, taking place from October 2015 to May 2016, the applications and technologies developed in TEAM will be “challenged” at test sites in five countries and seven cities. The TEAM applications will be demonstrated and tested in Finland (Tampere), Sweden (Gothenburg), Germany (Berlin), Italy (Torino & Trento) and Greece (Athens & Trikala).

The objectives of this important activity are:
- Deploy fully integrated TEAM systems at the test sites.
- Exploit real data from various sources.
- Demonstrate elastic infrastructures and collaborative applications to a broad audience and stakeholders.
- Confirm that TEAM applications ameliorate challenging situations in urban environments.
- Investigate user acceptance for collaborative applications and serious gaming approaches.
TEAM
Tomorrow’s Elastic, Adaptive Mobility

MOTIVATION AND OBJECTIVES
TEAM turns static into elastic mobility by joining drivers, travellers and infrastructure operators together into one collaborative network. All network participants are meant to act as a team, balancing individual and network needs to create better transport solutions. The active collaboration is the key concept. It extends the cooperative concept of vehicle-to-x (V2X) systems to include interaction and participation. The main objectives are:

- Collaborative decision making and optimisation algorithms,
- Technology building blocks for the automotive cloud,
- Real-time management of individual driving and travelling needs,
- Quantification of the technical performance and impacts.

PROJECT PLAN AND MILESTONES
The TEAM project already successfully integrated the basic system and enablers. This leads the way to eleven collaborative TEAM applications and to the testing and enhancement in the Euro-EcoChallenge, a Europe-wide mobility experiment to illustrate the systems’ benefits. Supported by business modelling workshops, this will result in effective exploitation measures for TEAM technology.

TECHNICAL APPROACH
Extending the concept of existing V2X, TEAM is taking the next evolutionary step through the conversion of ubiquitous data streams into information. This is addressing the issue of massively increased requirements for computing, storage and bandwidth posed by V2X systems following a three-fold approach:

- Distributed collaborative services, reducing overall network complexity,
- Advanced cloud-based mobility services and LTE/802.11p convergence,
- Leverage vehicles and smart phones cooperation.

EXPECTED ACHIEVEMENTS

- Design and development of eleven collaborative applications
- Novel distributed sensing and best-effort balancing algorithms, anticipating traveller actions
- Advanced local dynamic map services (LDM++) and converged communication technologies
- Off-board automotive cloud and smart phone integration
- Coaching mechanisms for safe and green driving and travelling
- Demonstration of the TEAM systems’ benefits during the Euro-EcoChallenge
- Development of business models for effective deployment of elastic mobility systems

Budget
11.1 M€

Duration
48 months

DG
Connect

Coordinator
Ilja Radusch, Fraunhofer FOKUS

Contact
ilja.radusch@fokus.fraunhofer.de

Partners
BMW, CRF, Volvo, JLR, Cosmote, Delphi, Intel, IMC, HERE, NEC, NXP, RE; Lab, TI, ST,
e-Trikala, Infotrip, Ramboll, Mizar, STS, AIT, Create-Net, Fraunhofer, ICCS, NUIM, TUB,
DCAITI, UNIGE, VTT, EICT

Website
www.collaborative-team.eu
**AutoNet2030**

Co-operative Systems in Support of Networked Automated Driving by 2030

**MOTIVATION AND OBJECTIVES**

Triggered by the lack of convergence between sensor-based automation and cooperative V2X communications, the AutoNet2030 project seeks to research and validate procedures and algorithms for 802.11p-based interaction control among co-operative (automated and manually-driven) vehicles focusing on:

- Cooperative decentralised control system to realise fully-automated vehicles and drive the advised manoeuvring of manually-driven vehicles,
- V2X-message-based communications to (feed ETSI ITS standardisation and) enable automated manoeuvre planning (e.g., lane merging) and traffic flow optimisation,
- Onboard sensor-based architecture to enable reliable positioning and lane-keeping automation.

**PROJECT PLAN AND MILESTONES**

Overview of the project timeline and its major milestones:

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<tbody>
<tr>
<td>Kick-off meeting</td>
<td>Requirements analysed &amp; communications interfaces specified</td>
<td>Prototyping is mostly completed, ready for drive testing &amp; simulation-based testing</td>
<td>Full system prototyped, tested &amp; ready for pre-development</td>
</tr>
</tbody>
</table>

**TECHNICAL APPROACH**

- Research and specifications of cooperative manoeuvring control algorithms and information sharing
- Specification and standardisation of required enhancements to existing cooperative communication protocol standards
- Development of perception processing modules and multi-source data fusion specifications
- HMI specifications and implementation for advised manoeuvring
- Realistic test-track- and simulation-based evaluation

**ACHIEVEMENTS**

The so-far AutoNet2030 achievements can be summarised as follows:

- Design of manoeuvring control algorithms and collection of system level requirements
- Prototyping of the AutoNet2030 components and specifications for both the internal system interfaces and external (i.e., V2V and V2I) communication interfaces
- Sensor input processing and lane-level positioning on digital maps
- (Dual-display) HMI system design and preliminary implementation
- Definition of cooperative automated driving use cases (that meet road safety requirements)

Goals that are yet to be accomplished:

- Contributions to the standardised use of 5.9 GHz V2X communications for automated driving
- Finalisation of the AutoNet2030 software modules and system/platform integration
- Test-track drive validation of the cooperative manoeuvring control algorithms and AutoNet2030 system functionality
- Simulation-based verification of the AutoNet2030 system scalability
- Shaping the path for cost-optimised and widely deployable automated driving technology

**Budget** 4.6 M€  
**Funding** 3.3 M€  
**Duration** 36 months  
**Start** November 2013  
**DG** Connect  
**Contract n°** 610542  
**Coordinator** Angelos Amditis, ICCS  
**Contact** a.amditis@iccs.gr  
**Partners** ARMINES, BaseLabs, BroadBit, CRF, EPFL, Hitachi Europe, ICCS, TUD, SCANIA  
**Website** [www.autonet2030.eu](http://www.autonet2030.eu)
ADAPTIVE TECHNICAL WORKSHOP

In 2016 AdaptIVe will host a second intermediate workshop. After having discussed legal aspects in 2015, this workshop will focus on the first results of simulations and experiments related to human factors as well as hardware and software architecture for automated driving. Please visit www.AdaptIVe-ip.eu for more information coming up soon.
AdaptIVe
Automated Driving Applications & Technologies for Intelligent Vehicles

MOTIVATION AND OBJECTIVES

AdaptIVe develops, tests and evaluates automated driving applications for passenger cars and trucks in daily traffic. AdaptIVe will demonstrate automated driving in eight demonstrator vehicles in close-distance, urban and highway scenarios.

