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Sustainable Surface Transport

Research Technological Development and Integration




2002 - 2006 Projects Synopses

PROJECT SYNOPSES

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HOW TO USE THIS BOOK

This book contains synopses of surface transport research projects co-financed under the Sixth Research Framework Programme (FP6) of the European Commission.

The synopses are intended to provide a brief overview of project objectives, technological approaches and expected achievements. Some administrative features and partnership details are also given, allowing for a more comprehensive description of the projects. The names and addresses of the project co-ordinators are provided, should any further information be required.

Also included in the book are lists of National Contact Points and contact details of the Commission staff involved in surface transport research. A list of abbreviations is intended to assist the reader in understanding the notation used in throughout the book, especially country names, institutions and widely used technical terms.

In addition, two indexes allow the identification of projects by contract number and by project acronym. Finally, an alphabetical index of all project participants gives the page number of every project in which the participant is involved.

European Surface Transport Research under the Sixth Framework Programme

Efficient transport is a fundamental condition for sustainable wealth and prosperity in Europe. Transport drives employment, economic growth and global exports. It provides European citizens, societies and economies with essential resources and means of mobility, while technological advances in transport stimulate and accelerate knowledge acquisition, innovation and European integration. All of this makes transport a cornerstone of the European Union's Lisbon strategy for achieving the greatest knowledge-based economy in the world.

But the increasing demand for mobility is also a major challenge. Rising levels of traffic bring increased safety and health concerns. The environment suffers from transport activities, with CO2 emissions now having a real impact on climate change. Meeting transport challenges will require radical solutions, highlighting the essential role of research.

Transport – a critical industry

Surface transport encompasses road, rail, and waterborne transport modes, each of which plays an important part in people's daily lives. Efficient surface transport is a central economic factor, supporting competitiveness and employment:

- The road transport industry provides jobs for more than 14 million people and contributes 11% of European GDP.
- Maritime transport accounts for 90% of EU external trade and over 40% of its internal trade. European shipbuilders have an annual turnover of €20 billion and employ some 350 000 people. European shipping controls more than 40% of the world fleet with a direct employment of more than 1.5 million people and a turnover of more than 160 billion €.
- Europe produces 60% of the world's railway rolling stock, employing 250 000 people and creating an annual turnover of €20 billion. Rail operators employ 1 million people and account for €75 billion in turnover per year.

Tough challenges ahead

Current EU research and development in surface transport is aimed at four strategic objectives:

- Reducing the **environmental impact** of transport, including harmful emissions and noise.
- Improving the **safety and security** of transport operations and services.
- Increasing the **mobility** of people and goods while achieving better balance among the three transport modes.
- Improving the **competitiveness** of the European surface transport industries, including manufacturers and operators.

Ongoing commitment to the ERA

The Underlying concepts of the European Research Area (ERA) are co-operation, sharing and exchange. There are still barriers to overcome in order to create an open space for research in Europe. Such barriers include, for example, linguistic, administrative and cultural differences.

The ERA initiative combines three complementary goals:

- The creation of an 'internal market' in research, an area of free movement of researchers, technology and knowledge, with the aim of increasing co-operation, stimulating competition and achieving a better allocation of resources;
- A restructuring of the European research fabric, in particular by improved coordination of national research activities and policies, which account for most of the research carried out and financed in Europe;
- The development of a comprehensive European research policy, addressing not only the funding of research activities, but also taking into account all relevant aspects of other EU and national policies.

The pooling of dispersed resources and expertise will allow the undertaking of more important and potentially more beneficial research programmes. Improved information exchange and coordination will help to eliminate redundancy, increasing efficiency and confidence. Ultimately, the ERA will provide increased coherence and greater force for European research.

Research instruments

The Sixth Framework Programme (FP6) for Research, Technological Development and Demonstration Activities (2002-2006) made available a number of instruments for implementing research on selected priority themes, including Sustainable Surface Transport.

The new FP6 instruments

In addition to traditional research instruments available under previous Framework Programmes, two new instruments were added:

- Integrated Projects (IPs) – designed to achieve ambitious and clearly defined scientific and technological objectives by building a critical mass of activities and resources. Each Integrated Project should be aimed at obtaining specific results relevant either to increasing European competitiveness or addressing major societal needs.
- Networks of Excellence (NoEs) – bringing together resources and expertise around a joint programme of activities. The Network of Excellence is an instrument for promoting excellence by tackling the fragmentation of European research, where the main deliverable should be a durable structuring and shaping of the way that research is carried out on the topic being covered by the network.

These new instruments are characterised by their capacity to integrate and mobilise European surface transport shareholders, helping to structure and integrate the fabric of European research.

The traditional instruments

- Specific Targeted Research projects (STREPs) – an advanced form of the shared-cost RTD and demonstration projects used in previous Framework Programmes.
- Coordination Actions (CAs) – intended to promote and support the networking and coordination of research and innovation activities.
- Specific Support Actions (SSAs) – to support the implementation of the Framework Programme and to help with preparations for future Community research policy activities.

Sustainable Surface Transport Research under FP6

Scope

Sustainable Surface Transport priorities are aimed at solving problems linked to transport activities, from an all-encompassing and global perspective. Research efforts focus on the development of new products and systems that are safer and more environmentally friendly, but also address the key problem of clean and cost-efficient industrial processes, for the production, inspection, maintenance and recycling of vehicles, vessels and transport infrastructure. All of this is in support of the political orientations developed in the 2001 Transport White Paper.

Research priorities also encompass the development of systems and technologies for more efficient interfacing between transport modes and the development of new approaches to improve rail interoperability. Finally, the integration of information and communications technologies (ICTs) is of importance in the optimisation of safety and infrastructure capacity.

Main research areas

Sustainable surface transport research in the Sixth Framework Programme addresses four broad objectives. Within each objective, two categories are defined: 'research to support European transport policy' and 'research, technological development and integration'. Research initiatives under the first category were implemented by the EU's Transport and Energy Directorate-General (DG TREN) whereas those in the second were implemented by the Research Directorate-General (DG RTD). In the list below, the DG in charge of is indicated in brackets. This book only contains projects implemented by DG RTD.

OBJECTIVE 1: New technologies and concepts for all surface transport modes

Research domains:

- 1.1: Testing implementation and transition strategies for clean urban transport – CIVITAS II (DG TREN)
- 1.2: High-quality public transport (DG TREN)
- 1.3: Advancing knowledge on innovative measures in urban transport (DG TREN)
- 1.4: Technologies for propulsion increasingly based on alternative and renewable fuels in vehicles and vessels, in particular the optimisation of engines, the development of new components and auxiliary systems, the combination of various types of motorizations and fuels for optimal propulsion efficiency and cleanliness. (DG RTD)
- 1.5: Integrating zero or near-zero emission propulsion systems and components such as fuel cells that offer high-energy efficiency benefits. (DG RTD)
- 1.6: Development of holistic noise abatement solutions which consider the entire vehicle/vessel and infrastructure system, new technologies and systems approaches for improved noise control at source and the further support to legislation. Particular attention given to urban areas. (DG RTD)
- 1.7: Integration and validation of measurement and sensing technologies to ensure the optimised environmental operation of both vehicles/vessels and infrastructure. (DG RTD)
- 1.8: Technologies and related legislation for the effective, safe and clean supply and delivery of alternative and renewable fuels at fuel distribution points. (DG RTD)
- 1.9: Development of concepts for innovative, non-polluting means of transport to achieve a more effective organisation of urban transport of persons and goods that would, as a consequence, result in a more rational use of motorised traffic. (DG RTD)
- 1.10: Research to develop, compare and assess possible scenarios for the transport system and energy supply of the future, taking into account ongoing research outside the Research Framework Programme undertaken by or in co-operation with the Commission. (DG RTD)

OBJECTIVE 2: Advanced design and production techniques

Research domains:

- 2.1: Integration and standardisation of enhanced product development tools for design, simulation, prototyping, testing and risk management that would reduce product development time and all associated costs and resources. (DG RTD)
- 2.2: Application of advanced design and manufacturing techniques used in vehicle production and infrastructure aiming at developing clean, silent, safe and comfortable products and services with reduced operational cost and energy consumption. (DG RTD)
- 2.3: Development of advanced, low-mass material structures and systems for vehicles and vessels offering product structural and functional integrity for rated performance at low cost. (DG RTD)
- 2.4: Integration of manufacturing processes for products characterised by a high degree of complexity with emphasis on quality, cleanliness, flexibility and cost effectiveness. (DG RTD)
- 2.5: Development of strategies and processes for clean maintenance, dismantling and recycling of vehicles and vessels. Emphasis on clean, cost and energy effective processes, autonomous systems for maintenance and inspection, innovative dismantling and recycling operations. (DG RTD)
- 2.6: Design and manufacture of new construction concepts for road, rail, waterborne and inter-modal infrastructures that are high quality, cost effective, energy efficient, low noise, safer, risk mitigating and low maintenance. (DG RTD)
- 2.7: Design and manufacturing technologies to improve vehicle/vessel interfaces with transport infrastructure and other vehicles/vessels from the same and different transport modes including infrastructure vehicle inspection aspects. (DG RTD)

OBJECTIVE 3: Re-balancing and integrating different transport modes

Research domains:

3.1 Implementation of change in the European railway system (DG TREN)

3.2 New concepts for trans-European rail freight services (DG TREN)

3.3 Freight transport corridors (DG TREN)

3.4 Intermodal freight transport systems, technologies and strategies (DG TREN)

3.5 Intermodal freight transport management system (DG TREN)

3.6 Improved intermodal loading units (ILU) (DG TREN)

3.7 Services and information for intermodal passengers (DG TREN)

3.8 Logistics best practice (DG TREN)

3.9 City logistics (DG TREN)

3.10 Maritime navigation and information services (DG TREN)

3.11 Safe, environmentally-friendly and efficient shipping operations (DG TREN)

3.12 Human resources development (DG TREN)

3.13 Maritime transport co-ordination platform (DG TREN)

3.14 Development of vehicle and vessel concepts for both passengers and freight, characterised by interoperability and inter-connectivity, for cross-operation between different transport routes and networks supported by advanced mechatronics, on-board electronics, information and communication systems. (DG RTD)

3.15 Development of new inter-modal vehicle/vessel concepts to attain optimal performance in terms of fuel economy, environmental impact (including noise), manoeuvrability (including obstacle avoidance), stability and maximum carrying volume. (DG RTD)

3.16 Development of equipment, methods and systems for optimal accommodation, fast loading and unloading of intermodal transport units and definition of optimal use of storage space both in vehicles/vessels and terminals and efficient final distribution of goods. (DG RTD)

3.17 Technologies to ensure effective, clean and safe operations of vehicles/vessels in terminals and minimisation of turn-round time combining manoeuvring assistance, terminal auxiliary services, waste management (including ballast water in ports) and integration of telematics support for improved communication with terminals control and management systems. (DG RTD)

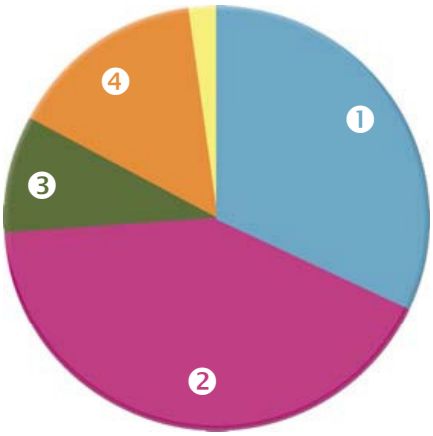
OBJECTIVE 4: Increasing road, rail and waterborne safety and avoiding traffic

Research domains:

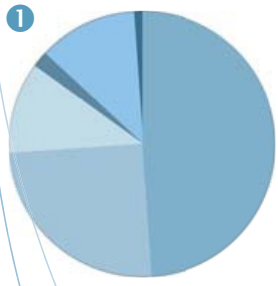
- 4.1: Accident analysis and injury analysis (DG TREN)
- 4.2: Driver safety training (DG TREN)
- 4.3: Road infrastructure safety (DG TREN)
- 4.4: Enforcement of traffic rules and drivers' aptitude to drive (DG TREN)
- 4.5: Awareness campaigns and acceptability of measures (DG TREN)
- 4.6: European service for electronic fee collection on roads (DG TREN)
- 4.7: Multimodal real-time information for people on the move (DG TREN)
- 4.8: Costs of transport infrastructure use (DG TREN)
- 4.9: Optimal investments and charging (DG TREN)
- 4.10: Pricing demonstrations (DG TREN)
- 4.11: Integrating technologies for driving, piloting and manoeuvring assistance to improve safety and maximise the effective capacity of infrastructure, including the secure transportation of hazardous goods. (DG RTD)

- 4.12: Developing technologies to sense and predict natural and infrastructure conditions affecting safety and efficiency of transport operations. (DG RTD)
- 4.13: Developing integrated safety systems which are reliable and fault tolerant (preventive, active and passive), taking into account human-machine interface concepts focusing on system implementation. (DG RTD)
- 4.14: Designing user-friendly driver interfaces based on human-centred design philosophies, taking into consideration bio-mechanical ergonomics, injury reduction measures, environment perception and effective lay-out of signalling and piloting information for improved safety. (DG RTD)
- 4.15: Developing computer-based training systems for drivers, that are cost effective, with monitoring capability of fitness to navigate and muster, including crisis management conditions. (DG RTD)
- 4.16: Development of technologies for intelligent management and guidance systems, as part of a large-scale integration and validation platform, across modes, for the realisation of the intelligent transport vehicle and infrastructure of the future that will regulate vehicle speed and separation with high accuracy and reliability. (DG RTD)

EU financing of Surface Transport Research by objective

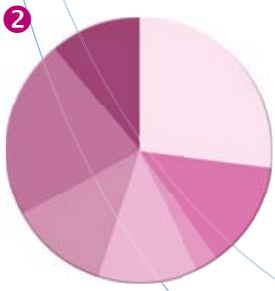


- New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)..... 32%
- Advanced Design and Production Techniques..... 42%
- Re-balancing and Integrating Different Transport Modes 9%
- Increasing Road, Rail and Waterborne Safety and Avoiding Traffic Congestion 15%
- Horizontal Activities 2%



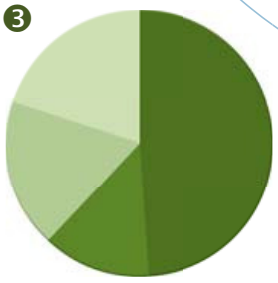
New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)

- Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)....48%
- Development of zero or near-zero emission propulsion (Hydrogen, fuel cells, electric vehicles)....25%
- Development of holistic noise abatement solutions....11%
- Integration and validation of measurement and sensing technologies....2%
- More effective organisation of urban transport....12%
- Scenarios for the transport system and energy supply of the future....1%



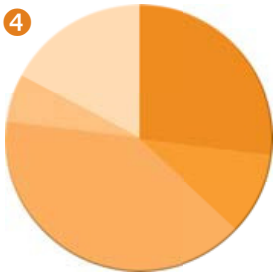
Advanced Design and Production Techniques

- Integration and standardisation of enhanced product development tools (Developing new advanced design tools)....27%
- Application of advanced design and manufacturing techniques (Using advanced design tools, new products and systems generation) 13%
- Development of advanced, low-mass material structures and systems....3%
- Integration of clean and economic manufacturing techniques....12%
- Strategies and processes for clean maintenance, dismantling and recycling of vehicles and vessels (Including post-Prestige package)....12%
- Design and manufacture of new construction concepts for road, rail and inter-modal infrastructures....22%
- Design and manufacturing technologies to improve vehicle/vessel interfaces..11%



Re-balancing and Integrating Different Transport Modes

- Development of vehicle and vessel concepts, characterised by interoperability and inter-connectivity....50%
- Development of new inter-modal vehicle/vessel concepts....13%
- Development of logistics systems and concepts (Loading/unloading, containers, space optimisation in terminals) 18%
- Technologies to ensure effective, clean and safe operations of vehicles/vessels in terminals....20%



Increasing Road, Rail and Waterborne Safety and Avoiding Traffic Congestion

- Integrating assistance and decision support tools to facilitate driving, piloting and manoeuvring 27%
- Developing technologies to acquire and predict information on infrastructure conditions and parameters....10%
- Developing integrated safety systems (preventive, active and passive) 40%
- Developing computer-based training systems....6%
- Development of a platform for the intelligent transport vehicle and infrastructure of the future 17%

List of Abbreviations

Countries

AT	Austria
AU	Australia
BE	Belgium
BG	Bulgaria
BR	Brazil
CA	Canada
CH	Switzerland
CL	Chile
CN	China
CS	Serbia And Montenegro
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
GA	Gabon
GR	Greece
HR	Croatia
HU	Hungary
IE	Ireland
IL	Israel
IN	India
IT	Italy
JP	Japan
LT	Lithuania
LU	Luxembourg
LV	Latvia
MK	The former Yugoslav Republic of Macedonia
NL	Netherlands
NO	Norway
PH	Philippines
PL	Poland
PT	Portugal
RO	Romania
RU	Russian Federation
SE	Sweden
SI	Slovenia
SK	Slovakia
TH	Thailand
TR	Turkey
UA	Ukraine
UK	United Kingdom
WW	Internationnal
ZA	South Africa

Instruments:

CA	Coordination Action
IP	Integrated Project
NoE	Network of Excellence
STP	Specific Targeted Research Project

Scenarios for the transport system and energy supply of the future

Advanced Design and Production Techniques 141

Integration and standardisation of enhanced product development tools (Developing new advanced design tools)

Development of advanced, low-mass material structures and systems

Integration of clean and economic manufacturing techniques

Strategies and processes for clean maintenance, dismantling and recycling of vehicles and vessels (Including post-Prestige package)

New Technologies and Concepts for all Surface Transport Modes

(Road, Rail and Waterborne)




B-COOL

Low-cost and High-ffficiency CO_2 Mobile Air Conditioning System for Lower Segment Cars

The project aims at developing a new high-efficiency, low-cost air-conditioning system using CO_2 as a refrigerant for small cars (A and B segments). Methods to assess performance, annual fuel consumption and environmental impact will be identified, constituting a preliminary step for new EU standards.

Background

In the Sixth Framework Programme, a specific call was published on "…highly efficient air conditioning systems with near zero greenhouse gas emissions and elimination of hydrofluorocarbon (HFC) …"

This project addresses that call and its main objective focuses on the development of a new low-cost, high-efficiency mobile air conditioning system based on R744 (CO_2) working fluid. This is because the application of these systems to the lower segment cars represents a real bottleneck due to the cost and energy consumption constraints. In fact, the state-of-the-art R744 systems are too expensive and sophisticated for the A, B and low priced C-car segments and light commercial vehicles.

For this reason, the system developed in the framework of the B-COOL project will be cost and energy effective so as to allow an easier and more rapid HFC replacement in the automotive sector.