- The project provides guidelines for the implementation of shared control involving both the driver and the automation.
- To enhance the performance of automated systems the project improves the communication capabilities of the system.
- It defines and validates new specific evaluation methodologies and assesses the impact of automated driving on European road transport.
- AdaptIVe examines existing legal conditions with regards to barriers to implementation.

PROJECT PLAN, MILESTONES AND DELIVERABLES

Overview of the project timeline and its major milestones:

<table>
<thead>
<tr>
<th>Scenarios for legal aspects</th>
<th>Legal glossary</th>
<th>Evaluation plan</th>
<th>Demonstrators equipped</th>
<th>Evaluation methodology</th>
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<tbody>
<tr>
<td>Use cases</td>
<td>System specifications</td>
<td>System architecture</td>
<td>Midterm evaluation of HVI</td>
<td>Sensor fusion</td>
</tr>
</tbody>
</table>

TECHNICAL APPROACH

- Derive functional and operational requirements.
- Define technical specifications, considering cooperative technologies.
- Integrate functionalities in demonstrator vehicles.
- Provide guidelines on legal aspects.
- Evaluate automated driving applications in realistic driving manoeuvres.

ACHIEVEMENTS

- Classification of automated systems from a legal perspective and an examination of legal conditions
- Enhancement of continuous driver support applications towards automated functions
- Eight advanced demonstrator vehicles: seven passenger cars and one truck
- Strategies for system-driver interaction
- Evaluation methods and tools
- Improved understanding of the impacts of automated driving on road safety, traffic and the environment

Budget: 25 M€  
Duration: 42 months  
DG: Connect  
Coordinator: Aria Etemad, Volkswagen Group Research  
Partners: 28 partners, among them BMW, CRF, Daimler, Ford, Opel, PSA, Renault, Volvo Cars, Volvo Technology, VW  
Website: www.adaptive-ip.eu
RobustSENSE
Robust and Reliable Environment Sensing and Situation Prediction

MOTIVATION AND OBJECTIVES

Today’s driver assistance systems offer comfort and safety in sound environmental conditions. However, in harsh environmental conditions – when needed most – systems stop working due to reduced sensor information quality. Targeting on the area of highly automated driving, the improvement of perception, decision and planning under adverse conditions is one of the main challenges to be addressed. The goal of RobustSENSE is making sensing systems able to cope with real world requirements under all environmental conditions.

PROJECT PLAN AND MILESTONES

Duration 36 months, June 2015 – May 2018

TECHNICAL APPROACH

RobustSENSE’s main technical goal is to define, develop and evaluate measures for detecting performance degradation and for reacting to adverse conditions – for assistance systems on every level of an automated system all the way from sensor level up to strategy planning. The two key issues the project focuses on are:

- Each system component has to be able to monitor continuously its own performance and deliver this information to the other modules. This leads to a continuous overall system performance assessment facility, which will be used to adapt present driver assistance or automated driving capabilities to the envisaged system quality.
- Building on system redundancy and improved sensing performance e.g., with respect to the sensor setup and performance and available external data, embedded redundancy will be used to calculate the best environmental representation under given circumstances and present sensor reliability.

ACHIEVEMENTS

RobustSENSE aims at enhancing the robustness of all sensing methods and algorithms required for advanced driver assistance systems and automated driving. The project will contribute to enhanced road safety with a more reliable, secure and trustable sensing system:

- Reliable in harsh environmental conditions.
- Secure by self-diagnosis, adaptation and robustness.
- Trustable on every level of assistance and automation systems.

Budget 8.6 M€
Duration 36 months
DG Research & Innovation
Coordinator Werner Ritter, Daimler AG
Partners Daimler AG, EICT, AVL, Bosch, CRF, CTAG, Fico Mirrors SA, Fraunhofer, FZI, Modulight, Oplatek, Sick AG, UUlm, VTT
Website www.robustsense.eu
FINAL EVENT: 16-17 MARCH 2016, STUTTGART, GERMANY

The ecoDriver Final Event will be hosted by project partner Daimler at the Mercedes-Benz Museum at Untertürkheim, Stuttgart on 16 and 17 March 2016.

The event will showcase and discuss the project’s achievements. Join us and:

- Learn about the different ecoDriver applications,
- See the results from Europe’s most extensive on-road eco-driving trials,
- Take a ride in our vehicles to see ecoDriver in action on the surrounding road network and
- Engage in discussions with research and industry leaders.

There will also be an opportunity to visit the iconic Mercedes-Benz Museum itself, one of the leading visitor attractions in the Baden-Württemberg region. Experience a unique journey through over 125 years of automotive history.

Participation in the two-day event is free but registration is required.

To find out more and to register, scan the QR code or visit our website: www.ecodriver-project.eu
ecoDriver
Supporting the driver in conserving energy and reducing emissions

MOTIVATION AND OBJECTIVES
The ecoDriver project addresses the human element in promoting “green” driving, as driver behaviour is a critical element in energy efficiency. The focus of the project is on driver interaction with the vehicle and optimised feedback strategies (including HMI – Human-Machine Interface) to ensure user acceptance and compliance. It addresses technical aspects in the vehicle-environment-driver loop across a range of vehicles and powertrains. The target is a sustained 20% reduction in energy use in fitted vehicles.

The main innovative aspects of the project are to:
• Optimise feedback for nomadic devices and built-in systems and compare their effectiveness,
• Tailor feedback to driving style and traffic conditions,
• Minimise any side-effects of eco-driving support in terms of driver distraction and safety,
• Use real-time fuel use calculators to ensure the most accurate feedback.

PROJECT PLAN AND MILESTONES
The five technical Sub-Projects are:
SP1 provided information on driver styles, vehicles, fleets, and system state-of-the-art.
SP2 provided the functions for real-time assessment of energy use and emissions.
SP3 undertook extensive real-world trials in seven countries.
SP4 is developing HMI assessment tools to evaluate the data emerging from SP3, as well as monitoring user feedback and acceptance.
SP5 is predicting future impact and cost-benefit analyses of various systems and scenarios; also identifying barriers to deployment, providing policy-makers with information on incentives and regulations to promote adoption.

Current deliverables from each SP are available on the project’s website. The project ends in March 2016 with a Final Event in Stuttgart.

TECHNICAL APPROACH
Both integrated and nomadic ecoDriver applications have been developed. These applications contain two important parts: the Energy Threshold Interpreter and the Driver Feedback Interface. The Energy Threshold Interpreter determines the best energy efficiency that could be achieved at a given moment, considering both the fixed conditions that cannot be influenced (e.g., road type, traffic density, weather, the vehicle engine and the weight of the vehicle) through the Vehicle Energy & Environment Estimator and the semi-fixed conditions (driving styles) through the Driving Style Estimator.

The difference between the optimal energy consumption and the real energy consumption is fed back to the driver through the HMI.

ACHIEVEMENTS
Powertrain models to accurately estimate CO₂ emissions have been derived and validated. Models of the vehicles taking part in the field trials have been developed and integrated in several eco-driving algorithms (suitable for PCs, smartphones, nomadic devices and for integrated dashboards), which have all been fine-tuned using simulations.

The central prototype developed and built by the project is called the Full ecoDriver System. Three variations of this were then adapted and integrated by CRF and BMW (for cars) and Daimler (in a truck). TomTom developed an aftermarket system aimed at fleet operators (which is now commercially available) and IFSTTAR led the development of a Smartphone-based version.

Field trials in the Netherlands, Sweden, UK, Germany, Italy, Spain and France have been carried out, involving 30 cars, 26 goods vehicles and 10 buses, together with 180 drivers.

Budget 12.7 M€  Funding 10.7 M€
Duration 54 months  Start October 2011
DG Connect  Contract n° 288611
Coordinator Oliver Carsten, University of Leeds  Contact o.m.j.carsten@its.leeds.ac.uk
Partners BMW, Daimler, CRF, TNO, VTI, CTAG, TomTom, IKA, IFSTTAR, ERTICO, Simotion
Website www.ecodriver-project.eu
AFFORDABILITY & COMPETITIVENESS

New sustainable approach for developing and producing affordable and competitive vehicles in Europe.

APPLICATION OF SUITABLE MATERIALS FOR FUTURE VEHICLES

Materials suitable for enhanced affordable and competitive design and manufacturing of functionally-optimised and lightweight vehicles.

VIRTUAL ENGINEERING

PRODUCT PROCESS INTEGRATED APPROACH

Innovative engineering solutions to guarantee and ensure the European automotive competitiveness for future vehicle generations.

SUSTAINABLE AND FLEXIBLE MANUFACTURING

Efficient and effective manufacturing systems capable of producing affordable and competitive vehicles in Europe.
STRATEGIC PILLAR
AFFORDABILITY &
COMPETITIVENESS
MAPPING OF R&I PROJECTS
Affordability & Competitiveness

2010 2012 2014 2016 2018

Materials

ALIVE - Advanced lightweight vehicles
ENLIGHT - Lightweight Design

Virtual Engineering

MATISSE - Modelling of key composites
SafeEV - Simulation
CRYSTAL - Systems engineering

Manufacturing

Know4Car - Manufacturing knowledge
ALIVE
Advanced high volume affordable lightweighting for future electric vehicles

MOTIVATION AND OBJECTIVES

- The ALIVE project concept aims to advance both the lightweight design capabilities of automotive industry as well as their lightweight manufacturing & joining capabilities for high volume affordability, reliability and safety.
- ALIVE advances computer-based as well as experimental validation approaches (and their combinations) to enable fast and reliable design & optimisation loops to be run on component, sub-assembly, assembly and full vehicle-body-in-white level.
- Build up full-scale demonstrators to validate noise, vibration and harshness (NVH) and crash performance.

TECHNICAL APPROACH

Realisation of a highly innovative vehicle-body-in-white incorporating highly advanced materials and their respective manufacturing technologies in a real context. Thus the dialogue between design and materials/manufacturing research will be developed both the virtual (simulation) and the experimental (testing & validation) platform. By running in parallel, both testing and simulation capabilities will advance:

WP1 Vehicle design: Body-in-white design and optimisation, design and optimisation of chassis, Hang-on parts, closures and front seats
WP2 Simulation: Virtual performance assessment and validation of vehicle design options
WP3 Manufacturing technologies: Characterise and adapt selected material classes, develop manufacturing, joining and bonding technologies, realise manufacturing and assembly strategies
WP4 Testing and validation: test strategies, characterisation test coupons, sub-systems, full vehicle testing an validation
WP5 Demonstrator and Assembly
WP6 Life cycle analysis

ACHIEVEMENTS

- Design for electric vehicle concept completed
- Bill of materials and joining techniques defined
- New joining simulation models generated
- Simulated proof of NVH and crash performance
- CA prepared for components
- Build up of body-in-white demonstrators to be started in December 2015
LIGHTWEIGHT CONTROL ARM WITH IMPROVED NVH BEHAVIOUR

Carbon-fibre reinforced plastics (CFRP) control arm (wishbone) with integrated shunted piezo-ceramics to improve the NVH behaviour:

- 50% weight saving compared to a conventional aluminium control arm.
- About 20 dB vibration reduction of the relevant 1st eigenmode of the control arm.
- Manufacturing technologies available for mass production.
ENLIGHT
Enhanced Lightweight Design

MOTIVATION AND OBJECTIVES
Lightweight materials such as carbon-fibre reinforced plastics (CFRPs) have been used up to now mostly in high-performance cars with relatively high cost and low production volumes. However, the need for weight reduction in future Electric Vehicles (EVs), without unduly compromising performance and safety, is even stronger since additional weight translates into either reduced driving range or in larger, heavier and more expensive batteries. Thus, the electric cars of the future require lightweight solutions that not only enable specific design requirements to be respected but are also cost-effective and sustainable throughout their life cycle.

ENLIGHT aims to accelerate the technological development of a portfolio of innovative thermoset, thermoplastic, bio-based and hybrid materials which together offer a strong potential to reduce weight and overall carbon footprint to enable their viable application to medium-high volume EVs in 2020-25.