The B-COOL project contributes to the objectives of the Kyoto protocol by:

- the reduction of CO_2 emissions resulting from high efficiency, in comparison to a non-optimised R744 system or the present R134a system
- the elimination of CFC/HCFC/HFC refrigerants (100% reduction
- the availability of a low-cost system to allow its diffusion on small and medium-sized cars (70% of the EU market).

Objectives

The major objective of the project is the development of an innovative low-cost and high-efficiency mobile air conditioning system based on the CO_2 (i.e. R744) vapour compressor cycle for low-cost vehicles, integrating the efforts made recently and addressed to higher class vehicles.

This target will be achieved with a systemic approach that starts with the identification of the most suitable system architecture and proceeds with the development of new components and their optimisation, their integration on the system and on the vehicle.

The development will be supported by the technological feasibility analysis that will lead to the realisation of results suitable for rapid exploitation.

Besides this main objective, methods to assess performance, annual fuel consumption and environmental impact will be identified and validated to constitute a preliminary step for new EU standards.

The B-COOL system (low-cost and high-efficiency R744 MAC) will support the EU efforts to reduce resistance to the HFC ban and allow a rapid diffusion of the new system with the related environmental benefits, thus making EU industries more competitive.

Description of work

The work programme is organised following the logical steps required to develop an automotive air-conditioning system. Firstly, the reference vehicle and major system requirements are identified: target performance, cost estimation and technological aspects.

Then common and agreed assessment methods and procedures will be identified, gathering all the partners' competencies so as to make the system's real characteristics evident and to be able to estimate the system's true environmental impact and perceived performance.

The development of the system architecture and components represents the crucial phase of the project. Using advanced system modelling, the most suitable system architecture and component requirements will be defined, taking into account the constraint of the two reference vehicles. Innovative components matching the requirements will then be designed and realised, and the systems assembled and characterised. The compressors will be derived from the ongoing development of the responsible tier one suppliers, as new developments are not compatible with the timing and budget of the project.

Then the systems will be integrated in the demonstrators, tuned and tested following the procedure identified in the project.

The new systems will be compared with the reference systems and with other competitor technologies in terms of environmental impact and cost.

Results

Two demonstration vehicles will be realised, one based on a Fiat Panda with an automatic climate control and one based on a Ford Ka with a manual air conditioning system.

Both vehicles will be equipped with a specific version of the B-COOL system.

The developed systems will have a target cost of about €30 more than the baseline, will be 10% more efficient and will be equivalent to the references for all the other features.

The following experimental and assessment procedures will be also identified in the framework of the project:

- assess the system efficiency on a bench
- assess the additional fuel consumption, the associated comfort level and the specification of the testing facility
- an algorithm to estimate the mean annual fuel consumption due to air conditioning depending on the geographical area
- estimate the environmental impact (production, usage and maintenance including direct and indirect effects, dismantling).
- These procedures will be applied to the demonstrator vehicles and to the reference vehicles so as to create an initial database. They will contribute to the definition of the European Standard to assess the MAC system performance and environmental impact.

Keywords: Air conditioning, refrigeration, environmental impact, greenhouse effect, greenhouse emissions, car, vehicle, carbon dioxide

:RF – Fiat Auto: Fiat Panda 1.2 l
asoline with automatic air
onditioning system

FORD: Ford KA 1.3 l gasoline
with manual air conditioning
system

The B-COOL Project Demonstrators

B-Class Vehicle	Technical Advances		
		R134a	B-COOL
	Comfort rate (1-10 scale)	7.5	
	Fuel over consumption (l/100km) @ 28 °C - 50% R.H. NEDC cycle	18%	14%
	Cost - 500 kPcs/year (Euro)	185	215
	Weight (kg)	10.5	11.5
	Reliability - failure freq. 12 months		Equivalent to present R134a systems
	Re - Charge period (minimum)	2 year	2 year
	Safety	100%	100%

Acronym:	B-COOL	
Name of proposal:	Low-cost and High-ffficiency CO_2 Mobile Air Conditioning System for Lower Segment Cars	
Contract number:	TST4-CT-2005-012394	
Instrument:	STP	
Total cost:	4 649 220 €	
EU contribution:	2 548 510 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.03.2005	
Ending date:	31.08.2008	
Duration:	42 months	
Sector:	Road	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)	
Website:	http://www.b-cool.info	
Coordinator:	Dr Malvicino Carloandrea Centro Ricerche Fiat Strada Torino 50 IT 10043 Orbassano	
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Tel:	+39 0119083260	
Fax:	+39 0119083898	
Partners:	Delphi Automotive Sistems Luxemburg SA	LU
	Valeo Climatisation	FR
	Maflow S.p.A.	IT
	Hydro Alunova a.s (Hydro Aluminium Precision Tubing Tonder a.s)	DK
	Association pour la Recherche et le Développement des Méthodes et Processus Industriels	FR
	SINTEF Energy Research	NO
	Technische Universität Carolo Wilhelmina zu Braunschweig	DE
	Ford-Werke AG	DE




CLEANENGINE

Advanced technologies for highly efficient Clean Engines working with alternative fuels and lubes

CLEANENGINE is focused on developing modern clean internal combustion engines based on liquid biofuels coming from biomass (biodiesel and bioethanol) and environmentally friendly and ash-free lubes and/or lubrication concepts. The objective is to increase efficiency and minimise harmful emissions.

Background

In recent years, the main incentives towards biofuel technology were provided by the need to reduce the western world's dependence on fossil fuels, the demand of the agricultural sector to be opened towards new products and markets, and the environmental need to face the increasing greenhouse effect. For these reasons biofuels represent an attractive alternative to conventional oil-derived energy sources as they can fuel the well-proven IC engines. Their extensive introduction on the market will be principally driven by the results of further studies on their technical performances, and by their cost competitiveness, sustainability and related legislation, regulation and standards.

This project mainly addresses two of these issues: the planned research activities will evaluate and optimise the effect of the combined usage of biofuels and biolubes in current IC engine performances, in terms of efficiency and emissions, and the environmental impact of renewable fuel and lube production and usage phases by the so-called 'well-to-wheel' analysis.

Objectives

The main objective of CLEANENGINE is the optimisation of modern clean IC engines working with liquid biofuels coming from biomass and environmentally friendly and ash-free lubes.

Diesel and gasoline engine configurations will be evaluated and compatible solutions in terms of materials (base materials and anti-corrosion, low-friction coatings), engine part geometry and after-treatment systems will be developed in order to:

- increase engine efficiency (by reducing internal friction and improving combustion
- reduce CO_2 emissions at the source (taking into account the complete lifecycle of the biofuels)
- reduce NO_x, CO and PM emissions when using mixtures of oxygenated biofuels as bioethanol
- improve the technological and industrial practice related to the use of alternative fuels in combination with environmentally friendly lubricants
- increase the utilisation share of biofuels.

Description of work

To achieve the targets mentioned above, the following research areas will be covered:

- Development of raw materials and additives
- Evaluation and selection of the best alternative fuel mixtures and additive packages
- Development of suitable low emission lubricants and lubrication systems
- Evaluation of the engine materials' compatibility with biofuels and lubes and the development of new tailored coatings

- Simulation of injection and combustion phases, and optimisation of injection strategies and engine part geometry
- Development of specific aftertreatment systems and optimisation of the catalytic converter and filter configurations
- Lifecycle analysis of biofuels and alternative lubes in all phases from production to usage.

All these activities will be addressed and supported by the continuous feedback given by an extensive engine-testing programme that, in parallel, will evaluate and assess the proposed engine modifications.

Results

The project will deliver optimised car, leisure boat and ship engines capable of running on high biofuel content blends and lubricated by optimized biolubricants, while achieving high efficiencies and very low emissions through specific aftertreatment systems.

CLEANENGINE fulfils an industrial and societal need while facing an environmental problem linked to a currently used mass product, the internal combustion engine. Its outcome will have a large impact and benefit on the quality and lifetime of the engine, the level of pollution and, finally, on increasing the employment deriving from the usage of alternative fuels and oils.

Acronym:	CLEANENGINE	
Name of proposal:	Advanced technologies for highly efficient Clean Engines working with alternative fuels and lubes	
Contract number:	TST5-CT-2006-031241	
Instrument:	STP	
Total cost:	3 646 137 €	
EU contribution:	1 999 793 €	
Call:	FP6-2005-Transport 4	
Starting date:	01.01.2007	
Duration:	36 months	
Sector:	Road	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)	
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ECO-ENGINES

Energy COnversion in Engines

ECO-ENGINES aims to set up a virtual research centre (VRC) on advanced engine combustion modes for road transport, giving special emphasis to the use of alternative and renewable fuels, and establishing it as a world reference in the domain.

Background

Research on energy conversion in engines in the last decade in Europe, Japan and the USA has shown the great potential of advanced combustion modes like CAI, HCCI or CCS in terms of efficiency gain and reduction of pollutant emissions.

They allow for a dramatic reduction in the emissions of NO_x from combustion engines, to often less than 1% of those from engines running in standard modes. The complex deNO_x after-treatment systems typical of today's cars could therefore largely be simplified, while at the same time complying with the most stringent emission standards.

To a lesser extent this also holds for the soot particle emissions from diesel engines running HCCI modes, which can be reduced by some 20-30% as compared with standard engines.

The definitive advantage is that these emission reductions are achieved while maintaining or even further increasing the high levels of efficiency of the most developed engines. This leads to good perspectives for further reducing the CO_2 emissions from engines, achieving the ambitious goals set by the EC and other organisations like EUCAR.

These widely recognised advantages of advanced combustion modes has led to intense research in Europe, Japan and the USA aimed at making them usable in real engine applications.

Objectives

The overall aim of the ECO-ENGINES is to set up a virtual research centre (VRC) on advanced engine combustion modes for road transport, with special emphasis on optimised alternative and renewable fuels. This VRC will be the result of an integration of the related research activities of major European institutions in the domain, and will include dedicated actions towards education and dissemination. The ambition is to be recognised as a worldwide leader of research on advanced engine combustion modes.

In order to enable ECO-ENGINES to make a definitive contribution to the development of low CO_2 and near zero emission powertrains for cars, three research topics (RTs) will be addressed by the VRC, covering all aspects of research on advanced engine combustion:

RT1: Experimental techniques

including research on optical diagnostics to explore flow and combustion inside the combustion chamber of engines, as well as research on experimental techniques for measuring ultra low pollutant emissions.

RT2: Combustion simulation

including research on 3D numerical simulation of fuel injection, flow and combustion inside the combustion chamber of engines.

RT3: Fuel/engine emissions

including research on fuel test methods, procedures to evaluate the performance of fuel/engine couples in terms of CO_2 emissions/efficiency and pollutants, and methods to characterise fuels.

Description of work

These overall objectives and ambitions will be realised by implementing a joint programme of activities (JPA) with the following detailed objectives to be achieved during the envisaged three-year funding by the EC:

1. Create a common knowledge basis by setting up and regularly updating an extensive state-of-the-art survey on researching ECO-ENGINES' topics;
2. Define common standard procedures: The objective is to jointly define, use and constantly update basic standard procedures which are the basis of research work. The aim is to facilitate exchanging or comparing outcomes of research actions undertaken by different partners, thus facilitating an integrated planning of research.
3. Jointly plan and organise new research on advanced combustion modes: The objective is to increase knowledge in Europe within the domain of advanced combustion in engines by triggering new research actions using the ECO-ENGINES resources and knowledge, but it is also open to outside collaborations.
4. Set up a common education and training: The objective is to set up a common, integrated education and training programme in the domain of advanced engine combustion modes and to seek intense collaborations with partners outside the network and all over Europe.
5. Actively disseminate knowledge and results: The objective is to ensure a wide dissemination of the knowledge and exploitation of results.

Results

The following results have so far been achieved:

1. extensive state-of-the-art survey on the three pre-competitive research topics
2. work on best practice guidelines in the three research topics
3. definition, planning and realisation of a first Advanced Engine Combustion Summer School commonly organised by network members
4. Based on 1) and 2), the identification of gaps in research. Filling these gaps is of high European interest
5. Based on 5), start of defined research projects undertaken by the network partners
6. Creation of a public and restricted access website to advertise project activities and organise information exchange between the partners.

Keywords: Combustion, engine, simulation, diagnostics, alternative fuels

Acronym:	ECO-ENGINES	
Name of proposal:	Energy COnversion in Engines	
Contract number:	TNE3-CT-2003-506520	
Instrument:	NoE	
Total cost:	2,000,000 €	
EU contribution:	2,000,000 €	
Call:	FP6-2002-Transport 1	
Starting date:	01.02.2004	
Ending date:	31.01.2007	
Duration:	36 months	
Sector:	Road	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)	
Website:	http://project.ifp.fr/eco-engines	
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	Volvo Technology Corporation Reg. No. SE 55 65 42 43 21 01	SE
	Volkswagen AG	DE
	REGIENOV (Renault Recherche Innovation acting on behalf of Renault and its subsidiaries, in particular Renault Sport and SOMAC)	FR
	Gaz de France	FR
	TOTALFINAELF - Refining and Marketing Research Division	FR
	FEV Motorentechnik GmbH	DE
	European Commission - Directorate General Joint Research Centre	IT
	Reaction Engineering Solutions	UK
	Chalmers University of Technology	SE
	Warsaw University of Technology	PL
	Université Pierre et Marie Curie - Paris 6	FR
	PCI, Ruprecht-Karls Universität Heidelberg	DE
	Politecnico di Milano	IT
	Valeo	FR
	Perkins Engines Co. Ltd	UK
	CNRS	FR
	Universität Duisburg Essen - IVG	DE

GREEN

Green Heavy Duty Engine

In the GREEN project, European HD engine manufacturers join forces with suppliers, academia and leading engineering institutes. The common goal is to promote future advanced engine technologies to achieve lower emissions, lower fuel consumption and improved sustainability for future fuels.

Background

The development of HD engines is undergoing a rapid step in its evolution. Increased demand for fuel efficiency, emissions and global competition are driving forces. The HD (heavy-duty) engines operate under constraints much more severe than those of passenger cars, such as:

- higher durability (> 600 000 km) of the engine and of the related after-treatment
- higher mechanical and thermal stress of the engine (heavier load factor)
- higher pressure on reliability (up-time), investment and fuel economy.

The above constraints characterise the HD engines for their more general applications: not only trucks and urban vehicles but also the rail traction and the inland waterway vessels of the directive 2002/765.

New technologies will help us in meeting future emission and fuel consumption targets by:

- a new combustion process enabled by variable components
- new control strategies
- considering the engine and the exhaust after-treatment as one system
- considering sustainable fuels.

Objectives

The main objective of GREEN is to perform research, which will lead to sub-systems for a heavy-duty engine. The objectives should be achieved with strict boundary conditions for: i) a competitive cost base, and ii) the highest fuel conversion efficiency of the diesel cycle, to achieve near-zero real-world, including off-cycle, pollutant emissions and significant reductions of CO_2 and other greenhouse gases.

The project puts emphasis on diesel engines for trucks and rail applications, and on natural gas engines for city transport applications. The combination of innovation and durability is strongly supported.

The research targets have been chosen to look beyond all legislation known today. Targeting possible sharpening after the year 2010 with a focus on near-zero real-world emissions (NO_x 0.5 g/kWh, PM 0.002 g/kWh, ETC Cycle BSFC = 204 g/kWh for diesel and corresponding targets for natural gas) are set.

Description of work

The work in GREEN is divided into sub-project and crossover activities:

HD gas engine for urban areas: with the objective to reach low gaseous emissions and diesel-engine equivalent fuel consumption by variable valve management, cooled EGR for gas engines and close-to-valve multipoint port-gas injection, and comparing this with DI injection.

Enhanced flexible engine: with the objective to find the best combination and concept to reach emission limits beyond Euro 5, flexible engine components/sub-systems and exhaust after-treatment systems.

Innovative control and air utilisation: with the specific objective to develop the sub-systems for a new combustion process with complete air utilisation and to develop the models for a model-based closed-loop emission control, to regard engine and after-treatment as one system in the future.

High BMEP engine: with the specific objective to investigate the advantages and possibilities of a very high brake-mean effective pressure to reduce fuel consumption as much as possible.

The crossover activities link the subprojects further:

Future HD technology adaptation to rail diesel engines and to develop the rail diesel engine in 2012+

Basic investigations and comparison on fuels: diesel – biofuels – GTL

Further development of a comparable injection system for gas engines – electromagnetic operated control valve (EOCV) system.

Results

The project will provide research results and new components that will enable future emission standards and put European HD manufacturers in a more competitive position.

The introduction of valve management and electronic controls for gas engines will make the NG engine competitive for both emissions and greenhouse gases.

The global conflict of fuel consumption and emissions will be targeted for HD diesel engines. New technologies for improving the fuel efficiency without sacrificing fuel economy look promising. Improved high-tech engine components, such as fuel injection systems, turbine-compressors, variable compression ratio, and many others, are now being electronically controlled and equipped for future engines. GREEN also secures compatibility with future sustainable diesel fuels.

The project targets improvement for both urban and long haulage applications. The rapid start and positive early results look promising for the future. The HD sector has previously been supported on a level that is far too low in relation to the impact on the economy and the environment. GREEN proves that a change will be efficiently governed.

Keywords: Diesel engine, emissions, NO_x, particulates, fuel consumption, natural gas, sustainable fuels, train engine

Acronym:	GREEN
Name of proposal:	Green Heavy Duty Engine
Contract number:	TIP4-CT-2005-516195
Instrument:	IP
Total cost:	21,749,770 €
EU contribution:	12,000,000 €
Call:	FP6-2003-Transport 3
Starting date:	01.03.2005
Ending date:	29.02.2008
Duration:	36 months
Sector:	Road
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)
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DaimlerChrysler AG	DE
Delphi Diesel Systems	UK
DEUTZ AG	DE
Swiss Federal Institute of Technology Zurich (ETH)	CH
FEV Motorentechnik GmbH	DE
Holset Engineering Co. Ltd	UK
Iveco S.p.A.	IT
Iveco Motorenforschung Ltd	CH
Johnson Matthey plc	UK
METATRON s.r.l.	IT
National Technical University of Athens	GR
Politecnico di Torino	IT
Ricardo UK Limited	UK
Rheinisch-Westfälische Technische Hochschule Aachen (RWTH)	DE
Universidad Politécnica de Valencia	ES
FORD OTOMOTIV SANAYI A.S.	TR
NONOX BV	NL
Institut Français du Pétrole	FR
MTU Friedrichsfhafen GmbH	DE
Union Internationale des Chemins de Fer	FR
Paul Scherrer Institut	CH
Union of European Railway Industries	BE

HERCULES

High-efficiency Engine R&D on Combustion with Ultra-low Emissions for Ships

The HERCULES IP will develop new technologies to drastically reduce gaseous and particulate emissions from marine engines and concurrently increase engine efficiency and reliability, hence reducing specific fuel consumption, CO_2 emissions and engine lifecycle costs.