PROJECT PLAN, MILESTONES AND DELIVERABLES
Seven technical work packages addressing
• Design & simulation
• Material development
• Manufacturing technologies
• Testing & validation
• Life cycle assessment (LCA)

Baseline is the vehicle architecture developed in ALIVE. Five modules selected for validation.

TECHNICAL APPROACH
• Development of highly innovative lightweight/low embedded CO2 materials for their application in medium-volume automotive production (50,000 units/year)
• Design capabilities for affordable medium-volume lightweight EVs
• Manufacturing and joining capabilities for affordable medium-volume lightweight EVs
• Experimental and simulation validation environments to enable rapid & reliable multi-parameter optimisation loops when designing with these new materials
• LCA and economic analysis to ensure the highest probability of application by 2020, taking into account all salient factors

ACHIEVEMENTS
• Each considered module saves 40% weight compared to the SuperLightCar project.
• Implementation of advanced lightweight materials such as hybrids, CFRPs or thermoplastics.
• Cost-effective manufacturing technologies for medium-scale production advanced lightweight materials.
• Qualification of renewables and low-cost fibres for the automotive sector meeting current automotive standards and required manufacturing costs.

Current status:
• Final design for each module ready.
• Materials and manufacturing route selected for each module.
• Material development finished.
• Simulation and testing on-going.
• LCA on-going.

Budget 10.9 M€  Funding 7.1 M€
Duration 48 months  Start October 2012
DG Research & Innovation  Contract n° 314567
Coordinator Thilo Bein, Fraunhofer LBF  Contact thilo.bein@lbf.fraunhofer.de
Partners 21 partners among them Renault, CRF, Jaguar Land Rover, Volvo, Benteler, DSM
Website www.project-enlight.eu / www.seam-cluster.eu
MATISSE

Modelling And Testing for Improved Safety of key composite StructurEs in alternatively powered vehicles

MOTIVATION AND OBJECTIVES

With increasing energy costs and stringent emission targets aiming for 95 g/km CO$_2$ emissions for the year 2020, material efficient lightweight design and alternative propulsion systems play an important role in today’s vehicle research and development activities. Furthermore, the security of occupants is a core demand on passenger vehicles. MATISSE addresses both, electric and compressed natural gas (CNG) storage systems and an extensive use of light fibre reinforced structures.

For the reliable application of fibre reinforced polymers (FRP) in a vehicle structure the accurate prediction of the material behaviour using the finite element method (FEM) is crucial. MATISSE focuses on advancing the modelling, simulation and testing capabilities for FRP structures under dynamic loading (crash impact safety). Crash modelling tools used in the automotive industry currently do not adequately address a number of issues specific to FRP structures under these load conditions.

PROJECT PLAN, MILESTONES AND DELIVERABLES

The main research results are:

- Prognosis of future crash scenarios and hazards for occupants,
- Advanced modelling techniques for composite materials,
- Novel adaptive composite crash structures,
- Enhanced type IV CNG storage tanks,
- Proposal for virtual evaluation methods for composite structures.

MATISSE aims to develop an integrated, validated approach to the modelling, simulation and testing of safety-critical pressurised FRP structures. MATISSE assures that these advances will be applicable to automotive applications like adaptive, expandable FRP structures and FRP CNG tanks.

TECHNICAL APPROACH

MATISSE focuses on advancing the modelling, simulation and testing capabilities for FRP structures under dynamic loading (crash impact safety). Crash modelling tools used in the automotive industry currently do not adequately address a number of issues specific to FRP structures under these load conditions.

ACHIEVEMENTS

WP1: Analyses of future traffic scenarios show that the highest share of accidents is assumed to be taken by frontal collisions. Especially in alternatively powered vehicles (APV) the locations need to be protected where a potential for electrical, chemical or thermal hazards exists.

WP2: For the generation of modelling techniques for fabric reinforced structures, suitable modelling approaches were analysed and finally selected. For the modelling of the materials to be examined the necessary values for the implementation of material cards were generated based on coupon testing and validations took place.

WP3: The development of adaptive (shape changing by pressurisation) fibre reinforced beams by simulations and testing with different geometries and materials was proceeded. Thermoset and thermoplastic materials reinforced with GF or CF were examined. Successful expansion tests of initially folded thermoset beams were carried out. In addition, impact tests with a 60 kg drop weight were successfully executed with the expanded beams.

WP4: The development of a virtual testing procedure of type IV CNG tanks was done. Based on the impact on the CNG tank determined in full vehicle rear crash simulations, different load cases for a component testing were derived. In parallel, the model of the tank was developed from the stage 0 (rough) over the stage 1 and the stage 2 (very detailed composite model) to stage 3 (for full vehicle simulations). Several impact tests on the tank were carried out and build the basis of a future validation for a virtual testing methodology.

WP5: The development of evaluation criteria for the safety of APVs, the assessment of possible cost and weight saving potentials of APVs and the compiling of guidelines for the application of the new modelling tools as well as for safety requirements were done. This tool chain allows designers to predict the safety performance of parts and of the whole vehicle prior to hardware testing.

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<td>Research &amp; Innovation</td>
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<td>Coordinator</td>
<td>Roland Wohlecker, fka</td>
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<td>Partners</td>
<td>11 partners, among them CRF, Daimler, TU Graz, Autoliv, Chalmers, TU Munich</td>
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<td>Website</td>
<td><a href="http://www.project-matisse.eu">www.project-matisse.eu</a></td>
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</table>

Funding 2.2 M€
Start October 2012
Contract n° 314182
Contact info@project-matisse.eu
SafeEV

Safe small Electric Vehicles through advanced simulation methodologies

MOTIVATION AND OBJECTIVES

Small Electric Vehicles (SEVs) show distinctive design differences compared to the traditional car (e.g., no bonnets, vertical windscreens, outstanding wheels). Thus the consequences of impacts of SEVs with vulnerable road users (VRU) and other (heavier) vehicles will be different from traditional collisions. These fundamental changes are not adequately addressed by current vehicle safety evaluation methods and regulations. VRU protection, compatibility with heavier opponents and the introduction of active safety systems have to be appropriately taken into account in order to avoid any SEV over-engineering by applying current regulations and substantially impair the SEVs (environmental) efficiency. Therefore, the project SafeEV aims, based on future accident scenarios, to define advanced test scenarios and evaluation criteria for VRU, occupant safety and compatibility of SEVs. Moreover, industrial applicable methods for virtual testing of these scenarios and criteria will be developed.

PROJECT PLAN, MILESTONES AND DELIVERABLES

The figure below shows the main deliverables of the project.

TECHNICAL APPROACH

New SEV designs are not taking into account current safety standards and regulations (e.g., pedestrian protection). Furthermore active safety systems like emergency brake assistant systems, which significantly will contribute to vehicle safety in the future, especially for compatibility and pedestrian protection issues, are also not considered. SafeEV will substantially support and accelerate the introduction of safer small electric vehicles for urban areas in the next decades by considering of above mentioned gaps. Taking the opportunity of defining advanced evaluation methods in an early stage – compared to the traditional vehicles, where in the past experimental testing and homologation was the main concept – the introduction of virtual testing methods towards virtual certification for small electric vehicles will be promoted.

ACHIEVEMENTS

- Identification of the most relevant future pedestrian and occupant accident scenarios involving SEVs
- Specification of test configurations for vulnerable road users and occupant protection assessment (incl. compatibility) in accidents involving SEVs in urban areas
- Seamless tool chain for the investigation of pedestrian safety and occupant protection solutions towards virtual assessment and finally virtual certification testing
- Definition of advanced principles for optimised pedestrian and occupant protection systems to be applied in SEVs
- Physical prototyping and pre-testing of a dedicated safety solution on component level of a SEV
- Cost-efficient development of SEVs will be made possible by the new virtual testing methodologies developed
- Best practice guideline and implementation of the advanced simulation methodologies concerning pedestrian and occupant safety in SEVs

Budget 3.2 M€ Funding 2.1 M€
Duration 36 months Start October 2012
DG Research & Innovation Contract n° 314265
Coordinator Andreas Teibinger, Vf
Partners Vf, VW, Daimler, CRF, Pininfarina, Chalmers, UNISTRA, IKA, TU Graz, Bosch, Swerea
Website www.project-safeev.eu / www.seam-cluster.eu
THE PUBLIC AEROSPACE USE CASE DEMONSTRATOR

Since end of 2013 a Public Aerospace domain demonstrator is available that shows traceability among life cycle artefacts on a de-icing system using OSLC as basis for tool connections. Over the last months the use case was significantly extended to address additional engineering methods, especially on heterogeneous simulation and trade-off analysis. A new demonstration is now available that shows how to run an integrated simulation using common industry simulators like Modelica, SysML and Simulink using FMI as integration standard. As a next step the focus will be on integrating the OSLC based traceability of lifecycle data (including simulation models) with the FMI based heterogeneous simulation approach. In addition, the work on the challenge of versioning and configuration handling in a heterogeneous tool environment, focusing on ALM-PLM platforms integration has started. This is being validated through a Change Impact Analysis scenario (Contributing project partners: Airbus, Alenia, Polito, IBM and others).
CRYSTAL
Critical Systems Engineering Acceleration

MOTIVATION AND OBJECTIVES

CRYSTAL fosters Europe’s leading edge position in embedded systems engineering, in particular quality and cost effectiveness of safety-critical embedded systems and architecture platforms. Major tool providers and OEMs cooperate to establish and push forward a Reference Technology Platform focused on an Interoperability Specification (IOS) as an open European standard for the development of safety-critical embedded systems. CRYSTAL gathers and connects the main European players regarding embedded systems engineering in the areas of aerospace (onboard and ground systems), automotive (onboard systems and parts of the roadside infrastructure), rail (onboard and interlocking systems), and healthcare (patient and hospital staff safety, new medical procedures and medical apparatus) and thereby establishes a critical mass of European technology providers to achieve both societal impact regarding future safer transport and healthcare as well as technological advances in terms of cross-domain platform-based reusability.

PROJECT PLAN, MILESTONES AND DELIVERABLES

The figure below shows the main deliverables of the project.

<table>
<thead>
<tr>
<th>Kick-off Meeting</th>
<th>MS1 Use Case Specification V1</th>
<th>MS2 1st Platform Phase V2</th>
<th>MS3 Enhanced Platform Phase V3</th>
<th>MS3 Final Evaluation</th>
</tr>
</thead>
</table>

TECHNICAL APPROACH

The strategy for CRYSTAL technical innovation is based on four pillars:
1. Apply engineering methods on industrially relevant use cases and increase the maturity of existing concepts developed in previous projects.
2. Provide technical innovations (“technology bricks”) with high maturity to fill gaps identified in the use cases.
4. Support SME integration into the embedded systems engineering ecosystem. Within and across the industrial domains Aerospace, Automotive, Healthcare and Rail, CRYSTAL will cover the entire software product life cycle and support product line development towards ready-for-use industrial tool chains.

ACHIEVEMENTS

The aims of CRYSTAL are ambitious and the expected results will have significant economical and societal impacts. OEMs will benefit from better supplier collaboration and reduced system design costs due to the improved and smart integration of system specification and design, safety analysis, and system exploration tools. In addition, the CRYSTAL IOS will increase the flexibility for all stakeholders and has the potential to deeply impact the market on a global level. OEMs can easily combine tools from different vendors, and tool vendors will be able to find new market opportunities in an open and extensible environment.

Results by M24:
• Definition of real-world industrial use cases
• Interoperability specification (IOS) V2
• Definition of engineering methods relying on the IOS
• Prototype implementations of IOS adaptors for a significant set of engineering tools
• First version of the platform builder which assists system integrators to compose integrated system engineering environments
• Prototypes of integrated system engineering environments in the 4 domains (aerospace, automotive, health care & rail)

Budget 82 M€ Funding 36 M€
Duration 36 months Start May 2013
DG ARTEMIS Joint Undertaking Contract n° 2012-332830
Coordinator Christian El Salloum, AVL List GmbH Contact christian.elsalloum@avl.com
Partners Volvo, Siemens, Philips, PTC and 64 partners from 10 countries
Website www.crystal-artemis.eu
Know4Car
An Internet-based Collaborative Platform for Managing Manufacturing Knowledge

MOTIVATION AND OBJECTIVES
The Know4Car project addresses the following objectives:
• More efficient knowledge management and collaboration throughout the product life cycle, supporting the capture, the systematic organisation of manufacturing knowledge.
• Advanced, knowledge-enabled User Interfaces (UI) context in the engineering office and the shop floor, with emphasis on faster, easier UI for data entry and feedback.