Background

Worldwide there are 80 000 ships larger than 2 000 tons, and about 900 new ships of this size are built each year (a ship's life is about 20 years). Today, diesel engines account for 98% of ship power plants. A typical large marine engine on a merchant ship will operate during this period for more than 150 000 hours. A ship will achieve approximately 0.02 KWh/ton-km energy consumption which is ten times more efficient than using road transport for the same goods. During the same period, this typical single marine engine of assumed output 25 000 KW, with a maximum efficiency of about 50%, the highest of all thermal power plants, will consume 500 000 tons of fuel and will produce 60 000 tons of NO_x, 2 000 tons of CO_2 and 3 500 tons of particulates, all from the lifetime of a single power plant.

The vision of HERCULES, of drastically reducing emissions and at the same time increasing engine efficiency and thus reduction of CO_2, will potentially affect the vast majority of ships (both new and, through possible technology, existing ships). It will therefore have a significant societal implication of worldwide effect.

Objectives

HERCULES aims to push the limits of marine engine expertise. The focus of the project is on the development of a future generation of optimally efficient, clean and reliable marine power plants.

The specific objectives are provided below in terms of percentage changes related to current best available technology in service (BAT-IS) for shipboard prime movers, with at least one marine engine installation worldwide reference for 2003. The target of HERCULES is to obtain or surpass the following:

1. Reduction of fuel consumption and CO_2 emissions by 1%
2. Reduction of NO_x (relative to IMO 2000 standard) by 20%
3. Reduction of other emission components (PM, HC) by 5%
4. Improvement in engine reliability of 10%
5. Reduction of time to market by 10%
6. Reduction in lifecycle cost

To achieve the above objectives, the scope of the project includes all the technology interrelations needed for a holistic approach to marine engine efficiency improvement and emissions reduction. The integrated RTD work will allow the above objectives to be achieved simultaneously.

Description of work

The objectives of HERCULES will be attained through interrelated developments in thermodynamics and mechanics of extreme parameter engines, advanced combustion concepts, multistage intelligent turbo-charging, 'hot' engines with energy recovery and compounding, internal emission reduction methods and advanced after-treatment techniques, new sensors for emissions and performance monitoring, and adaptive control for intelligent engines. Advanced process models and engineering software tools will be developed to assist in component design. Prototype components will be manufactured and rig-tested.

Engine experimental designs will be assessed on test-beds to validate the new technologies and confirm the achieved objectives. Full-scale shipboard tests of chosen systems will demonstrate the potential benefits of the next generation engines.

The work is structured in nine work packages, with 18 tasks and 54 subprojects. The consortium includes engine makers, component suppliers and equipment manufacturers, renowned universities and research institutions, as well as world-class shipping companies. The partners hold 80% of the world market in marine engines and thus are the keepers of today's best available technology.

Results

Work in all HERCULES work packages has progressed well. The initial concept studies and process simulation activities are completed in almost all tasks. Experimental rigs have been set up; the design of the ensuing prototype components is finished in most cases and a large number of new components have been manufactured. Full-scale tests have been performed in some cases.

New combustion models have been developed for use in marine engines and a large spray combustion chamber has been manufactured.

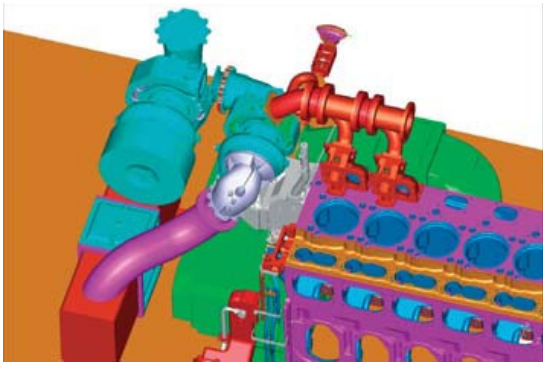
Advanced turbo-charging options have been studied and prototype PTI/PTO devices for two stroke engines have been designed and manufactured.

'Hot' engine, combined cycle configurations and key engine components have been tested.

Direct water injection (DWI) systems, inlet air humidification systems and fuel water emulsification (FWE) systems have been installed on test rigs or onboard ships. Exhaust gas recirculation (EGR) systems for two-stroke engines were designed, produced and laboratory tested.

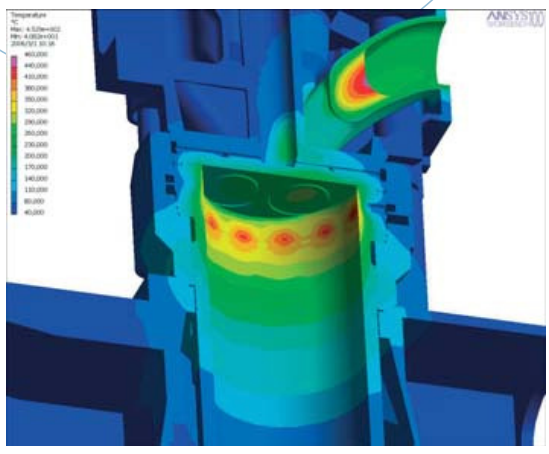
Wet-scrubber systems were studied and rig-tested. A test rig for friction loss measurements was manufactured. Studies for 'intelligent' control and self-learning components with adaptive behaviour were integrated with the engine control system and full-scale tests will follow.

Twenty-seven deliverable reports have been produced during the first two years of the project.



Wartsila Corporation

Final prototype tests with 2-stage TC on W20 - Design Studies - HP and LP turbocharger transversally



MAN B&W DIESEL A/S

Linking CFD-combustion simulation and FEM simulation for calculating thermal load of the combustion chamber

New Technologies and Concepts for all Surface Transport Modes
(Road, Rail and Waterborne)

Acronym:	HERCULES
Name of proposal:	High-efficiency Engine R&D on Combustion with Ultra-low Emissions for Ships
Contract number:	TIP3-CT-2003-506676
Instrument:	IP
Total cost:	33,642,700 €
EU contribution:	14,999,944 €
Call:	FP6-2002-Transport 1
Starting date:	01.03.2004
Ending date:	30.09.2007
Duration:	43 months
Sector:	Waterborne
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)
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HI-CEPS

Highly Integrated Combustion Electric Propulsion System

HI-CEPS aims to develop highly integrated powertrains and related thermal-electric auxiliaries for hybrid electric vehicles (HEVs) to be verified at bench and vehicle validation levels. The developed devices have to satisfy both the environmental and final-user requirements for the 2010-12 mass market.

Background

Past experience:

The 'modern' HEVs of the 1980s have been investigated to overcome the limits of battery electric vehicles in terms of allowable range and recharge time.

According to this approach, the solutions developed were mainly based on series-range extender hybrids and parallel architectures with extended pure electric (zero emission) range targets. Their high weight-to-volume battery packs made it impossible to apply these vehicles to the mass market.

Present scenario:

The current HEVs for the mass market have been designed by sacrificing the pure electric extended range and utilising newer generation, higher specific energy and lower cost batteries.

These powertrains can be regarded as co-operative hybrids or electrically-assisted ICEs (internal combustion engines). The electric contribution is aimed primarily at reducing the consumption of fossil fuels and CO_2 emissions.

The related figures are reassuring as to gasoline engine HEVs, showing an increasing passenger car market in Japan and North America. In Europe, with its greater use of diesel vehicles, it is possible to achieve similar reductions at a lower purchase cost.

Next steps:

To continue with the reductions in regulated and CO_2 emissions while developing new solutions with mass-market applicability in Europe.

Objectives

1. Develop three different, innovative, integrated series-parallel full hybrid thermal-electric powertrains utilising low-cost and standardised electric devices (e-motors, power electronics and batteries), vehicle auxiliaries and dedicated gasoline, diesel and natural gas engines with specific exhaust after-treatment systems. The adaptation to future fuels and combustion systems will also be taken into account.
2. To achieve, at vehicle level, both the environmentally friendly requirements (fuel consumption, CO_2 and regulated noxious emission reduction) and fun-to-drive characteristics (enhanced transient performance, driveability and comfort) at an acceptable purchasing/operation cost (perceived value).

In order to obtain these results the following three actions will be performed:

1. Improve the power train efficiency to deliver a larger consumption reduction
2. Reduce the extra costs through:
   - electric device improvements and standardisation (synergies with the running Hy-SYS IP and among the threee concepts)
   - powertrain component integration and simplification
3. Act on the 'final user functions' (performance, driveability, comfort, etc.) increasing the perceived value.

Description of work

The project is structured into six subprojects (SPs). One SP is devoted to the project management (SP1000) while the other five are devoted to technical activities.

The five technical SPs are subdivided in three vertical and two horizontal SPs.

Vertical subprojects (one for each new hybrid power train):

- SP3000 - ElectroMagnetic Split Hybrid: with CNG ICE, for passenger cars, up to vehicle validation level
- SP4000 - Dual Mode Split Hybrid: with gasoline ICE, for passenger cars, up to vehicle validation level
- SP5000 - Advanced Dual Clutch Combined Hybrid: with diesel ICE, for light delivery vehicles, up to test bench level.

Horizontal subprojects:

- SP2000 covers the integration of thermal auxiliaries (electrical regeneration, thermal storage systems, air conditioning) and energy management to reduce fuel consumption and emissions, whilst maintaining high thermal comfort for complex hybrid powertrains
- SP6000 focuses on the boundary condition and load cycle definition, and the final comparative performance and cost assessment of the investigated hybrid systems, taking into account the vehicle safety and powertrain integration needs.

Results

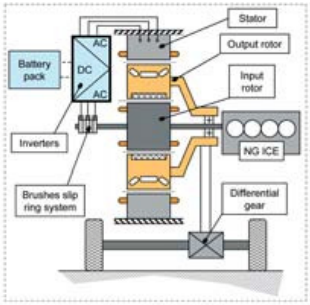
The main expected results are:

1. Hybrid powertrains assessment, comprehensive validation of the devices and their related control/ management strategies for the different operating modes.
2. Identification of best solutions and operating strategies for thermal and ICE auxiliaries to guarantee:
   - effective integration in the hybrid powertrain architectures
   - complete thermal and energy flow optimisation
   - efficient recovery of wasted energy
   - optimal thermal comfort in the vehicle, both for extremely low and high ambient temperature conditions
   - lower overall emissions and increased life cycle for ICE
   - simplification of exhaust gas after-treatment devices
   - constant emission levels during the vehicle's lifetime.

The project results will have a useful impact in different application fields. The main ones are:

- FC vehicles: accelerate the introduction (common electrical devices and management strategies)
- ICE vehicles: speed up the introduction of new electrically supplied auxiliaries
- other transportation sectors: synergies with environmental friendly traction systems for boats and/or auxiliaries (buses, etc.)
- stationary pure electric power generation up to the Combined Heat and Power (CHP) (same electrical architecture and related energy and thermal management strategies) for emission reductions and integration of new functionalities.

Keywords: Hybrid electric vehicles, full hybrid power trains, thermal auxiliaries, electrically based exhaust gas after-treatment, energy and thermal management



Electro-Magnetic Split Hybrid Powertrain with NG-ICE: architecture lay-out

Electro-Magnetic Split Hybrid Powertrain with NG-ICE: hybrid-electric CVT

Acronym:	HI-CEPS	
Name of proposal:	Highly Integrated Combustion Electric Propulsion System	
Contract number:	TIP5-CT-2006-031373	
Instrument:	IP	
Total cost:	19,324,816 €	
EU contribution:	9,875,898 €	
Call:	FP6-2005-Transport 4	
Starting date:	01.09.2006	
Ending date:	31.08.2010	
Duration:	48 months	
Sector:	Road	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)	
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	AVL List GmbH	AT
	Getrag Ford Transmissions GmbH	SE
	MAGNA STEYR Fahrzeugtechnik AG & Co KG	AT
	Saft S.A.	FR
	SELIN SISTEMI SPA	IT
	The Netherlands Organisation of Applied Scientific Research (TNO)	NL
	Institut Français du Pétrole	FR
	EICAS Automazione S.p.A.	IT
	FEV Motorentechnik GmbH	DE
	Ricardo UK Limited	UK
	Rheinisch-Westfälische Technische Hochschule Aachen (RWTH)	DE
	Università degli Studi dell'Aquila	IT
	University of Maribor, Faculty of electrical engineering and computer sciences	SI
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	Bertrandt AG	FR
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	Eneftech Innovation S.A.	CH

IPSY

Innovative Particle Trap System for Future Diesel Combustion Concepts

Future diesel car engines will have 'conventional' combustion at high and full loads, and partial homogeneous combustion at low loads with different emissions. This makes necessary to develop new cleaning devices. To ensure soot regeneration at the resulting low NO/NO_2 and exhaust temperature levels, the research will develop a compact porous media design for the trap, with tuneable particle collection and multifunction catalytic nanostructured materials together with the needed control strategies.

Background

Advanced diesel combustion processes for passenger car diesel engines, such as homogeneous charge compression ignition (HCCI), or partial homogeneous combustion, are developed for their potential to achieve near zero particulate and NO_x emissions. One of the drawbacks of this technology is the difficult combustion control at medium and high loads and consequently a limited operating range where NO_x and particulate emissions are at a very low level. For this purpose, novel exhaust cleaning devices are necessary to process the different loading areas with its specific emissions well below the Euro V emission level. To ensure soot regeneration for the needed particulate trap at the low NO/NO_2 and exhaust temperature levels resulting from efficient combustion, the project focuses on a novel design of porous media and novel catalytic nanostructured materials in a compact unit, with tuneable soot particle collection that will accommodate multifunctional catalytic coatings.

Objectives

The objectives will be a global filtration efficiency, even on ultra fine particulates above 95% with a nearly constant fuel consumption at slightly increased back pressure and advanced regeneration strategies in the range of 580°C in an acceptable time, therefore the focus lies on particulate and not only on CO and HC. In detail that means:

- PM< 0.001 g/km NEDC
- NO_x: 0.06 g/km NEDC
- applicability to passenger cars as well as adaptability to truck engines
- fuel consumption equivalent to the Euro IV calibration including regeneration
- ability to run in all driving conditions.

One of the main pillars of the project is to design, develop, construct and test an innovative multifunctional filter/reactor (MFR) for treating the particulate and gaseous pollutants from the exhaust streams of a HCCI, partial homogeneity and conventional combustion process of a diesel engine in the complete engine map. The other main pillar is the development of advanced regeneration strategies to minimise active regeneration cases to avoid the risk of increasing the fuel consumption.

Description of work

There will be different key activities in the project:

1. Development and construction of the multifunctional reactor divided in two tasks.

Task 1A – MFR development:

- catalyst synthesis and deposition on small-scale filters

- construction of the MFR subunits
- MFR prototype assembly and initial assessment
- production of two fully-instrumented MFR prototypes for functional tests

Task 1B – MFR evaluation with engine tests for loading and regeneration:

- testing the MFR on a conventional multi-cylinder engine on steady-state and transient operation (NEDC)
- testing the system with the HCCI engine under steady-state conditions
- testing the system with applied control algorithms

2. Physical modelling of particulate morphology on particulate trapping and the setting-up of a 3D CFD simulation model including all necessary boundary conditions. Due to the fact that the thermo-mechanical interactions in the system must be taken into account, the model must include a gas phase as well as a solid wall structure of the DPF (conjugate heat transfer).

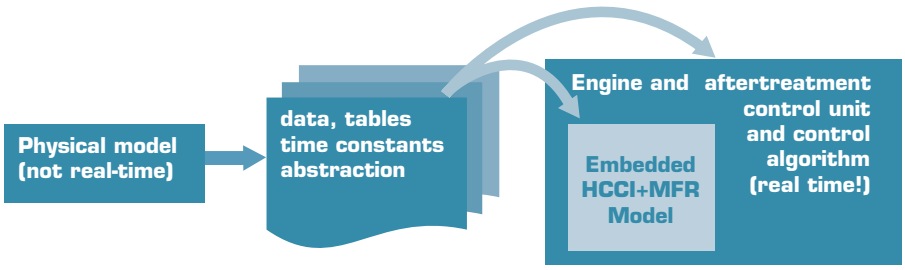
   Following this activity, an algorithms for the powertrain control unit using the 3D simulation real-time model of the complete exhaust system and different filter characteristics will be developed. This will take into account thermal behaviour, coating, loading and soot oxidation for the new filter, as well as the engine out emissions and exhaust temperature of the HCCI diesel engine to integrate the real behaviour of the trap system in the entire vehicle environment.

Results

1. Development of a MFR (multifunctional reactor) concept with:
   - novel catalysts (material, porosity, etc.) to cope with the higher CO, HC emissions and lower exhaust temperature
   - new DPF substrates to ensure passive regeneration and high filtration efficiency according to the soot characteristics produced by these future engines along with a low exhaust back pressure and high ash tolerance
   - adapted exhaust line designs to improve DPF global performance with the specific constraints of HCCI engines (high EGR rate with possible impact of exhaust gas composition on EGR valve and cooler, low exhaust temperature, etc.).
2. Development of advanced control strategy concepts for exhaust gas after-treatment systems for diesel engines for the management of DPF regeneration based on experimental and simulation investigations, at first with the goal to widen passive regeneration zone and then for a forced regeneration by minimising extra fuel consumption and avoiding excessive thermal shock for a better DPF durability.
3. Overall time and cost reduction in developing exhaust gas after-treatment systems for diesel engines by improved simulation methods.

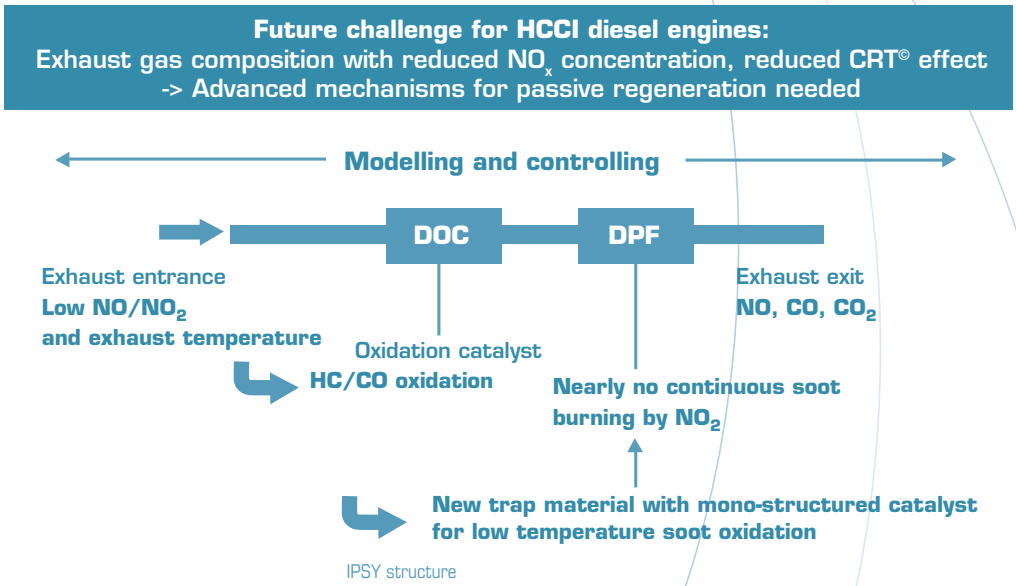
All these expected results are necessary to improve the exhaust emissions well below the expected Euro V level to cope with the future challenges of achieving environmentally-friendly vehicles for the EU citizens.