PROJECT PLAN, MILESTONES AND DELIVERABLES

<table>
<thead>
<tr>
<th>Kick off Meeting</th>
<th>M1 Definition of Requirements in technology and industrial application level</th>
<th>M3 Functional Demonstration and assessment of basic platform features</th>
<th>M5 Assessment of integrated Know4Car platform</th>
<th>M7 Testbed Setup and Preliminary Validation</th>
<th>M9 Know4Car packaging and further exploitation/commercialisation plans</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

TECHNICAL APPROACH
The Know4Car components are developed as an integrated platform comprising the following:
• Engineering collaborative platform,
• Engineering software agents supporting tasks such as line balancing and production information extraction,
• Knowledge identification and reuse service,
• Knowledge enabled, advanced Graphical User Interfaces (GUIs) and mechanisms, utilising technologies such as Augmented Reality.

ACHIEVEMENTS
After the successful integration of the Know4Car components, the Final system validation was realised through the final cases:
• Automotive Assembly
• Extended Engineering Collaboration

The major achievements of the final year of Know4Car:
The final prototype of the Know4Car platform was tested through usability tests, while business process simulation models were used to assess the following defined measurable goals of Know4Car on a larger scale. The Know4Car platform could lead to:
• Reducing product/production process changes by 18%, with significant cost and time savings,
• Reducing the production time design from conceptualisation to realisation by 19%.

Realisation of information extraction agent:
• Automated sharing of engineering information from simulation and process reducing time need for non-adding value tasks for engineers.
• Distinct application that can be used on a stand-alone basis, following a new service-oriented business paradigm.

Budget 9.66 M€  
Duration 51 months  
DG  
Coordinator Thomas Lezama, Volvo  
Proj. Manager Nikos Papakostas, LMS - Uni. Patras  
Partners 11 partners, among them Volvo, CRF, LMS, SAP and EDAG  
Website www.know4car.eu  

Funding 6.15 M€  
Start September 2011  
Contract n° 2011.7.4-284602  
Contact thomas.lezama@volvo.com, papakost@lms.mech.upatras.gr
COMMERCIAL VEHICLES

An integrated approach for reliable, clean, safe and efficient freight transport and passenger mobility, through dedicated vehicle concepts and effective logistics.

CONNECTED COMMERCIAL VEHICLE
Commercial vehicles that are connected to the infrastructure, operators and drivers, supporting an efficient and resilient transport system and effective logistics.

SAFE COMMERCIAL VEHICLE
Commercial vehicles that protect all road users and avoid and mitigate accidents through advanced vehicle technology, cooperative systems and increasing levels of automation.

EFFICIENT COMMERCIAL VEHICLE
Commercial vehicles with optimum efficiency and performance, making use of advanced propulsion and energy systems and dedicated vehicle configurations.
STRATEGIC PILLAR
COMMERCIAL VEHICLES
MAPPING OF R&I PROJECTS
Commercial Vehicles

2010  2012  2014  2016  2018

CV related projects

DELIVER - Electric light vans
SmartFuSION - Urban Freight
CONVENIENT - Heavy Trucks
TRANSFORMERS - Configurable Truck
EBSF2 - EU Bus System of the Future

MAPPING OF CROSS-CUTTING SUPPORT ACTIONS

2010  2012  2014  2016  2018

Support Actions

FOSTER-ROAD - Platform
**DELIVER**

Design of Electric Light Vans for Environment-impact Reduction

**MOTIVATION AND OBJECTIVES**

CO₂ emissions, noise emissions and other negative impacts caused by present urban delivery concepts and specifically by commercial vehicles are unsustainable in present and future European urban life. Fully electric light commercial vehicles (LCV) not only offer zero local CO₂ emissions and close-to-zero noise emissions. The possibility to integrate the electric motor into the wheel further increases the design freedom.

The DELIVER project’s objective was to explore and identify conceptual design options for the next generation of electric delivery vehicles. The project partners, which bundle different competence fields throughout Europe, developed and built an innovative and sustainable vehicle concept that fulfils the demands of tomorrow.

**PROJECT PLAN, MILESTONES AND DELIVERABLES**

The project started in November 2011 and continued for 39 months. The most important milestone was the completion of the demonstrator vehicle.

The complete demonstrator vehicle is also the main deliverable of this project. It served for testing and validation of the concept and has been presented on various national and international conferences e.g., the EUCAR Conference 2014.

**TECHNICAL APPROACH**

DELIVER generated, investigated and analysed innovated design concepts for electric LCVs with in-wheel motors. It delivered an advanced architecture, which enables the same level of safety as known from current conventional vehicles with maximised energy efficiency, optimised ergonomics & loading space at affordable costs as well as good levels of comfort and driving performance.

**ACHIEVEMENTS**

In a joint effort, the DELIVER partners have built-up a demonstrator vehicle, which is showcasing the main derivate of the DELIVER vehicle family and its unique design. The demonstrator is dedicated for urban delivery services and comprises some novel features such as a rotating seat to allow easy access and egress for the driver also on the curb side of the road. Since there is no B-post on the right hand side, a very large opening can be provided for loading.

The fully electric drivetrain comprises a Li-NMC battery system and Michelin Motorized Wheels, offering excellent driving performance and allowing the payload area to be large and flat. Above all, this vehicle is locally emission free and reduces noise emissions significantly – perfect for urban use.

<table>
<thead>
<tr>
<th>Length / Width / Height</th>
<th>4,485 mm / 1,885 mm / 2,000 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelbase</td>
<td>2,750 mm</td>
</tr>
<tr>
<td>Kerb weight (incl. 75 kg driver)</td>
<td>1,500 kg</td>
</tr>
<tr>
<td>Gross vehicle weight</td>
<td>2,200 kg</td>
</tr>
<tr>
<td>Payload mass / volume</td>
<td>700 kg /4 m³</td>
</tr>
<tr>
<td>Drivetrain</td>
<td>2-speed in-wheel motors on rear axle</td>
</tr>
<tr>
<td>Pₘₐₓ / Tₘₐₓ</td>
<td>57 kW / 42 Nm (per wheel)</td>
</tr>
<tr>
<td>Acceleration 0 - 100 km/h</td>
<td>10.3 sec (at kerb weight) / 15.4 sec (at GVW)</td>
</tr>
<tr>
<td>Top speed</td>
<td>100 km/h</td>
</tr>
<tr>
<td>Range (half laden)</td>
<td>120 km</td>
</tr>
</tbody>
</table>