Keywords: Internal combustion engine, exhaust gas after-treatment, system control



FEV Motorentechnik GmbH

Modelling and controlling



Acronym:	IPSY
Name of proposal:	Innovative Particle Trap System for Future Diesel Combustion Concepts
Contract number:	TST5-CT-2006-031410
Instrument:	STP
Total cost:	1,795,556 €
EU contribution:	988,257 €
Call:	FP6-2005-Transport 4
Duration:	36 months
Sector:	Road
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)
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METHAPU

Validation of a Renewable Methanol-based Auxiliary Power System for Commercial Vessels

METHAPU strives to facilitate the introduction of international regulations concerning the use of methanol as a fuel onboard ship. The project induces innovation activities on fuel cells, methanol fuel bunkering, distribution and storage technology, thus moving society to a higher level of sustainability.

Background

There are many types of fuel cell on the market and the types mostly considered for marine applications are PEM, PAFC, MCFC and SOFC. According to online chemical engineering information, the electric efficiencies of PEM and PAFC are lower than that of SOFC and MCFC. SOFC and MCFC are both high-temperature fuel cells having approximately the same range of electric efficiency. Currently SOFC seems to be very promising and this project is utilising a certain type of SOFC technology.

Currently in Europe there are big projects, including FellowShip, aiming at integrating a fuel-cell unit with a marine vessel. Phase one of the FellowShip project has been completed successfully, but the project has not yet entered the validation phase. METHAPU serves as a good way to build upon what phase one of FellowShip has accomplished.

The challenge here is that while international regulations permit the carriage of methanol as a cargo, there are currently no international regulations allowing the use of methanol for fuel onboard ships. METHAPU will facilitate the introduction of international regulations on methanol as a marine fuel.

Future research activities on larger fuel cells and a sustainable society based on renewable fuels need a good knowledge base, and METHAPU is structured to provide the necessary springboard for such activities.

Objectives

The objectives of the project are:

1. the introduction of renewable fuels onboard ship in support of the wider use of sustainable fuels in the marine transportation sector through research activities
2. to validate marine-compatible methanol running on marinised solid oxide fuel-cell technology
3. to innovate the necessary technical justifications for the use of methanol onboard cargo vessels involved in international trade in order to support the introduction of necessary regulations to allowing the use of methanol as a marine fuel
4. to facilitate future research activities on larger marine-compatible SOFC units and a methanol-based economy
5. assess short-term and long-term environmental impacts of the application.

Research and innovation activities will focus on solving the technical and regulatory obstacles related to methanol fuel bunkering, distribution and storage systems.

The research activity concerns a 250 kW SOFC unit and this activity is reinforced by actually building a properly marinised and methanol-using 20 kW SOFC unit.

The 20 kW methanol-using unit will be onboard a vessel sailing the oceans and, for a period of one year, the measurement data concerning such issues as efficiency and emissions will be gathered. The measured data will be utilised when reviewing the studies done in the project.

Description of work

The marinisation study of the 250 kW unit will be done with an approach similar to the Delphi-method. The consortium is well positioned to provide the necessary expertise. This study will be applied to the building of the marine compatible 20 kW unit. The 20 kW unit will be run for a certain period and the necessary data collected. The collected data will provide inputs for reviewing the marinisation study concerning the 250 kW unit.

The technical and regulatory obstacles related to methanol bunkering, distribution and storage will be tackled with a Delphi-like approach as well. The outcomes will serve as inputs to the preparation of new regulations concerning the use of methanol as an onboard fuel.

Marinisation and regulation-related works are supported by the lifecycle assessment done to the methanol-using 250 kW unit.

Results

The work on regulatory issues would facilitate the birth of new regulations aimed at enabling the use of methanol as a fuel onboard ship.

Together with the marinisation study, these two studies would facilitate the work of other fuel-cell system integrators and provide a technical basis for the growth of a new industry around methanol.

With the results of the lifecycle assessment and the previously mentioned studies, this project would generate a tremendous base of knowledge for further research activities on greener ships, larger fuel cells and a sustainable society based on renewable fuels.

Keywords: Methanol, SOFC, marinisation, marine regulations

Acronym:	METHAPU
Name of proposal:	Validation of a Renewable Methanol-based Auxiliary Power System for Commercial Vessels
Contract number:	TST5-CT-2006-031414
Instrument:	STP
Total cost:	2,023,540 €
EU contribution:	1,000,000 €
Call:	FP6-2005-Transport 4
Start date:	01.11.2006
Duration:	30 months
Sector:	Waterborne
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)
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NICE

New Integrated Combustion System for Future Passenger Car Engines

The NICE Integrated Project was proposed by the European automotive industry, and given the highest responsibility level. The main objective of NICE is to develop a new integrated combustion system that, independent of the type of fuel, achieves the highest fuel conversion efficiency.

Background

The project clusters of the Fourth and Fifth Framework Programme developed advanced technologies for Otto-cycle engines (in ADIGA and GET-CO_2) and diesel-cycle engines for passenger cars (in ADDI and D-ULEV). These combustion systems present opposite problems: the Otto-cycle has a high fuel consumption but with low emission levels, while the diesel-cycle shows very low fuel consumption but with substantial problems in meeting low emission levels. In the 2002 annual review of Valencia, a combined combustion system able to join the advantages of the two cycles was imagined for the first time and this is now being considered by NICE. The approach will also support, as an intermediate stage, the definition of innovative diesel- and Otto-cycle engines, to be considered as by-products of the research. The network will establish a reference legislative frame and linkages with other research projects. Particular care will be devoted to favour the integration process of the NICE sub-projects.

Objectives

The main objective of NICE is to develop a new integrated combustion system that, independent of the type of fuel (i.e. neutral fuel), is able to achieve today's highest fuel conversion efficiency of the DI diesel engine (43%), while complying with a zero-impact emission level. As a result of the gained knowledge and realised technologies of such an integrated combustion system, innovative diesel- and Otto-cycle engines, to be considered as by-products of the NICE research, will be developed. These by-products will allow Europe to maintain the leadership in the production of internal combustion engines in the years 2010-2015, while allowing the completion of the integrated combustion system in an innovative powertrain, which will take us to 2020. The fully flexible powertrain will be characterised by very high fuel conversion efficiency, mainly using newly designed bio and/or alternative fuels and gas, in the given emission constraints.

Description of work

The NICE IP is divided into four sub-projects:

a. enlarged HCCI-diesel/CAI-Otto combustion process under transient operation

b. compressed/spark ignited variable engine: based on gasoline or diesel engines combining the advantages into a new combustion system, with high EGR, supercharged and adapted to bio-fuels

c. future gas internal combustion engines with diesel equivalent fuel consumption

d. improved CFD tools and modelling: the main R&D objectives are:

- sensible increase of HCCI/CAI region in the engine map
- bio-fuel specifications addressed to the new combustion system
- the combination of different electronic control units (ECU) to define new advanced systems including ECU-algorithms, real-time models and software tools for automatic validation, hardware-in-the-loop tests and calibration

- advanced control systems for mixture preparation and combustion, required to adapt the injection and combustion strategy to the recognised fuel composition
- a predictive, affordable and 'useful in practice' numerical tool describing new low emission highly efficient combustion processes.

Results

The focus of months 13 to 24, regarding sub-projects A1, A2 and A3, was to finalise the procurement and production of test samples and advanced sub-systems, to assemble single cylinder and multi-cylinder engines, and to start the test bench investigations. The main task for the sub-project B1 was to use CFD models to assist the sub-projects A1, A2 and A3 as well as improve or generate new models.

Keywords: Combustion, Car, Engines, Automotive, Development, Research

Acronym:	NICE	
Name of proposal:	New Integrated Combustion System for Future Passenger Car Engines	
Contract number:	TIP3-CT-2004-506201	
Instrument:	IP	
Total cost:	26,351,062 €	
EU contribution:	14,499,731 €	
Call:	FP6-2002-Transport 1	
Starting date:	01.01.2004	
Ending date:	31.12.2007	
Duration:	48 months	
Sector:	Road	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)	
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	C.R.F. Società Consortile per Azioni	IT
	Delphi Diesel Systems Ltd	UK
	FEV Motorentechnik GmbH	DE
	Ford Forschungszentrum Aachen GmbH	DE
	Institut Français du Pétrole	FR
	Institut National des Sciences Appliquées de Rouen	FR
	Istituto Motori of the National Research Council	IT
	Mechadyne International Limited	UK
	Politecnico di Torino - Dipartimento di Energetica	IT
	REGIENOV (Renault Recherche Innovation acting on behalf of Renault and its subsidiaries, in particular Renault Sport and SOMAC)	FR
	Rheinisch-Westfälische Technische Hochschule Aachen (RWTH)	DE
	Siemens VDO Automotive AG	DE
	Technical University of Graz	AT
	Universidad Politécnica de Valencia	ES
	UNIVERSITA'DEGLI STUDI DI GENOVA DIPARTIENTO DI MACHINE, SISTEMI ENERGETICI TRASPORTI	IT
	The Chancellor, Masters and Scholars of the University of Cambridge	UK
	Volkswagen AG	DE
	Volvo Technology Corporation Reg. No. SE 55 65 42 43 21 01	SE
	Universität Karlsruhe	DE
	Universität Cottbus	DE

PAGODE

Post-treAtment for the next Generation Of Diesel Engines

The aim of this project is to provide a comprehensive, system-oriented view on potentially new after-treatment processes that will be required for the next HCCI (homogeneous charge compression ignition) combustion systems, taking into account the next fuel generation.

Background

Diesel innovation and leadership in core technological and scientific competencies are the key drivers for European competitiveness. In this context, diesel engine improvements towards more efficient and less polluting vehicles play a critical role in the competitiveness of the European car industry and in the long-term sustainable growth and job preservation in Europe, along with the necessary improvement of air quality and reduction of health effects. In the next ten years, it is anticipated that a smooth transition from conventional engines to new diesel technologies will happen (from conventional to partially homogeneous and then to finally homogenous over a wide range of operating points). Diesel homogeneous charge compression ignition (HCCI) combustion processes are seen as a promising way to meet the future environmental challenges, which will have to achieve both significantly lower pollutant emissions and fuel consumption. With these concepts, NO_x and PM emissions are simultaneously drastically reduced avoiding the installation of a complex and costly NO_x specific after treatment. The main drawback of this concept is that the level of low-temperature related emissions, i.e. CO and HC, can increase by several orders of magnitude. This implies that conventional oxidation catalysts' technologies, currently used on Euro IV compliant vehicles, are no more able to convert these harmful emissions because of the saturation of the active catalytic sites. As a result, such increased CO and HC emissions have to be reduced to safe levels using innovative catalysts or emergent technologies, which have to be characterised by a different reaction kinetic, so are less dependant on the pollutants' concentration. It is also admitted that such innovative combustion processes will merge with an increasingly wider diffusion of new fuel properties and renewable formulations, so that will be helpful to enlarge the engine running range (EUCAR RENEW project). The impact of these new fuel formulations on next-generation after-treatment processes will also have to be investigated.

Objectives

The aim of this project is to provide a comprehensive, system-oriented view on potentially new after-treatment processes that will be required for the next HCCI combustion systems taking into account the next fuel generation.

The scientific objectives of this project are:

- to understand the complex kinetic mechanisms and chemical principles of CO/HC low temperature oxidation for the next generation diesel engines exhaust environment
- to develop a robust, efficient, and accurate computational models to analyse, simulate and improve the performance of next generation catalytic converters: a transient one-dimensional model and a single spatial dimension will be developed as a first step, and then 2D and 3D calculations will be investigated and integrated.

The technological objectives are:

- to formulate, develop, test and optimise advanced new catalyst formulation for CO/HC low temperature oxidation
- to design, develop and test emerging flexible low temperature oxidation technologies based on plasma concepts
- to perform a powertrain system synthesis and evaluate, for the next generation powertrains, the requirements and boundary conditions needed to implement the advanced after-treatment processes in diesel engines.

Results

At the time of submitting this content, the PAGODE project had not started.

Keywords: Exhaust emissions, fuel combustion, catalysis, after treatment, emergent technologies

Acronym:	PAGODE
Name of proposal:	Post-treAtment for the next Generation Of Diesel Engines
Contract number:	TST5-CT-2006-031404
Instrument:	STP
Total cost:	4,075,685 €
EU contribution:	2,192,544 €
Call:	FP6-2005-Transport 4
Duration:	36 months
Sector:	Road
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)
Website:	http://www.psa-peugeot-citroen.com
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Partners:	C.R.F. Società Consortile per Azioni IT Johnson Matthey plc UK Institut Français du Pétrole FR Chalmers University of Technology SE Aerosol and Particle Technology Laboratory / Center for Research and technology Hellas / Chemical Process Engineering Research Institute GR Ecole Supérieure d'Electricité FR

POSSEIDON

Progressive Oil Sensor System for Extended Identification ON-Line

POSSEIDON addresses the development of a sensor-based processing unit to continuously monitor lube oil degradation and contamination in main propulsion and power-generating engines aboard ships.

Background

The prime mover in the maritime industry is the diesel engine. A single propulsion engine of a modern container ship can cost around $1 million and circulate up to 70 tons of lubricating oil. This critical fluid is subjected to a wide range of contamination factors in addition to its normal, unpredictable service life. Historically, quality control has been performed by a combination of rudimentary field tests conducted by shipboard engineers and laboratory analysis of samples submitted to the supplying oil company. Its long been recognised that the time gap between receiving the results of lab analyses and the questionable security of relying on stressed shipboard staff to perform and interpret oil tests was an area of considerable vulnerability. To date no affordable technology exists to deliver real-time analysis aboard ship. A ship is an isolated community constantly moving around the world in a hostile operating environment. The engine and the ship are at risk when lube oil fails. POSSEIDON intends to remove this vulnerability by delivering technology to provide sensor systems to measure real-time lube oil quality, plus additional benefits for operators and the environment by optimising lubrication oil use and enhanced understanding of the oil and equipment for the crew, operator and OEMs. It will also enable oil suppliers to eliminate wasteful practices.

Objectives

POSSEIDON addresses the development of a complete sensor-based processing unit that can continuously monitor a ship's lubricated systems to provide scrutiny over serviceable life enabling crews to predict degradation, anticipate problems and take remedial action before damage and failure occurs. This will extend engine lifetime, avoid loss of performance and could prevent catastrophic failures. There are also environmental benefits as the optimisation of lube oil reduces the quantity of spent lubricant destined for disposal (2 million tons/year). POSSEIDON will monitor the main lube oil properties (viscosity, water-in-oil, base number and total impurities) that indicate degradation and contamination. This will provide more precise understanding of actual engine status and timely scheduling of remedial actions incorporating proactive maintenance towards condition monitoring. These include replenishment for optimising lube oil conditions for engine operation, worn component replacement to suit the vessel's schedule and surveys based on real conditions as opposed to arbitrary time periods. An important objective will be to reduce/eliminate dependence on land-based analysis and vulnerability to sudden contamination. The unique operating environment aboard a ship provides the challenge of integrating shipboard data management and expert/control systems, including transmission to and from remote locations.

Description of work

The work plan is organised into 12 work packages (WP) starting with a precise definition of user requirements and architecture of the sensor, including electronic and software architecture and prototype specifications.

WP2 assesses the sensor fundamentals by studying actual lube oil and determining the relationship between various parameters and oil quality.

WP3 determines the calibration patterns for the various parameters.

WP4 addresses design and development of the optical IR sensor.

WP5 will determine the measurement principles for the TBN sensor and develop the design and fabrication.

WP6 deals with the development of the viscosity sensor concept and overall design, fabrication, interfacing testing, electronics, software development and data processing. WP7 addresses similar issues for the impurity sensor while WP8 deals with sensor unit integration development. The main tasks/actions of this work package are development of the sensor-processing unit, development of distributed ship/ground communications and the interface for delivering data into the shipboard management system.

WP9 deals with intelligent support software developments such as data fusion, condition-monitoring strategy, integrated troubleshooting and risk management and best practices for human interaction.

The final three work packages cover testing, revision and validation of the technology and the management and exploitation of the project.

Results

The principal deliverable is a demonstrator of the sensor system for monitoring the condition of the main engine in lubricating oil aboard large ships. This sensor system is expected to provide quantitative information regarding the key parameters of lube oil enabling operators to predict and anticipate deterioration conditions. The sensor system will facilitate integration with alarm systems, expert management systems, data management systems and onward communication. The significance of these developments is that it could remove a significant area of vulnerability in an extremely safety-sensitive industry. In addition it would alleviate an overstretched manpower situation and facilitate monitoring and management from a remote location. The successful adoption of the system could optimise the use of lubricating oil and minimise the cost and consequence of disposing with spent oil. In the maritime industry, the logistical patterns of end-users makes disposal, repair costs and interruption in service severely punitive. However, while the facility of remote condition monitoring has major impact for land-based industry, the potential offered to maritime users is enormous. It is expected that this development could have a substantial strategic effect on both vessel operators and lube oil suppliers.

Keywords: Lubrication, condition monitoring, predictive maintenance, contamination, degredation, ships, maritime

Acronym:	POSSEIDON
Name of proposal:	Progressive Oil Sensor System for Extended Identification ON-Line
Contract number:	TST5-CT-2006-031473
Instrument:	STP
Total cost:	2,293,778 €
EU contribution:	1,200,000 €
Call:	FP6-2005-Transport 4
Ending date:	29.12.2002
Duration:	36 months
Sector:	Waterborne
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)
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Railenergy

Innovative Integrated Energy Efficiency Solutions for Railway Rolling Stock, Rail Infrastructure and Train Operation

The project plans to develop a holistic framework approach incorporating new concepts and integrated solutions to improve energy efficiency in the railway domain under specific technical, operational, political and socio-economic constraints.

Background

There are strong incentives on the part of the railway sector to reduce energy consumption so as to reduce life-cycle costs and to maintain and enhance the railways' image as the most environmentally friendly mode of transport. Energy costs are becoming a principal cost driver for railway operators due to rising energy prices in recent years and it is becoming a question of economic survival to bring these costs down, at least in relative terms. Freight customers are mostly concerned with unit prices, especially for the 'high-volume/low-value' rail transport market, while passengers using trains today, apart from the cost of the ticket, are increasingly demanding greater comfort and overall attractiveness of trains. While trying to meet their customers' expectations, railways have to address issues that arise as a consequence of other functions, such as growing energy consumption. While there are some best practices available in Europe in terms of operational and technical measures to improve energy efficiency, they certainly do not address the problem in a comprehensive manner as seen from a strategic and management point of view. There is a need to examine the question of energy consumption in railways in a more profound and complete way.