**Funding** 2.8 M€

**Start** November 2011

**Contract n°** 285296

**Contact** info@deliver-project.org

**Budget** 4.3 M€

**Duration** 39 months

**DG** Research & Innovation

**Coordinator** Micha Lesemann, ika

**Partners** ika, CRF, VW, Liberty Electric Cars, Michelin, POLIS, SP, HPLP, CADEM, MOBIT

**Website** www.deliver-project.org
SmartFuSION
Smart Urban Freight Solutions

MOTIVATION AND OBJECTIVES
SmartFuSION, a public-private partnership (PPP), rationalised urban goods distribution services, with a view to reducing pollution and traffic. The main objectives were:
• To enhance the innovation process at urban-interurban interfaces.
• To demonstrate and evaluate the technical and logistical feasibility of introducing electric vehicles and the second generation of hybrid truck technology into existing business supply chains and to apply these vehicle technologies in conjunction with information technology, operational, managerial and regulatory innovations including urban consolidation centres and telematics systems.
• To determine the critical success factors in stimulating the market uptake of new sustainable vehicle technology and other innovations in the urban logistics environment.
• To develop a Smart Urban Designer tool that allows the other city-regions and company supply chains to analyse the likely success and benefits of applying these innovations in their domain.

TECHNICAL APPROACH
In Berlin the trial aimed to increase the market share and use of larger electric trucks, for inner city deliveries. Since large, fully electric trucks are not yet commercially available in Germany, the Berlin tests used a VOLVO hybrid electric truck, switching to full electric mode in predefined locations to improve air quality in the city along a 8km route between the logistics centre and the final customers.

In Como four SmartFuSION test elements (logistics, policy, vehicle and IT technology) were combined in order to increase the use of clean vehicles in the city centre and to transship more goods through the Urban Consolidation Centre ‘Merci in Centro’. This was achieved via a change in access rules for the clean vehicles, allowing a more flexible delivery schedule throughout central Como’s pedestrian zone.

In Newcastle upon Tyne the trial lasted nine months for deliveries to all 80 university buildings, under real business conditions, with a fully electric truck. The pilot used a warehouse management system to consolidate single deliveries to different parts of the campus. These were first delivered to the University Consolidation Centre, from where they were distributed, more efficiently by a single clean vehicle, to the final receiver.

ACHIEVEMENTS
• A better understanding of how successful stakeholder interventions in urban freight can be initiated and run, using logical framework analysis tools
• Trip planning and battery management software, with integrated links between the vehicle CAM bus, the human machine interface (HMI) on a tablet and a centralised routing and planning server
• Comparative demonstration and analysis of conventional (Internal Combustion) and clean (Electric/Hybrid) vehicles deployed on the same routes
• A Smart Urban Freight Designer tool, enabling urban policy makers, users and operators to analyse the likely successes and benefits of applying green vehicle technologies
• A European-wide network of industry stakeholders (Enhanced Transfer Programme), policy makers, academics and industry experts, who will take SmartFuSION discoveries into the wider domain, allowing further exploration

Budget 4.05 M€
Duration 42 months
DG MOVE
Coordinator NewRail - Newcastle University
Partners CRF, Clipper Logistics, PTV, Volvo
Website www.smartfusion.eu
Funding 2.49 M€
Start April 2012
Contract n° 285195
Contact smartfusion@ncl.ac.uk
The final event will be organised in the occasion of:
CONVENIENT
Complete Vehicle Energy-saving Technologies for Heavy-Trucks

MOTIVATION AND OBJECTIVES
Fuel efficiency is a first priority for customers of long-haul trucks, because of its major impact (about 30%) on the Total Operating Costs. The efficiency of heavy-duty vehicles can be improved in a relevant way by operating on both the tractor and the semi-trailer.

The main objective of the CONVENIENT project is the development of a novel long-distance heavy-truck archetype featuring a suite of technologies enabling a 30% fuel saving.

The project includes the development and integration of:
- innovative energy efficient systems and energy harvesting devices,
- advanced active and passive aerodynamics devices,
- energy management at vehicle level,
- driver support to maximise the benefits of the energy-saving systems and strategies.

PROJECT PLAN, MILESTONES AND DELIVERABLES
The figure summarises the project organisation and the main deliverables, i.e. the 3 demo trucks:

TECHNICAL APPROACH
- The CONVENIENT project aims to develop a novel long-distance heavy-truck prototype featuring a suite of technologies enabling a relevant reduction of fuel consumption.
- The plan is to adopt an holistic approach to on-board energy management, focusing on the tractor, the semi-trailer, the driver behaviour and the mission.
- The project includes the development and integration of innovative energy efficient systems and energy harvesting devices, advanced active and passive aerodynamics devices on the truck and on the semi-trailer; energy management system at vehicle level; driver support system to maximise the benefits of energy-saving devices.

ACHIEVEMENTS
SP A1 Demo truck 1 (IVECO)
- Electric Hybrid transmission coupled to a dual energy storage system
- Electrically assisted steering, brake, and climate control
- Electrically powered coolant pump

SP A2 Demo truck 2 (VOLVO)
- Predictive integrated Energy Buffer Control to minimise fuel consumption using road topology
- Driver coaching refining the communication between the driver and the cruise controller
- Controllable Electrified Auxiliaries as fans, radiator shutter, water pump, power steering servo

SP A3 Demo truck 3 (DAF)
- Hybrid Powertrain Technology for a downsized engine
- Programmable smart Electrified Auxiliaries for steering and air supply to reduce parasitic losses
- Driveline friction reduction in the rear axle by applying a differential with variable oil level and novel bearings in the wheel hubs
- Active vehicle aerodynamics on the tractor in combination with optimised aerodynamic hardware for the semi-trailer

Budget 16.6 M€  Funding 10 M€
Duration 36 months  Start November 2012
DG Research & Innovation (EGCI)  Contract n° 312314
Coordinator Roberto Bracco, CRF  Contact roberto.bracco@crf.it
Partners 21 partners, among them IVECO, VOLVO, DAF, ZF, Continental, Magna ECS
Website www.convenient-project.eu
TRANSFORMERS
Configurable and Adaptable Trucks and Trailers for Optimal Transport Efficiency

MOTIVATION AND OBJECTIVES
TRANSFORMERS combines a modular approach for mission rightsizing by means of distributed hybridisation, truck engine rightsizing, and a semi-trailer design that addresses both, aerodynamics and load efficiency improvements. By combining reduced energy consumption with increased loading efficiency, the goal is to reduce overall energy consumption by 25% on a tonne.km basis in a real world application within the existing European regulatory framework.