Objectives

The overall objective of Railenergy is to cut energy consumption in the railway system, thus contributing to a reduction of life-cycle costs of railway operation and of CO_2 emissions. The project target is to achieve a 6% reduction in specific energy consumption (e.g. energy consumption per seat/km or tons/km) of the rail system by 2020 by addressing different systems, subsystems and components of railways in an integrated way. The cumulative impact of the proposed innovative solutions will be assessed with the help of the global modelling tool to be developed within the project. The individual contributions of each subsystem and the relations among the subsystems in the energy consumption process will be clearly identified. The most promising solutions will be realised and tested. According to the results of the global modelling and testing, it will be demonstrated how one set of integrated solutions can contribute to reach the target of a 6% reduction below the anticipated energy consumption for 2020, given the target of a doubling in traffic intensity, as well as all the possible intermediate and longer term scenarios identified during the project.

Description of work

The 'Railenergy global model' is at the heart of this system approach and describes all energy flows in the railway system. This model is developed within the core subproject dealing with integrated energy efficiency management. The global model is unique in the sense that it is covering the following two important functionalities:

- integrated decision support tool
- plug and play principle

The following structure has been developed for project implementation:

- NRG-Needs (Energy needs and key performance indicators definition)

- NRG-Efficiency Management (Integrated energy management)
- NRG-Trackside (Trackside energy improvements)
- NRG-Components (Onboard innovative components)
- NRG-Traction (Onboard innovative traction)
- NRG-Topologies (Optimisation of electrical equipment topologies and operation)
- Training and Dissemination (for dissemination purposes only)
- Coordination

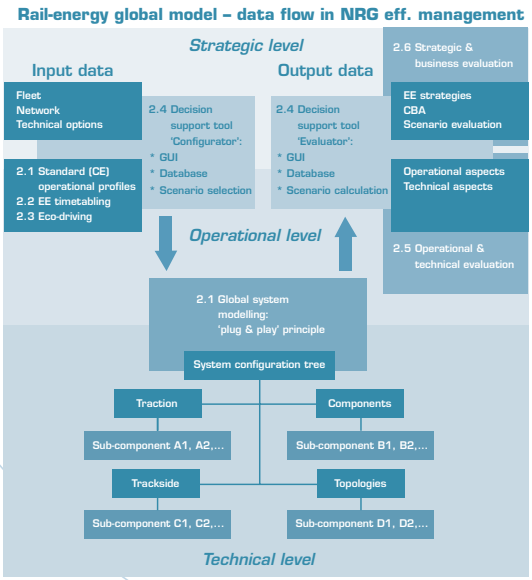
Results

Railenergy could make a considerable contribution to the EU policy on sustainable development in three ways:

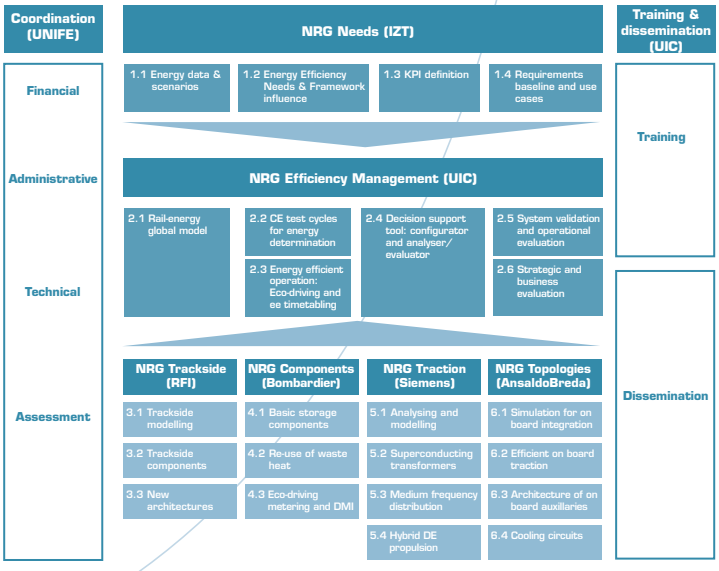
- boosting the competitiveness of railway transport (due to a reduced life-cycle cost) and thus enabling modal shift from road to rail, which is one of the pillars of sustainable development policy
- efficient use of scarce energy resources and subsequent contribution to improved security of energy supply
- lower emissions of greenhouse gases (mainly CO_2) and air pollutants thus helping to combat climate change.

The potential positive impact of reduced energy consumption is not limited only to the economic advantages for the railway sector itself. The environmental impact of the Railenergy project will be undoubtedly positive, contributing to reduced energy use (thus respecting the scarcity of the relevant natural resources) and lower emissions of air pollutants. By tackling the issue of energy efficiency, railways respond to the societal concerns about the security of energy supply and climate change. These concerns are at the heart of EU policy-making at present and railway stakeholders would contribute to addressing these issues by focusing joint efforts on reducing energy consumption in the entire railway system.

Keywords: Energy efficiency, holistic approach, reduction of energy consumption, measuring energy consumption, harmonised energy consumption data



Railenergy global model



The structure of the Railenergy project

Acronym:	Railenergy
Name of proposal:	Innovative Integrated Energy Efficiency Solutions for Railway Rolling Stock, Rail Infrastructure and Train Operation
Contract number:	TIP5-CT-2006-031458
Instrument:	IP
Total cost:	14,664,734 €
EU contribution:	8,000,000 €
Call:	FP6-2005-Transport 4
Duration:	48 months
Sector:	Rail
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)
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TOP EXPERT

TAILORED ON-BOARD ACTIVATED AGENTS PRODUCTION FOR EXHAUST AFTERTREATMENT PERFORMANCE ENHANCEMENT

The project is focused on the selection and assessment of an integrated active after-treatment system, compliant with Euro V regulations and beyond and capable of superior performances pursued via the generation of activated chemical agents via two alternative ways, a catalytic and an energy-based approach.

Background

Despite the diesel engines environmental impact, there has not been an application for any after-treatment technology for a long time. In the last few years, diesel emissions have had to face increasing worldwide public pressure, which has led to more and more severe emission regulations. Although catalyst-equipped Otto-engines are nowadays cleaner than diesels, as far as soot and NO_x production are concerned, diesel engines are preferred in almost all heavy-duty applications.

Since the first diesel engine emission regulations were issued, several engine modifications have been developed to reduce pollutant species production. While CO and HC emissions are manageable through the use of an oxidation catalyst, NO_x and particulates are a harder task to handle and abate. Optimisation of the engine's combustion towards low NO_x emission and soot emission has to face a trade-off. The necessary compromise between NO_x and particulate emissions make advanced after-treatment technologies a must to meet the current and future regulations; Euro IV regulations, at present in force, have been met by all car manufacturers thanks to the extensive use of after-treatment devices, in close synergy with engine management strategy. Anyhow the future emission limits will force the use of innovative after-treatment components/systems capable to contemporary reduce both NO_x and soot emissions.

Objectives

The specific objective of the proposal is to develop, procure and test the needed components and integrated systems, in order to achieve the following targets:

- EuroV (and beyond) emission levels for passenger cars, particularly in terms of NO_x emission
- low fuel/energy penalty (< 2 %)
- compatibility with the engine and vehicle systems
- system operation and maintenance that is fully transparent to the vehicle user
- cost-competitive system with a complete state-of-the-art after-treatment system.

From the outset, system integration is the leitmotiv of the project. The system will have to be an automotive one, and this will be ensured by a partnership strongly focused on automotive exhaust technology development, manufacturing and application. Efforts will be made to improve each single component of the pursued integrated technology. A scientific and rigorous approach will be followed:

- lab-scale testing of single devices and of pre-prototype assemble systems
- scale-up testing of both systems on the engine bench
- vehicle testing in real conditions for final assessment of the most promising technology.

Such a development process will follow the guidelines of a typical automotive development: this will ease the technology transfer for industrial exploitation of the results.

Description of work

Specifications and boundary conditions will be the first indispensable step to make the achievement of quantifiable results in terms of efficient after-treatment devices. The core part of the project is divided into two work lines:

- catalyst-based approach and energy-based approach to the generation and exploitation of activated agents
- developing dedicated after-treatment equipment, required to exploit the output of the activated agents' production devices.

The two work lines will produce lab-scale integrated systems, which will be extensively tested; also, a system simulation tool will be developed within the project, which will support the industrial application of the technologies under investigation. Providing a tool for activated agents' production and exploitation simulation will allow the integration of existing software and so facilitate a quick industrial exploitation of results.

The application engineering will transfer the developed systems from lab-scale to full-scale on the test bench for implementation onto a state-of-the-art engine exhaust line. This step provides the basic understanding of the technological capabilities in real working conditions. From the two approaches, the most promising technology will be selected for the implementation of a state-of-the-art vehicle for the final assessment.

Results

The mains project deliverables will be:

- Development of a complete software package for the simulation of catalyst and energy-based after-treatment systems and assessment based on experimental dataset.
- Scale-up of the catalytic and energy-based systems for the engine test bench experimental campaigns to asses the system functionality, assess it in different engine working conditions, assess the compatibility with engine systems, the emission abatement efficiency assessment in terms of exhaust pollutant removal efficiency and counter pressure/compatibility with engine systems.

This will allow performing an objective and straightforward comparison whose output will be the final project deliverable:

- Selection of the most promising technological route for the final assessment on a vehicle.

  The system that results in being the most promising between the two explored technological routes will be finally assembled on a vehicle for the evaluation of the system capabilities in real driving conditions and in standard driving cycles. The positive environmental impact of the project is clearly visible, considering the increasing number of vehicles equipped with diesel engines and their emissions mainly consisting of NO_x and fine particulate matter. The proposed project intends to provide an alternative solution to these problems by applying novel concepts to exhaust after-treatment engineering.

Keywords: After-treatment technology, plasma reforming, NO_x reduction, onboard fuel reforming

Acronym:	TOP EXPERT	
Name of proposal:	TAILORED ON-BOARD ACTIVATED AGENTS PRODUCTION FOR EXHAUST AFTERTREATMENT PERFORMANCE ENHANCEMENT	
Contract number:	TST5-CT-2006-031471	
Instrument:	STP	
Total cost:	2,723,848 €	
EU contribution:	1,645,002 €	
Call:	FP6-2005-Transport 4	
Starting date:	01.10.2006	
Ending date:	30.09.2009	
Duration:	36 months	
Sector:	Road	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)	
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	ArvinMeritor Emission Technologies GmbH	DE
	Johnson Matthey plc	UK

TOPMACS

Thermally Operated Mobile Air Conditioning Systems

The goal of the project is to develop mobile air conditioning systems (MACS) with a reduced impact on the environment. The systems will be considered for two vehicle applications: passenger cars and trucks.

Background

The state of the art of the MACS is represented by vapour compression cycles that use R134a as a refrigerant, which is a greenhouse gas with a high global warming potential (GWP, equal to 1 300). Due to the refrigerant leakages during usage, it has been estimated that in Europe, every year, between 750 and 2 500 tons of R134a are emitted in the atmosphere. Taking into account the GWP, this is equivalent to up to 3 millions of tons of CO_2.

Europe is making a huge effort to reduce greenhouse gas emissions. The development of highly efficient air conditioning systems with a near-zero greenhouse gas emission and eliminating hydrofluorocarbon (HFC) have been considered a priority. According to the new EC regulation, by 2011, no refrigerant having a GWP higher than 150 can be used on MACS.

At present two gases are being considered as options to replace the R134a. CO_2 has a low GWP (equal to 1), but as it works at high pressure, it needs the development of new components. Moreover, its performance could be critical at high ambient air temperatures. The other option is R152a, which is still a HFC but with a GWP below 140. The drawback is its slight flammability.

Objectives

The project aims at:

- eliminating the environmental impact from refrigerant leakages. The refrigerants used (water, ammonia or hydrogen) are in agreement with new regulations.
- reducing indirect emissions. The MAC system's impact on fuel consumption will be minimised since the primary energy source will be waste heat, while the electric compressor-driven metal hydride system can have a COP of up to 3.4.
- decoupling the MAC systems from the engine. The availability of a low-consumption electrical powered cooling system could be the ideal solution for a vehicle with electrical traction architectures (stop&start vehicles, hybrid vehicles or fuel cells). These vehicle types risk serious commercial problems, and elimination of their environmental advantages, if a high efficiency solution for thermal comfort is not available.
- developing an auxiliary heating system. Since these systems are capable of a heat pumping operation, they can be a solution for the lack of waste heat of highly efficient diesel engines and also for vehicles not powered by an internal combustion engine.
- developing additional functions like pre-conditioning. The potential of these systems to provide energy storage or the presence of an APU, will allow pre-warming and pre-cooling, for which the car market demand is growing and it is considered all important in the truck.
- downsizing the system. To have pre-conditioning systems is also beneficial from an energy point of view, allowing a system design with lower peak power.

Description of work

The following system requirement definitions need to be determined:

1. specifications for systems in trucks and cars (weight, size, operating temperatures, vibrations, noise, etc)
2. target performance expected from the systems, (refrigerant power, efficiency, thermal comfort, quality of the air)
3. reference truck and car on which the performances will be verified and the corresponding assessment method defined.

Overall Systems Model: lumped parameter models of the truck and car that include all the sub-systems having an interaction with the MAC system need to be developed. The models will allow the simulation of:

- thermal performances (power and perceived comfort)
- energy consumption.

Development of a metal hydride system: investigations will be carried out with either waste heat (from the engine or APU) or electric energy (for hydrogen compression) as the primary energy source. A test bench prototype will be set up and the performance evaluated.

Development of sorption cooling system: the design, construction and testing of lab-scale solid sorption air conditioner and cold storage systems for automotive applications.

A second-generation prototype will be installed onboard the car/truck and tested.

An evaluation of the environmental benefits and cost analysis will be carried out.

Results

An assessment methodology will be developed to evaluate both the fuel over-consumption due to the MACS and the thermal comfort. This methodology could be a useful base for a procedure proposal about the measurement of the over-consumption/emission due to MACS.

An overall model of the truck and car and the subsystems will allow a simulation of the thermal performance and predict the energy consumption of the systems.

There will be four test bench prototypes (three of sorption, one of metal hydride).

A prototype car and truck, equipped with the best innovative systems, will be developed. The prototypes will be compatible with the incoming EU regulations on fluids, and will also allow a lower impact of the MACS during the phase of use, lowering the additional fuel consumption generated by MACS. The MAC systems can be decoupled from the engine, offering a solution for vehicles powered by non-conventional powertrains and for truck air conditioning in parking conditions.

Acronym:	TOPMACS
Name of proposal:	Thermally Operated Mobile Air Conditioning Systems
Contract number:	TST4-CT-2005-012471
Instrument:	STP
Total cost:	4,453,732 €
EU contribution:	2,671,978 €
Call:	FP6-2003-Transport 3
Starting date:	01.03.2005
Ending date:	31.08.2008
Duration:	42 months
Sector:	Road
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)
Website:	http://213.21.184.250/CRFprojects/EuropeanProjects/TOPMACS/
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ULYSSES

The Future Propulsion as ONE System

The aim is to construct a platform for exchanging information and strategic planning of RTD projects on an internal combustion powertrain running on new fuels. This CA will identify links and favour integration by targeting pollutant/CO_2 reduction and energy supply security.

Background

Twelve years coordination of RTD projects was carried out by a Third Framework Programme (FP3) cluster, and during FP4 and FP5 by two thematic networks, PREMTECH I (Advanced propulsion systems and emission reduction technologies) and PREMTECH II (Efficient and low emitting propulsion technologies).

FP5 has generated engine control technologies, such as multi-injection of fuel, variable valve actuation, variable compression ratio, etc., capable of high flexibility. The challenge now is to pass from the single technology in FP5 to a controlled sub-system made up of more than one technology in FP6. The sub-systems composed of highly flexible technologies should converge on the design of a flexible propulsion system running on future fuels able to meet significant pollutant and CO_2 reduction. The breakthrough is represented by an ensemble of the technology sub-systems. Other activities had not been covered, such as after-treatment and the use of new synthetic fuels that together with an integrated control and gearbox would be required to treat the overall propulsion system.

ULYSSES will contribute to EU policies suggesting what is the state of the art and its future evolution via the road map of the propulsion system technologies, also taking into account the engine/after-treatment requirements in terms of the fuel type/quality, thus giving a substantial contribution to the European Research Area (ERA).

Objectives

The altered conditions of the FP6 and FP7 research, with respect to FP4 and FP5, is accounted by building this Coordination Action (CA) on two pillars:

- Content: the aim is the full implementation of the potential of the internal combustion (IC) engine and hybrid technologies developed in previous and current projects by considering the three elements – fuel, powertrain (engine and gear box) and after-treatment – as ONE system able to combine the two conflicting requirements of low emissions and high efficiency with future fuel characteristics.
- Partnership: the consortium enables a 360° coverage of technology innovation and fuel processing. Linkages with EUCAR, EARPA, CONCAWE and AECC (Association for Emissions Control by Catalyst) are established to design future research strategy.

The CA objective is to construct a platform for exchanging information and strategic planning of EC-funded research projects dealing with new propulsion technologies/concepts based on IC engines running on an ameliorated fuel, including alternative and renewable fuels for on-road vehicles. Extension to rail and waterborne propulsion is also considered.

Description of work

The propulsion concept, based on IC engines for on-road vehicles, is organised according to a matrix structure with the following:

- Three vertical developmental areas coordinated by META:
  a. fuel led by VW and OMV
  b. powertrain system including engine, gearbox and hybrids lead by Centro Richerche Fiat and DaimlerChrysler (DC)
  c. after-treatment led by DC.

- Four horizontal work packages (WP) to perform a platform for exchanging information and strategic planning of EC-funded projects:

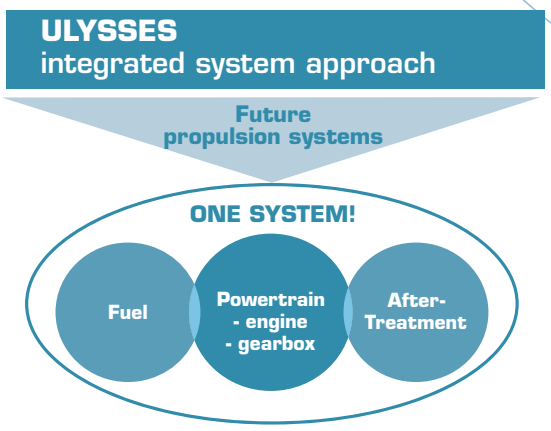
1. System analysis: propulsion systems (on-road, railways, waterborne) versus fuel evolution by AVL, FEV, Institut Français du Pétrole and OMV, coordinated by META
2. RTD strategy and plans: assessment of the international state of the art, identification of gaps and needs in the RTD activities, definition and updating of the joint RTD strategy and plans, and innovation technology acceptance by the three OEMs (original equipment manufacturers) coordinated by META
3. Exploitation and dissemination: identification of linkages among the projects as expressed by the main deliverables, proper actions for favouring project integration/technology transfer on the occasion of the CA projects annual review, definition of coordinated cross-fertilisation plans in order to improve the dissemination of project outcomes, reporting and dissemination of knowledge by META
4. Supporting infrastructure: provision of the basic infrastructures needed to operate ULYSSES by META.

Results

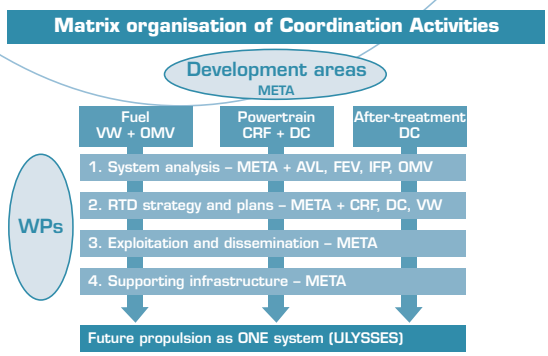
The main outputs that will be generated by the CA projects deal with a wide range of applications of vehicle technologies, mainly affecting light- and heavy-duty on-road engines. The system analysis performed in WP1 represents the basis for the OEMs to orient the project's technologies and to supply a strategic planning to the EC in WP2. The dissemination ensuring the optimal use of the results via the cross-fertilisation among the projects will support the exploitation (WP2 and WP3). Achievements will be exchanged with organisations (EUCAR, EARPA, CONCAWE and AECC) and EC programmes, such as the European Climate Change Programme (ECCP) and the Clean Air for Europe (CAFE). To ensure the optimal use of the results beyond the participants, the partnership is an open structure allowing other partners to join the meetings/activities depending on the interests represented by new projects. Furthermore, to cover the large area of interests a close collaboration will be pursued with:

- Commission services (Environment, Enterprise, etc.)
- International organisations
- regulatory bodies of the USA (EPA and CARB) and Japan (Ministry of Environment)
- normative bodies, like ISO and CEN
- ERTRAC (European Road Transport Research Advisory Council) by orienting its strategic targets according to the recommendations for FP7 through the given input on research needs and gaps.

Keywords: Propulsion systems engineering, vehicle engineering, fuels technology



The integral approach regarding fuel, powertrain and after-treatment as ONE system



Matrix structure of the CA ULYSSES: the three developmental areas and the four work packages

New Technologies and Concepts for all Surface Transport Modes
(Road, Rail and Waterborne)

Acronym:	ULYSSES
Name of proposal:	The Future Propulsion as ONE System
Contract number:	TCA5-CT-2006-031365
Instrument:	CA
Total cost:	1,200,000 €
EU contribution:	1,200,000 €
Call:	FP6-2005-Transport 4
Starting date:	01.06.2006
Ending date:	31.05.2010
Duration:	48 months
Sector:	Road
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Propulsion increasingly based on alternative and renewable fuels (Thermal engines, auxiliary systems and components, hybrid technology)
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FELICITAS

Fuel-cell Powertrains and Clustering in Heavy-duty Transports

FELICITAS aims to develop fuel-cell systems that are capable of meeting the demands of heavy-duty transport for road, rail and marine applications. These systems will be highly efficient, power-dense, durable, robust and reliable.

Background

Two of the fuel-cell (FC) technologies most suitable for heavy-duty transport applications are polymer electrolyte fuel cells (PEFC) and solid oxide fuel cells (SOFC). Currently neither technology is capable of meeting the wide-ranging needs of heavy-duty transport because of either low efficiencies (PEFC) or poor transient performance (SOFC). FELICITAS proposes the development of high-power fuel-cell clusters (FCC), which group FC systems with other technologies, including batteries, thermal energy and energy recuperation. The FELICITAS consortium will first undertake the definition of the requirements on FC powertrains for the different heavy-duty transport modes. This will lead to the development of FC powertrain concepts, which, through the use of advanced multiple simulations, will undertake evaluations of technical parameters, reliability and life-cycle costs. Alongside the development of appropriate FC powertrains, the consortium will undertake fundamental research to adapt and improve existing FC and other technologies, including gas turbines, diesel reforming and sensor systems for their successful deployment in the demanding heavy-duty transport modes. This research work will combine with the FC powertrains design and simulation work to provide improved components and systems, together with prototypes and field testing where appropriate. The FELICITAS consortium approach will substantially improve European FC and associated technology knowledge and expertise in the field of heavy-duty transport.

Objectives

FELICITAS focuses on the development of fuel-cell drive trains capable of meeting the demands of heavy-duty transport for road, rail and marine applications. The main requirements include power levels above 200 kW, power density at about 200 kW/t, system efficiency at about 60%, fuelled by hydrogen and/or hydrocarbon, having robustness and longevity, improved environmental impact and price competitiveness to conventional IC engines.

The scientific and technological approach in FELICITAS comprises clustering and hybridisation. FELICITAS will contribute by providing improved SOFC technology for marine applications, onboard diesel reforming technology for SOFC powertrains, and gas turbine technology for hybrid SOFC powertrains. In consequence of the so far predominantly stationary application of the SOFCs, significant improvements in performance and design are necessary to meet the requirements of heavy-duty transport.

Onboard fuel reforming will be a critical issue too within the framework of FELICITAS, because operating on high-energy-density fuels, such as liquid fuels, is essential for long distance operation of heavy-duty vehicles or ships. Addressing the particular demands of marine applications is therefore the first logical step in the use of SOFC for mobile applications.

FELICITAS will improve PEFC technology in a similar manner by developing PEFC clusters for heavy-duty road and light rail applications and hybrid PEFC clusters with extended durability, efficiency and increased power dynamics. PEFC technology is already well adapted for automotive applications, but the durability and power levels of PEFC remain a challenge: PEFC efficiency does not exceed 50% due to electrochemical restrictions. However, hybridisation and clustering of PEFC modules developed within FELICITAS should be a cost-efficient and practicable way to overcome this limitation.

Description of work

The subprojects and work packages draw on the principal FELICITAS themes of FC clustering and FC hybridisation.

Subproject 1 – 'Application requirements and system design' – addresses the issues of FC-based propulsion and auxiliary power units (APU) for heavy-duty transport. This phase of the project brings together the operators and end users of heavy-duty vehicles to define the basic performance and physical requirements of the propulsion and APU systems. FC-based systems will be designed to meet these requirements. The subproject leader is Lürssen, a shipbuilder located in Germany.

Subprojects 2 and 3 are devoted to the improvement of FC types suitable for heavy-duty transport – SOFC and PEFC – and are led by FELICITAS' major industrial partners and FC producers – Rolls-Royce and Ballard respectively.

The scope of Subproject 2 – 'Mobile hybrid SOFC' – is the marinisation of the Rolls-Royce Fuel Cell SOFC product currently being developed for stationary power generation. This will require components, systems and packaging improvements and modifications to meet the exacting needs of a marine application.

Subproject 3 – 'PEFC-Cluster' – concentrates on improving PEFC reliability and power level by clustering. The performance and packaging of these PEFCs are already very well advanced for mobile applications.

Subproject 4 – 'Power management' – concerns general technical problems of FC-based propulsion and will be led by one of the major research partners, FhG IVI.

Acronym:	FELICITAS	
Name of proposal:	Fuel-cell Powertrains and Clustering in Heavy-duty Transports	
Contract number:	TIP4-CT-2005-516270	
Instrument:	IP	
Total cost:	12,671,645 €	
EU contribution:	7,999,795 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.04.2005	
Ending date:	31.03.2008	
Duration:	36 months	
Sector:	Multi	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Development of zero or near-zero emission propulsion (Hydrogen, fuel cells, electric vehicles)	
Website:	http://www.felicitas-fuel-cells.info/	
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	Hochschule für Angewandte Wissenschaften Hamburg	DE
	Imperial College of Science, Technology and Medicine	UK
	National Technical University of Athens	GR
	Rolls-Royce Fuel Cell Systems Ltd	UK
	Institut national de Recherche sur les Transports et leurs Securite	FR
	University of Belfort-Montbéliard	FR
	Technische Universiteit Eindhoven	NL
	Università di Genova, Dipartimento di Macchine Sistemi Eneregetici e Trasporti (DiMSET)	IT
	Czech Railways - Railway Research Institute	CZ

HOPE

High Density Power Electronics for FC- and ICE-Hybrid Electric Vehicle Powertrains

In order to increase the fuel economy of vehicles, efficient electric drivetrains are needed for conventional or fuel cell-based hybrid cars. Affordable high-density power electronics are a precondition. HOPE has two approaches: a low-cost solution and a more advanced high-temperature solution without liquid cooling.

Background

Since the invention of cars, urban traffic has grown exponentially, and one of its main consequences is pollution. In the past internal combustion engines were improved by e.g. exhaust gas treatment and optimised combustion. To get to even lower emissions levels, other concepts are needed: e.g. fuel cell and hybrid electric cars. These cars include an electric drive which improves the overall efficiency and reduces CO_2. Several Japanese car manufacturers have brought HEV to the markets. In order to bring European hybrid technology successfully to the market, two elements are crucial beside the fuel cell: High performance batteries and highly efficient and reliable power electronics. HOPE addresses the power electronics challenge, with the aim of reducing costs and increasing power density, while ensuring reliability and driving performance.

The results of HOPE are relevant from a business perspective because they improve the competitiveness of European products. On the other hand they help in meeting the environmental targets and therefore HOPE is relevant for the whole European society.

Objectives

The general objectives of HOPE are:

- cost reduction
- meeting reliability requirements
- reduction of volume and weight.

These are a necessity to make the FC- and ICE-hybrid vehicles a success.

The overall target is to reduce fuel consumption because it will then correlate with CO_2 emissions. The ultimate solution is the fuel cell (FC) which requires only hydrogen. But FC cars will not be in large-scale series production before 2015. In the meantime, ICE- (internal combustion engine) hybrid cars will emerge like the various Toyota, Honda, Lexus and Ford models.

It is obvious that there is a need for different power ratings because of the great variety of cars and their level of electrification. If one assumed that there would be an individual power electronics for every car manufacturer and model, it is obvious that this would lead to high costs. Therefore a standardisation is needed that is based on 'power electronics building blocks' (PEBB) with a certain rated power, shape and terminal geometry. These PEBBs will then be a mass product, which can be manufactured at a reasonably low price.

Description of work

Work Package (WP) 1 defines common OEM specifications for FC- and ICE-hybrid vehicle drive systems; identifies common key parameters (power, voltage, size) that allows consequent standardisation; developes a scalability matrix for PEBBs. The power ranges will be much higher than those of, for example, considered in the HIMRATE project and will go beyond 100 kW electric power.

WP2 develops one reference mission profile which will be taken as the basis for the very extensive reliability tests that are planned.

WP3 investigates key technologies for PEBBs in every respect: materials, components (active Si- and SiC switches, passive devices and sensors), new solders and alternative joinings, cooling and EMI shielding.

In WP4, two PEBBs are developed: an IML (power mechatronics module), which is based on a lead-frame technology and a SiC-PEBB inverter.

WP5 develops a control unit for high-temperature control electronics for the SiC-PEBBs.

Finally WP6 works on integrating the new technologies invented in HOPE into powertrain systems and carries out benchmark tests.

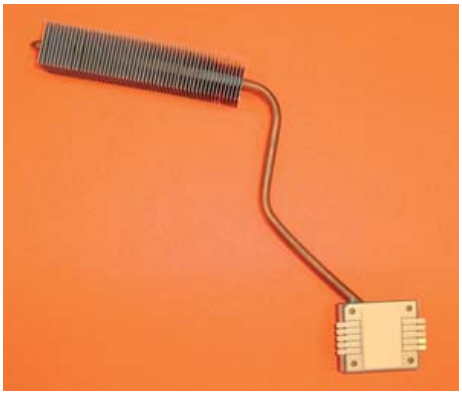
It is clear from the start that many innovations are necessary to meet the overall goals of HOPE. An IP management group will be formed as well as a reliability-testing group and standardisation group, which will make contact with different organisations. Contact will be made with the EU project HYSYS concerning the integration.

Results

The project has the following deliverables:

- Common specifications from OEMs including key parameter ranges for FC-hybrid and ICE-hybrid vehicles drive system
- Scalability matrix (assessment of OEMs needs covered by the technologies developed)
- Reference mission profile for FC- and ICE-hybrid electric vehicles
- Load patterns and lifetime requirements defined by OEMs for three different power ratings
- Applicable test procedures for power electronic systems
- Results of APCT, AMPCT and subsystem tests
- Synthesis of the reliability testing at high temperatures: failure modes and lifetime prognosis
- WP2 requirements; power partitioning for power modules
- Sensor evaluation
- HT-joining technologies
- Cooling concepts and verification
- Results of environmental and reliability tests
- Design of the first mechatronic test vehicles
- Final assessment on the new IML mechatronic power technology for automotive applications, including its compliance for scalability, comparison of different joining technologies and comparison of the performances of Si- and SiC-based power modules
- Low parasitic commutation cell concepts for extremely fast switching SiC devices
- First prototype SiC-driver and demonstrators/subsystems
- Requirements for SiC inverter control board
- SiC-control board
- HT – SiC-control board
- Specification of FC-hybrid/ICE-hybrid powertrain units
- Specification of modelling and simulation of powertrain units
- Impacts of implemented technologies on inverter integration
- Benchmark study

Keywords: Power electronics, automotive, hybrid electric vehicle, fuel cell



Acronym:	HOPE	
Name of proposal:	High Density Power Electronics for FC- and ICE-Hybrid Electric Vehicle Powertrains	
Contract number:	019848	
Instrument:	STP	
Total cost:	4 089 000 €	
EU contribution:	2 398 000 €	
Call:	HYDROGEN - 1	
Starting date:	01.01.2006	
Ending date:	31.12.2008	
Duration:	36 months	
Sector:	Road	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Development of zero or near-zero emission propulsion (Hydrogen, fuel cells, electric vehicles)	
Website:	http://www.fp6-hope.eu	
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	Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.	DE
	Institut national de Recherche sur les Transports et leurs Securite	FR
	MAGNA STEYR Fahrzeugtechnik AG & Co KG	AT
	REGIENOV (Renault Recherche Innovation acting on behalf of Renault and its subsidiaries)	FR
	Robert Bosch GmbH	DE
	Siemens VDO Automotive AG	DE
	Valeo Electronique et Systèmes de Liaisons	FR
	Volkswagen AG	DE
	University of Technology of Belfort-Montbéliard	FR
	Warsaw University of Technology	PL

HYHEELS

Optimisation of Hydrogen-powered Internal Combustion Engines

The overall goal of HyHEELS is to provide an UltraCap energy storage system for the use in hybrid- and fuel-cell vehicles, which satisfies all the properties necessary to make an integrative component.

Background

While the deployment of fuel-cell cars in the European fleet will take decades (it normally takes more than 20 years for standard functions to reach a 90% fleet penetration), CO_2 problems are present and demanding; the automotive industry favours solutions offering future potential when coupled with innovative powertrains as well as with the possible realisation of short-term benefits in combination with state-of-the-art powertrain technology.

In this regard, it is necessary to stress the fact that automotive technology has grown to be more and more complex in recent years by the addition of an increasing number of functionalities. OEMs addressed this challenge by decreasing the production of in-house parts and by the supply of black box-like system components, the integration of which still constitutes a big challenge in terms of handling complexity. This is why the HyHEELS consortium considered it to be appropriate to focus on providing an UltraCap storage function comprising all the properties necessary to make it an integrative component. This is the unanimous view of both the supplier and the OEM regarding manageable interfaces.

Objectives

The detailed scientific and technical objectives are the result of a thorough analysis of the challenges in the energy supply architecture of hybrid and hydrogen fuel-cell vehicles. A hydrogen fuel cell has to be provided with power and energy during the start-up phase as well as continuously during operation. High power is needed for the acceleration of the vehicle and for high power auxiliary fuel cell loads like the compressor. A powerful and reliable energy supply is crucial to fulfil the requirements of the future passenger car generation, which will be powered by hydrogen fuel cells.

These could have high-power charge and discharge conditions as well as operating at low temperature, e.g. -20°C. UltraCaps could fill the power gap. The approved UltraCap storage technology is available but needs to be adapted to future automotive hybrid and hydrogen applications, satisfying the demands on cost efficiency, safety and reliability.

Description of work

The aim of the development is to provide an improved cost-efficient energy supply concept for hybrid vehicles based on an advanced, powerful UltraCap. This will be achieved by:

- increasing the maximum operating voltage of UltraCaps from 2.5V to 2.7V. High-cell voltage requires an electrochemical stability of the electrode, the electrolyte and the packaging materials
- cost reduction of the electrodes by new production technologies
- cost reduction of cells and modules by industrialisation
- advanced UltraCap component electrode and packaging. All the materials need to have a high electrochemical stability in order to operate the components at a higher voltage over a longer period of time. The component packaging weight must be minimised. Special attention must be paid to the packaging tightness and to the mechanical resistance

- advanced UltraCap module packaging with optimised thermal behaviour, weight and cost
- development of an UltraCap controller, including a single cell voltage measurement and cell balancing, providing extended UltraCap information to the fuel-cell system supervisor.

The final goal of the project is the installation of an advanced, reliable and cost-efficient UltraCap module, providing all necessary information, which enables the integration into the fuel-cell vehicle architecture.

Results

The contribution of HyHEELs to societal and policy objectives cannot be regarded in isolation but have to be seen in combination with the vehicle for which it delivers the energy supply. HyHEELs-developed Ultracaps are a necessary prerequisite for the development and validation of a hybrid vehicle with a vision to achieve

1. 'well to wheel' energy efficiency exceeding 35% on the extended European urban drive cycle,
2. 'tank to wheel' CO_2 emissions not exceeding 80g/km when fuelled by hydrogen derived from fossil-based fuels and
3. near zero CO_2 and pollutant emissions when fuelled by hydrogen produced from renewable sources.