PROJECT PLAN, MILESTONES AND DELIVERABLES

The figure below summarises key milestones and major deliveries from the project:

![Milestones and Deliverables Diagram]

TECHNICAL APPROACH
TRANSFORMERS will hybridise a mission adaptable truck-trailer combination by integrating distributed power, energy storage and intelligent energy controls in the trailer, known as “Hybrid-on-Demand”. A modular approach to hybridisation will be demonstrated, allowing future mission rightsizing options. The results will include: a pre-standardisation proposal for the truck-trailer interface to facilitate future market penetration, vehicle dynamics, an aerodynamically optimised hybrid-on-demand semi-trailer demonstrator, a loading optimised semi-trailer, extensive simulations of future combinations, the effects on highway infrastructure and economic viability.

ACHIEVEMENTS

WP1 Use Cases and End-user Requirements
European road freight transport market/fleet analysis, key performance indicators (KPIs) defined and verified with a broad end user group, possible test case scenarios defined for WP6.

WP2 Holistic Simulation
Vehicle model architecture with sub-system interfaces defined, and sub-system models available for holistic simulation.

WP3 Electric Hybrid-on-Demand (HoD) Framework
First proposal for a HoD pre-standard framework, drivetrain design and safety study for the demonstrator.

WP4 Mission Adaptable Truck-Trailer Architecture
Aerodynamic study, also designs and components identified for the HoD trailer with aerodynamic features, and for the load optimised semi-trailer.

WP5 Infrastructure Aspects and Compliance incl. Regulatory Framework
Identification of the critical infrastructure to assess, selection of the assessment methods.

WP7 Dissemination and Exploitation
Website, flyer, newsletters, end-user group and advisory board meetings, and conference papers.

TRANSFORMERS KPIs

![KPIs Diagram]

Budget 7.9 M€
Duration 42 months
DG Research & Innovation
Coordinator Paul Adams, Volvo
Partners Volvo, Fraunhofer, Schmitz Cargobull, TNO, Virtual Vehicle, Van Eck, Bosch, IFSTTAR, FEHRL, P&G, IRU, Uniresearch, DAF
Website www.transformers-project.eu
EBSF_2 GUIDELINES AND TOOLS

EBSF_2 will deliver guidelines and tools to facilitate the introduction of the innovations beyond the project demonstration sites and that are adoptable by all stakeholders, namely:

- Guidelines for including energy efficiency in procurement material
- Guidelines for ergonomic design of driver assistance systems interface
- Guidelines for the use of adaptable buses
- The electric Bus Passengers Simulation Tool
- Design and decision-making methodologies for public transport infrastructure design
- The Design Charter for new electric buses
EBSF_2
European Bus Systems of the Future 2

MOTIVATION AND OBJECTIVES

- Test and evaluate innovative solutions for urban and suburban bus systems through demonstrations in real service.
- Improve the efficiency of bus operations mainly in terms of costs and energy consumption as well as the attractiveness to the users.
- Demonstrate in real services in 12 cities and validate technological solutions addressing six key areas for innovation.

PROJECT PLAN, MILESTONES AND DELIVERABLES

To achieve its objectives, EBSF_2 is based on a consolidated methodological approach characterised by three main phases, namely:

- Setting the scenarios and performance targets.
- Test innovations in real operation.
- Evaluation and validation of the results.

TECHNICAL APPROACH

Each site tests a subset of innovations, identified according to their technological maturity to ensure an easy commercialisation after the end of the project. Prototype and simulation tools will be used as well for more futuristic solution.

All together the demonstration sites deal with most current propulsion technologies (from internal combustion to hybrid and fully electric) and a wide range of bus systems, from BRT to local lines.

Also, a system approach is applied that considers the vehicle as one of the elements integrated in the whole bus system together with infrastructural requirements and mobility concepts.

ACHIEVEMENTS

By involving more than 500 vehicles with the related interfaces towards garage and urban infrastructure, EBSF_2 will greatly contribute to:

- Improve energy and thermal management of buses.
- Concepts and technologies for green driving assistance systems.
- Feasibility of innovative Human-Machine Interfaces solutions.
- New bus layout concepts for optimised interface between vehicle and platform.
- Fully interoperable IT solutions based on European standards.
- Modular bus that adapts the vehicle capacity to actual demand.
- Intelligent garage as well as processes for predictive maintenance.
- New interface between vehicle and urban infrastructure.
FOSTER-ROAD
The Support Action for the European Technology Platform for Road Transport Research

MOTIVATION AND OBJECTIVES

• FOSTER-Road supports ERTRAC, the European Road Transport Research Advisory Council, to strengthen the research and innovation strategies of road transport industries and policies in Europe.
• It brings together experts from all relevant stakeholder groups to monitor projects, develop roadmaps, and support their implementation.

PROJECT PLAN, MILESTONES AND DELIVERABLES

Strategic road transport research priorities
Creating research agendas, roadmaps and implementation plans for current and future challenges

Dissemination and use of results
Improved communication and input to relevant transport programmes

Monitoring of projects and fostering innovation
Defining a methodology to follow European and national road transport RTD projects

ACHIEVEMENTS

ERTRAC strives to identify the paths towards a 50% more efficient road transport system until 2050. It strengthens the European Research Area for transport research and contributes to the global technological leadership of the European automotive industry.

RTD roadmaps published since 2013:
• Land Use and Transport Interactions
• Transport Infrastructure Innovation
• Energy Carriers for Powertrains
• Urban Freight Research
• Automated Driving

Budget 1.97 M€
Duration 46 months
DG Research & Innovation
Coordinator Alexander Holleis, AVL List GmbH
Partners AIC, AUTH, AVL, CRF, Concawe, Continental, ERTICO-ITS, FEHRL, POLIS, Renault, Ricardo, Robert Bosch, Scania, UITP, Valeo, Volkswagen, Volvo
Website www.ertrac.org

Funding EUR 1.97 M€
Start March 2013
Contract n° SC53-GA-2013-605339
Contact alexander.holleis@avl.com