Keywords: Supercapacitors, ultracapacitors, hybrid energy systems, hybrid electric vehicles

Acronym:	HYHEELS	
Name of proposal:	Optimisation of Hydrogen-powered Internal Combustion Engines	
Contract number:	TST4-CT-2005-518344	
Instrument:	STP	
Total cost:	4,727,565 €	
EU contribution:	2,635,383 €	
Call:	HYDROGEN - 1	
Starting date:	01.11.2005	
Ending date:	31.10.2008	
Duration:	36 months	
Sector:	Road	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Development of zero or near-zero emission propulsion (Hydrogen, fuel cells, electric vehicles)	
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	Scania CV AB (publ)	SE
	EPCOS AG	DE
	Maxwell Technologies SA	CH
	Vlaamse Instelling voor Technologisch Onderzoek (Flemish Institute for Technological Research)	BE
	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE
	Irion Management Consulting GmbH	DE
	University of Technology of Belfort-Montbéliard	FR
	Warsaw University of Technology	PL
	Vrije Universiteit Brussel	BE

HYICE

Optimisation of a Hydrogen Powered Internal Combustion Engine

The internal combustion engine is ideally suited for hydrogen application since it offers high-power density at relatively low cost. HyICE is an initiative for automotive hydrogen engine development, which will provide economically feasible and environmentally friendly solutions for the increasing mobility demand.

Background

To usher in a new era in global energy production, hydrogen can be produced using many kinds of renewable energy sources, including solar or geothermal power. As the only carbon-free fuel no CO_2 is released during combustion and it can also be applied for various drivetrain systems.

Increasing interest to accelerate the introduction of hydrogen gave space for using existing technologies such as the internal combustion engine (ICE), which is the most feasible approach considering time, cost and available knowledge. Due to the possibility of bi-fuel operation, the ICE has the potential to stimulate the mid-term transition into a hydrogen-based mobility.

Objectives

The goal of the project is to create the knowledge for building a highly efficient hydrogen engine with a better specific power than gasoline and diesel at competitive costs.

One key component is the system applied for mixture formation. For the two most promising concepts, direct injection (DI) and cryogenic port injection (CPI), the necessary knowledge concerning design and application has to be created.

As the first logical step, dedicated injectors capable of handling the new fuel with its specific characteristic have to be developed. The processes of mixture formation and combustion will be studied and optimised by the use of test engines as well as CFD calculations.

A third subproject is delivering the supporting technologies, necessary for both engine concepts. These are an ignition system, able to deal with the broad flammability limits of hydrogen, and CFD-models adapted to hydrogen application.

Within the fourth subproject, International Co-operation, an information exchange between automobile industry and researchers from Europe and the USA will extract the maximum benefit out of all efforts and investments made on both sides of the Atlantic Ocean.

Description of work

Subproject 1 – Direct Injection (DI):

Injectors for low-pressure as well as for high-pressure DI are developed by Hoerbiger Valve Tec.

The DI combustion system is developed at Graz Technical University (TUG).

The subproject Direct Injection, aims at a multi-cylinder engine, optimised by MAN and the simulation of a free piston energy converter, operated by Volvo Technology.

Subproject 2 – Cryogenic Port Injection (CPI):

The highest vehicle range can be achieved with liquid hydrogen. The properties of this cryogenic fuel fit very well to the requirements of the engine.

The related injectors have been developed and tested.

The optimisation of mixture formation and combustion takes place at BMW.

Subproject 3 – Supporting technologies:

Dedicated ignition system

Several generations of power modules (which integrate both ignition coil and electronics) have been developed by Mecel in Sweden.

CFD adaptation

CFD models have to be adapted to account for properties of hydrogen in both mixture formation and combustion. A URANS (Unsteady Reynolds Averaged Navier-Stokes) approach is the methodology adopted in the simulation work of HyICE. For calculating the combustion process, two models have been investigated. The first one is the ECFM (extended coherent flame model) developed by IFP, France and the second is a Flamelet-based model co-developed by the University of Armed Forces in Munich (UBW) and Ansys Germany.

Validation takes place at an optical chamber, built and operated by UBW, and at an optical engine of TUG.

Both combustion models will be integrated by Ansys Germany into the commercial flow solver CFX.

Subproject 4 – International Co-operation:

This subproject puts its emphasis on the technical co-operation in research activities between the European Community and the USA. The research work of Ford is conducted in Dearborn, Michigan. Additionally, Ford is also the US interface for work that is being carried out at the Sandia National Laboratories, Livermore, California and at the Argonne National Laboratory, Chicago. Furthermore, Ford is supporting H2DI spray penetration and mixing model development, and bench validation work at the ERC of the University of Wisconsin-Madison.

Results

The results of the project HyICE are the prerequisites for the further development of an optimised propulsion system including components and supporting technologies:

Subproject 1 – Direct Injection:

The feasibility of hydrogen DI injectors has been shown and the necessary design knowledge has been created.

Mixture formation and combustion are being optimised individually in several engines.

The H2 operation of a free piston energy converter has been simulated and relating design changes have been carried out.

Subproject 2 – Cryogenic Port Injection:

The injectors are working satisfactorily.

The engine tests show remarkable results in power as well as efficiency within the whole work envelope.

With the help of a specially developed simulation model, icing effects within the inlet manifold can be avoided.

Subproject 3 – Supporting technologies:

Dedicated ignition system

The work has been focused on a system that can provide a spark burning mainly in breakdown discharge mode, resulting in higher transfer efficiency to the gas and less electrode heating.

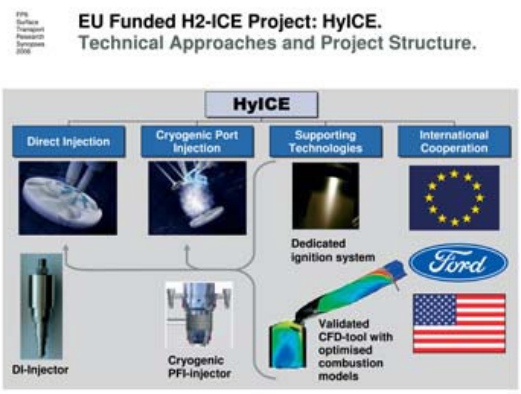
CFD Adaptation

Combustion models for diffusion flames as well as premixed and partially premixed combustion have been adapted to the special properties of hydrogen, validated by experiments on optical devices and engines. After approval, they will be inserted into the commercially available solver CFX provided by Ansys Germany.

Subproject 4 – International Co-operation:

An exchange between European and US research activities has been established, which has proved to be very fruitful for all involved parties.

Keywords: Internal combustion engine, hydrogen engine, mixture formation, direct injection, cryogenic port injection, CFD, hydrogen combustion, combustion model, optical engine, optical chamber, international co-operation



BMW Forschung und Technik GmbH

Acronym:	HYICE
Name of proposal:	Optimisation of a Hydrogen Powered Internal Combustion Engine
Contract number:	TIP3-CT-2003-506604
Instrument:	IP
Total cost:	7,716,741 €
EU contribution:	5,008,316 €
Call:	FP6-2002-Transport 1
Starting date:	05.01.2004
Ending date:	04.01.2007
Duration:	36 months
Sector:	Road
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Development of zero or near-zero emission propulsion (Hydrogen, fuel cells, electric vehicles)
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HYSYS

Fuel-Cell Hybrid Vehicle System Component Development

The objective of the project is the research on low-cost components for fuel-cell (FC) systems and electric drive systems, which can be used in future hybridised FC vehicles (a medium-term objective) and ICE vehicles. The components will be integrated and validated in two vehicles.

Background

Fuel-cell drivetrains for road transport applications are seen as the most promising technology for a sustainable mobility, especially when fuelled with hydrogen. Until now, intensive research and development has led to significant improvements of FC technology. However, market introduction of fuel-cell vehicles (FCV) has not yet been achieved due to several reasons. One very important point is the availability of reliable series components which can be mass-produced at low cost. This is a prerequisite for competitive fuel-cell vehicles. On the other hand, hybridisation of cars with internal combustion engines (ICE) is also a viable option for future transport. Hybrid (ICE) electric vehicles (HEV) could help to bridge the gap until hydrogen FCVs are available on the general market. FCVs and HEVs both need low cost e-drive components. Thus there is a need to achieve synergies between these two technologies in order to use scale effects for cost reduction of e-drive components. With this background, the project aims at the development of low-cost components for FCV hybrids and ICE hybrids in Europe. Automotive industries, suppliers, universities and research institutes are co-operating in a common effort to make the necessary steps forward.

Objectives

The goals of the project are:

- the improvement of fuel-cell system components for market readiness
- the improvement of electric drivetrain components (synergies between FC and ICE hybrids) for market readiness
- the optimisation of a system architecture for low-energy consumption, high performance, high durability and reliability
- the optimisation of energy management
- the development of low-cost components for mass production
- the validation of component and system performance on FC vehicles.

The concrete targets of the project are:

- low-cost automotive electrical turbochargers for air supply with high efficiency and high dynamics
- low-cost humidifiers with high packaging density
- low-cost hydrogen sensors for automotive use
- effective low-cost hydrogen supply lines
- highly efficient, high-powered density drivetrain
- low-cost, high-powered Li-Ion batteries
- enhanced FC drivetrain efficiency.

Description of work

The focus of the project is on components that have a high potential of significant cost reduction by decreasing the complexity and/or choosing innovative approaches to support a future mass production. The project is structured in four technical subprojects, plus one covering project management. In the subproject for the FC system components, the key components that are investigated are an innovative air supply based on electrical turbochargers, novel humidification subsystems, new hydrogen sensors and innovative hydrogen injection system components. In the subproject for the electric drive system we focus on highly integrated drivetrains (converters, inverters and electrical motors) and high-energy-density battery systems based on innovative Li-Ion technology, which has been developed in other EU-funded projects (EV-lift, Lionheart). All the component work is accompanied by a subproject covering work on vehicle requirements, subsystems and components (including standardisation and identification of synergies between FC and ICE hybrids), safety aspects, a comparative investigation of different electrical storage systems (battery/supercap) and the respective e-storage management. In the system level subproject, not only will the components be integrated and tested in the two validator vehicles, but work will also be performed on optimised vehicle control strategies, energy-management and the development of modular system control software.

Results

The main results of the project will be improved FC-system components and improved components for the e-drive and fuel-cell systems as well as the hydrogen supply, with full specifications for these components and the systems. Components standardisation and synergies between FCVs and HEVs will also be an outcome of the project. Finally, the developed components will be integrated in two vehicles with widely different hybrid architectures, although both oriented to the light good delivery sector which is likely to constitute an early market for FCV vehicles in fleet applications. The first will be a larger, full hybrid delivery van, while the second will be a smaller vehicle with a range extender architecture.

Results from testing the two vehicles will show to which extent the same components and principles can be applied for different vehicle concepts. Components developed in the project are intended to form the basis for series components which could be produced from European suppliers for future vehicle drive trains. Integrating these in fuel-cell vehicles and (ICE) hybrid electric vehicles will thus allow the development of competitive products for the European and world markets.

Example of an FC system (NuCellSYS HY-80) for an automotive drivetrain

Acronym:	HYSYS	
Name of proposal:	Fuel-Cell Hybrid Vehicle System Component Development	
Contract number:	019981	
Instrument:	IP	
Total cost:	22 786 509 €	
EU contribution:	11 197 200 €	
Call:	HYDROGEN - 1	
Starting date:	01.12.2005	
Duration:	48 months	
Sector:	Road	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Development of zero or near-zero emission propulsion (Hydrogen, fuel cells, electric vehicles)	
Website:	http://www.hysys.de	
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	Robert Bosch GmbH	DE
	Consejo Superior de Investigaciones Científicas - Centro Nacional de Microelectrónica	ES
	Conti Temic microelectronic GmbH	DE
	C.R.F. Società Consortile per Azioni	IT
	Ente per le Nuove Tecnologie, l'Energia e l'Ambiente	IT
	Ecole Polytechnique Federale de Lausanne	CH
	Fischer AG Präzisionsspindeln	CH
	FuMA-Tech Gesellschaft für Funktionelle Membranen und Anlagentechnologie mbH	DE
	Rheinisch-Westfälische Technische Hochschule Aachen (RWTH)	DE
	MAGNA STEYR Fahrzeugtechnik AG & Co KG	AT
	MicroChemical Systems SA	CH
	Peugeot Citroën Automobiles	FR
	RIVOIRA S.p.A.	IT
	Saft S.A.	FR
	SELIN SISTEMI SPA	IT
	ATB Technologies GmbH	AT
	Netherlands Organisation for Applied Scientific Research (TNO)	NL
	Volvo Technology Corporation	SE
	Volkswagen AG	DE
	University of Maribor, Faculty of electrical engineering and computer sciences	SI
	Laboratoire des Agrégats Moléculaires et Matériaux Inorganiques, UMR 5072 CNRS/Université Montpellier 2.	FR
	REGIENOV (Renault Recherche Innovation acting on behalf of Renault and its subsidiaries, in particular Renault Sport and SOMAC)	FR
	Fachhochschule Esslingen, Hochschule für Technik	DE

HyTRAN

Hydrogen and Fuel-Cell Technologies for Road Transport

The overall objectives of HyTRAN are to advance the fuel-cell technology towards a commercially viable solution by developing components and a system. Two innovative integrated fuel-cell systems will be demonstrated:80 kW direct hydrogen PEM fuel-cell system 5 kW APU diesel reformed gas PEM fuel-cell system.

Background

Local and global environment issues, as well as the consumption and supply of energy, are major challenges for the future. A fuel cell is an ideal device to generate electricity from either fossil or renewable fuels as it is clean and efficient. By using fuel-cell propulsion running on hydrogen, the vehicle has (local) zero emission. For a fuel cell with fuel-processing technology used for propulsion or auxiliary power units (APU), major air pollutants will be substantially reduced. Hydrogen fuel cells are therefore increasingly seen as a potential propulsion technology of the future for road transport. Additionally, fuel-cell APUs – possibly coupled with on-board fuel reformers – are also seen as a promising technology for both light- and heavy-duty vehicles. However, despite the potential of these technologies to reduce the environmental impact of road transport and to improve energy efficiency, both technical and economic barriers need to be overcome for them to be successfully introduced into mass markets. Issues to work on are the fuel-cell stack, components and main subsystems including the fuel processor and auxiliary components, the fuel-cell system and the vehicle integration, as well as the choice of fuel with its implications for technology and infrastructure.

Objectives

The scope of the HyTRAN project is to advance the fuel-cell technology towards solutions that are commercially viable. This will be demonstrated in two fuel-cell systems. The components and sub-systems are considered as major bottlenecks for fuel cell-based vehicle systems. HyTRAN is therefore largely focused on the development of the necessary components and sub-systems to make them meet the actual requirements derived from the two applications.

The challenges deal with factors such as cost, durability, weight, volume and efficiency which all need to be improved. The project has compiled targets for all these factors, which have to be met for commercial products. Based on the commercial targets, project targets have been elaborated which would be a leap forward from today's R&D status towards a commercial product. The plan to meet the project objectives leads to the development and innovation on both a component and system level. A multitude of components and subsystems will be developed and integrated into advanced systems, which will be tested and evaluated.

Description of work

The need for breakthroughs and innovations at the component level in order to meet the project objectives leads to the following developments within HyTRAN:

- innovative 80 kW direct hydrogen stack with strong weight and volume reduction, increased efficiency, durability and start-up time, and with innovative MEAs
- 5 kW reformate fuel-cell stack: work on innovative electro-catalyst and MEA elements, introducing novel catalysts and electrode structures
- innovative humidification/dehumidification apparatus
- heat exchanger and radiator customised for the application
- micro-structured diesel steam reformer and gas purification units.

To validate the progress towards these objectives, two corresponding technical platforms (TP) will be developed and used for assessment:

- TP1 – Powertrain: development of a compact system for traction power by an 80 kW direct hydrogen PEM fuel-cell system implemented in a passenger car
- TP2 – APU: development of a compact 5 kW auxiliary power unit for both light-duty and heavy-duty vehicles, including micro-structured diesel oil steam reformer, clean-up reactors, reformate hydrogen stack and balance of plant components.

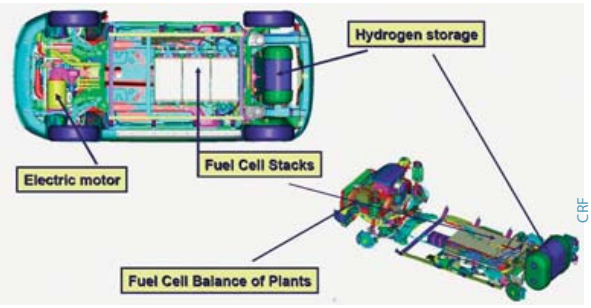
Results

In general, the first three years of the project will be mainly devoted to the development of innovative components to widen the technology. The last two years will then focus on the integration of these components into subsystems, including tests and preparation for implementation into vehicles.

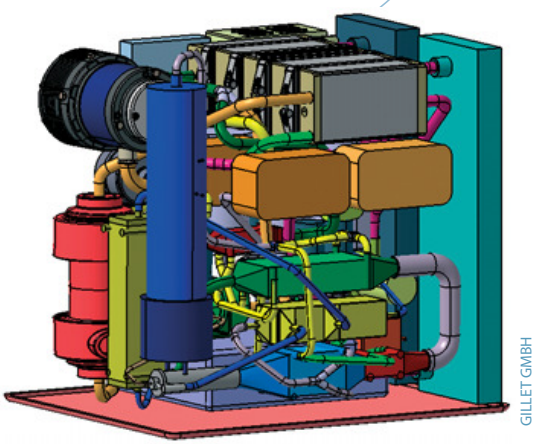
During the first year, the main events for developing the hydrogen fuel-cell platform were stack design, characterising tests, air supply, water and thermal management studies. This work focused on the definition of the specification that could make the realisation of a scalable FC system possible, considering the required characteristics of efficiency and compactness. These activities later resulted in many key issues being identified and 'frozen'. Major efforts have been focused on testing the stack on sensitivity, cycles and durability.

Continued activities have been devoted to developing the key components and providing a viable system design for the diesel-fuelled FC APU system. During the second year, progressive development of the fuel processor, which is a vital part of the APU system, has been made. Catalysts are now available for each stage of the reforming and CO clean-up system, and have been matched to the operating conditions identified from the system modelling activities. Prototype micro-channel plate reactors and fuel and water vaporisers have been designed, constructed and successfully tested.

Keywords: Fuel cell, hydrogen, APU, reformer



TP1: Fuel-cell vehicle



TP2: Fuel-cell APU

Acronym:	HyTRAN	
Name of proposal:	Hydrogen and Fuel-Cell Technologies for Road Transport	
Contract number:	TIP3-CT-2003-502577	
Instrument:	IP	
Total cost:	16,790,538 €	
EU contribution:	8,811,143 €	
Call:	FP6-2002-Transport 1	
Starting date:	01.01.2004	
Ending date:	31.12.2008	
Duration:	60 months	
Sector:	Road	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Development of zero or near-zero emission propulsion (Hydrogen, fuel cells, electric vehicles)	
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Partners:	Centro Ricerche FIAT Società Consortile per Azioni	IT
	REGIENOV (Renault Recherche Innovation acting on behalf of Renault and its subsidiaries)	FR
	Volkswagen AG	DE
	DaimlerChrysler AG	DE
	DAF Trucks NV	NL
	Nuvera Fuel Cells Europe SRL	IT
	Johnson Matthey Fuel Cells Ltd	UK
	OPCON AUTOROTOR AB	SE
	GILLET GMBH	DE
	Weidmann Plastics Technology AG	CH
	ADROP FEUCHTEMESSTECHNIK GMBH	DE
	Rheinisch-Westfälische Technische Hochschule Aachen (RWTH)	DE
	Energieonderzoek Centrum Nederland	NL
	Politecnico di Torino	IT
	Paul Scherrer Institut	CH
	INSTITUT FUER MIKROTECHNIK MAINZ GM...	DE
	Imperial College of Science, Technology and Medicine	UK
	Environment Park S.A.	IT

ILHYPOS

Ionic Liquid-based Hybrid Power Supercapacitors

The ILHYPOS project aims at developing green, safe, powerful and high-energy hybrid supercapacitors for application as peak power smoothing and energy recuperation devices in fuel-cell (PEM) powered electric vehicles and in small energy production plants (such as CHPs).

Background

The demand for clean energy is rapidly expanding worldwide and one of the most promising solutions is non-polluting energy production by fuel cells. Supercapacitors (SCs), due to their capability to deliver high specific power in a few seconds, are considered as electrical energy storage devices for smoothing the short-time power burst required in transport and stationary applications of fuel cells. Commercial SCs are double-layer carbon SCs (DLCS) which make use of electrolyte solutions consisting of a salt dissolved in an organic solvent, which permits relatively high operating voltages (around 2.5 V). The main drawback with these SCs is that the organic solvents do not often fulfil the requirements of environmental compatibility and safety for vapour generation, flammability and explosions. This is the case for DLCSs with acetonitrile-based electrolytes, which are the most common high-voltage DLCSs on the market. The high vapour pressure of these electrolytes requires a careful and expensive thermal control. Temperatures above 40°C, normal in fuel-cell vehicles and CHP (combined heat and power) systems, may cause the degradation of present SCs in terms of performance and safety. The volatility of organic solvents increases sharply with temperature, making SCs potentially unsafe beyond 50-60°C and, generally, non-environmentally friendly with the presence of polluting chemicals.

Objectives

The hybrid SCs to be developed in ILHYPOS are based on the use of ionic liquids as electrolytes and on a novel hybrid configuration using electronic conducting polymers (ECPs) as positive electrodes. Ionic liquids are excellent ionic conductors, virtually non-volatile and thermally stable up to 300°C, with a high working voltage (in excess of 5 V). These properties make ionic liquids excellent candidates as electrolytes in SCs with improved performances: specific energy and power of about 15 Wh/kg and 7 kW/kg can be reached.

The objectives identified to overcome the limitations of present SCs, by searching for materials suitable for ionic liquid-based SCs, are:

1. synthesis of ionic liquids with improved properties (ionic conductivity, electrochemical, chemical and thermal stabilities) at low temperatures (down to -20°C), as well as at 60°C and above
2. synthesis of ECPs optimised for the use as positive electrodes
3. identification of high surface area carbons (e.g. activated and aerogel) optimised for the use as negative electrodes
4. investigation of the electrochemical performance of current collectors. Surface treatments will be developed onto the Aluminium current collectors to decrease the series resistance.

Finally, ILHYPOS SCs do not contain polluting chemicals, largely used in present SC (organic electrolytes substituted by 'green' ionic liquids), thus making them highly innovative products.

Description of work

The project structure logically streamlines and cross-links all the activities related to material R&D, material and cell component scale-up preparation, and design and prototype construction up to final application-

specific testing in order to integrate expertise and equipment better, and to reach the project objectives efficiently and timely.

During Phase 1 (Electrode Materials R&D), academic and basic research organisations work on the optimisation of the electrode and electrolyte materials, significantly improving on the overall technical performances of each single component with respect to the present state of the art. With Phase 2 (Development and Production of SC Materials), the focus will be on the scale-up processes for optimising the material production. In Phase 3 (Application Requirements and Full-scale Prototype Production), a specific application study will be performed by two end users in collaboration with a research organisation as a hybrid vehicle configuration investigator, and, based on these studies, hybrid SC components will be designed and assembled in the final prototypes. In Phase 4 (Application Testing), testing procedures will be developed and used to verify the performance of the prototype experimentally with the respect to the project targets, which are competitive with present SC performance.

Results

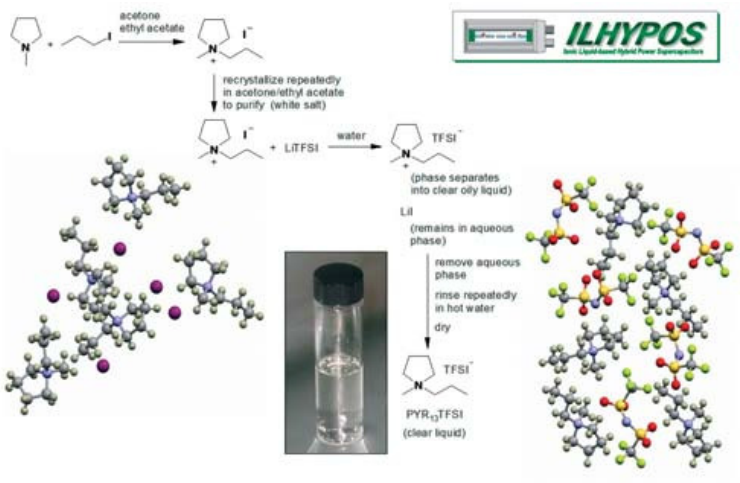
The expected results and deliverables from the ILHYPOS project are manifold and various in natures: scientific, technological and market-oriented with social and economical impacts. To reach the planned targets, the ILHYPOS participants will:

- prepare ionic liquids in large amounts, demonstrated at a level of 50/100 grams and extended to the level of at least 2 kg per batch
- prepare ECPs in large amounts, demonstrated at a level of 50/80 grams and extended to the level of at least 2 kg per batch
- prepare electrodes in large amounts, demonstrated at a level of 1-10 cm^2 and extended to the level of at least 1 m^2 per batch
- develop the LAMCAP® technology (soft-packaged laminated SCs), which should improve the performance of the hybrid SCs greatly (specific energy and power)
- compare the performances obtained with the requirements for fuel-cell vehicles and CHP applications.

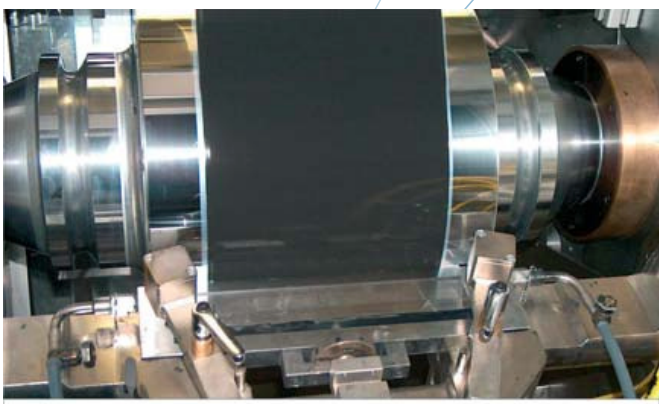
The ILHYPOS achievements will favour:

- the positioning of Europe as a leader in the new field of high voltage and environmentally safe SCs and leadership in the field of ionic liquids
- the relief from more polluting chemicals largely used in present SCs (organic electrolytes substituted by 'green' ionic liquids)
- a green future based on hydrogen and fuel cells, by favouring a larger and faster introduction of cleaner vehicles, and small and more efficient delocalised power generation systems.

Keywords: FC vehicles, CHP systems, ionic liquids, electronic conducting polymers, green supercapacitors



Synthesis route of low-temperature ionic liquids



Example of foil production equipment

Acronym:	ILHYPOS
Name of proposal:	Ionic Liquid-based Hybrid Power Supercapacitors
Contract number:	TST4-CT-2005-518307
Instrument:	STP
Total cost:	2,866,168 €
EU contribution:	1,643,184 €
Call:	HYDROGEN - 1
Starting date:	01.12.2005
Ending date:	30.11.2008
Duration:	36 months
Sector:	Road
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Development of zero or near-zero emission propulsion (Hydrogen, fuel cells, electric vehicles)
Website:	http://www.enea.it
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MC-WAP

Molten-carbonate fuel Cells for Waterborne APplication

MC-WAP is aiming at the application of the molten carbonate fuel cell technology onboard large vessels, such as RoPax, RoRo and cruise ships for auxiliary power generation purposes. MC-WAP aims to improve the performance of the system to allow an efficient application onboard.

Background

The use of fuel cells for marine applications constitutes a new market. Existing fuel cells (FC) for ships are only available on a prototype status and at low power. However, major ship manufacturers worldwide have announced commercialisation of fuel-cell ships in the next decade and most of them are working on this. These commitments have initialised a significant process of research and development on fuel-cell-driven boats and their components such as the fuel-cell stack itself and the necessary auxiliaries such as compressors, reformers, etc.

The market share of vessels hosting alternative auxiliary power units (APUs) for the year 2008 is estimated to be about 3%, rising to 10% in 2015-2020; most market forecasts envisage a growth in the use of alternative drive systems. The development of an APU may pave the way for the introduction of fuel cells for propulsion. Since fuel cells can provide electrical energy with much higher efficiency than the generator in ICE vehicles, APUs that convert diesel to electrical energy in order to cope with the ever increasing electric power demand in modern ships are an attractive option. APUs can be an early application, where the vehicle manufacturer and supplier industry can build up competence, experience and manufacturing capability, before later taking the next step where fuel cells are used as a prime power unit.

Objectives

The main objective of the MC-WAP project is the development, construction, installation onboard ship and testing of a 500 KWe APU based on molten carbonate fuel cells (MCFC). This ambitious goal perfectly fits the requirements of the Joint Call FP6-2004-Hydrogen regarding an IP instrument to cover "Generic RTD on components and systems development and integration for fuel cell systems … for auxiliary power units (APUs) in the power range100kW to 500kW for … ships". This challenge has never been attempted before on such a large scale and with a molten carbonate (MC) fuel cell technology.

Description of work

The work programme includes the following tasks:

- the improvement of the performance of MC fuel cells and of their components, to allow an efficient, reliable and safe use of them on board
- the improvement of the performance of the reformer technology and of its components, to allow an efficient, reliable and safe application in marine conditions
- the achievement of the best integration between the MC fuel cells and the reformer
- the design, construction, installation onboard and testing of a 500 kWe auxiliary power unit, powered by molten-carbonate fuel cells and fuelled by diesel oil
- the definition and design of a new lay-out for one or more selected typologies of ships, in which the traditional diesel generators for auxiliary power will be (entirely or partially) substituted by FC systems (APU) fuelled by diesel oil, mainly characterised by efficiency, safety and reliability, and perfectly integrated with all other plants, systems and facilities onboard.

Acronym:	MC-WAP	
Name of proposal:	Molten-carbonate fuel Cells for Waterborne APplication	
Contract number:	TIP4-CT-2005-019973	
Instrument:	IP	
Total cost:	17,173,480 €	
EU contribution:	9,899,413 €	
Call:	HYDROGEN - 1	
Starting date:	01.09.2005	
Ending date:	31.08.2010	
Duration:	60 months	
Sector:	Waterborne	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Development of zero or near-zero emission propulsion (Hydrogen, fuel cells, electric vehicles)	
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	Politecnico di Torino	IT
	TECHNIP KTI SPA	IT
	Turkiye Bilimsel ve Teknik Arastirma Kurumu	TR
	RINA SPA	IT
	Johnson Matthey Fuel Cells Ltd	UK
	Oel-Wärme-Institut GmbH	DE
	ADROP Feuchtemesstechnik GmbH	DE
	PROMEOS GmbH	DE
	Friedrich-Alexander-Universität Erlangen-Nürnberg	DE
	National Technical University of Athens	GR
	Institute of Chemical Technology Prague	CZ

POMEROL

Realizing Enhanced Safety and Efficiency in European Road Transport

POMEROL intends to develop high-powered, low-cost and intrinsically safe lithium-ion batteries by using a breakthrough in materials. The materials and batteries will be used for fuel-cell hybrid and conventional hybrid drivetrain automotive applications.

Background

The technology to be addressed in POMEROL is on Li-ion batteries for hybrid vehicles, primarily for fuel-cell hybrid vehicles (FCHEV). Several years of intensive worldwide R&D efforts have been dedicated to solving the problems of lithium metal cycling efficiency in rechargeable lithium batteries. In the early 1990s, metallic lithium was replaced by a carbon anode able to form intercalation compounds, so-called Li-ion. The potential use of this battery technology for the ICE-HEV automotive applications and fuel cells under development is clearly a highly important issue and is responsible for a major part of the size, weight and cost challenges facing all organisations in the attempt to reach a true market position for these applications.

With an adequate choice of materials, a very long life cycle can be achieved. However, cost, abuse tolerance and power remain major issues for the technology development in hybrid drivetrains.

Objectives

The challenging objective is to develop new materials, which will greatly reduce the cost of high-power lithium-ion batteries to €25/kW, one of the very critical issues for a widespread development of this technology for fuel-cell hybrids. This objective will be achieved, along with two others, to provide a high-power battery with a long life and an intrinsically safe electrochemistry. Technical and cost specifications are targeted for the battery, the cell and each new material to be developed in order to reach these goals.

POMEROL will provide a technological breakthrough ahead of the state of the art for adapted materials for Li-ion batteries in the following required domains:

- low cost, high-power materials for positive and negative electrodes
- highly stable positive electrode materials with adequate power levels
- stable non-reactive electrolytes.

Description of work

We propose innovative solutions through the development of speciality materials (LiFePO4, lithiated metal fluorinated oxides, non-flammable ionic liquid-based electrolytes and high-performance graphitised carbons), which will respond to the very ambitious challenge of adequate low cost, safety and life. POMEROL combines the complementary skills of seven industrial partners and specialised subcontractors, all having proven expertise in the research, development and production of materials and batteries. Having automotive end-users, material suppliers and a battery maker in the Consortium will allow for a rapid validation of the results, saving time and resources.

Results

The aim of POMEROL is to develop high-power Li-ion batteries as core breakthrough technology for hydrogen, fuel cell hybrid systems and ICE-HEV for automotive applications.

The deliverables of the project include deliveries of the new materials scaled-up during the contract, the

design of clean and efficient processes to use these materials inside Li-ion batteries, the assembly and test of Li-ion cells/modules using these new products.

The work will contribute to EC priorities through beneficial effects on the cost, environment (reduced fuel consumption and exhaust emissions of urban transport) and more efficient energy use and storage thanks to high efficiency batteries.

When successful the batteries developed in Pomerol will contribute to Li-ion batteries being increasingly recognised as a generic clean battery technology that will apply to all fields of energy storage including:

- automotive applications, as the main target, with the aim to achieve fuel savings >25% over the next 10 years. Emissions of CO_2/pollutants will be reduced accordingly.
- a large number of standby and stationary applications including association to renewable energy based power systems (DER and RES).
- LEO or GEO satellites.
- portable applications, where it has become the reference technology

Acronym:	POMEROL	
Name of proposal:	Realizing Enhanced Safety and Efficiency in European Road Transport	
Contract number:	TST4-CT-2005-019351	
Instrument:	STP	
Total cost:	4,863,845 €	
EU contribution:	2,470,953 €	
Call:	HYDROGEN - 1	
Starting date:	01.12.2005	
Ending date:	30.11.2008	
Duration:	36 months	
Sector:	Road	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Development of zero or near-zero emission propulsion (Hydrogen, fuel cells, electric vehicles)	
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	Merck KGaA	DE
	TIMCAL Ltd.	CH
	UMICORE	BE
	Volkswagen AG	DE

CALM II

Advanced Noise Reduction Systems

Further efficient reduction of transport noise requires intensive research. CALM II aims at coordinating European research for advanced transport noise mitigation, in particular facilitating interdisciplinary networking and dissemination of knowledge, and at further development of the CALM strategic research plan. All transport modes are concerned: road, rail, waterborne and aeronautic together with outdoor equipements.

Background

Over the last 30 years, noise reduction has become an increasing priority for legislation and research, both at national and European level. Despite substantial improvements, today's noise pollution is still a major concern of European citizens, with transportation as the main source of noise.

An estimated 80 million Europeans (ca. 20 % of the EU population) suffer from unacceptable noise levels. Estimations of the related annual financial damage lie between 0.2 and 2 % of the gross domestic product. This is an important societal problem. As mobility is a basic human need and an essential precondition for economic prosperity and growth in an enlarging EU, the adverse effects of noise must be reduced, while allowing a continued growth in freight and passenger transport.

Regulations limiting the noise emission from vehicles have been successful but not sufficient in the past. The Environmental Noise Directive 2002/49/EC (END) strives for avoiding, reducing or preventing harmful effects on human health. Therefore a major goal for future research is the transformation of END and the further development of noise policy covering the wide fields of noise assessment and abatement, new technologies and methodologies for improved noise control at source, and the future development of legislative standards.

The EC has published substantial noise reduction targets for the future, medium and short term, which can only be achieved by system approaches that involve research from all concerned areas. One general target is to find common research issues for road, rail, aeronautic and maritime transport utilising a maximum of synergies.

Objectives

The overall strategic objective is the synchronisation and encouragement of European transport noise research through a holistic system approach involving all related research areas. CALM II is designed to facilitate the networking of organisations, the coordination of activities and the exchange and dissemination of knowledge so as to optimise research efforts, reach critical mass, strengthen the complementarity and coherence of noise research objectives and enhance the impact at a European level.

Further aims are:

- monitoring European research activities and identification of research synergies
- identifying remaining research needs and setting research directions leading to updated noise research strategy plan
- considering the situation in the new Member States and integrating the demands of national research initiatives
- supporting the exploitation and dissemination of European noise research results
- increasing public awareness of environmental noise and the awareness of noise research with young people (e.g. by involving promising young researchers with CALM II workshops).

Description of work

The whole work programme is split into five work packages (WP).

WP1 (Networking of European transport noise research activities) is designed for the monitoring of European noise research activities and noise abatement technologies at EU and national level across all relevant research areas of transportation noise, including outdoor equipment and generic issues like noise exposure, health and socio-economic aspects, city planning and infrastructure. The most important recent research activities are summarised in an inventory called the Blue Book. For identification of the remaining gaps and discussion of the needs for further research in an open dialogue, workshops are held with industry, research organisations and public authorities.

WP2 (Sectoral integration of different areas of transport noise research) improves the coordination and information exchange between different noise sectors and platforms with specific workshops together with the European technology platforms ACARE (aeronautics), ERRAC (rail), ERTRAC (road) and WATERBORNE (maritime).

WP3 (Noise research strategies) is designed for identifying technology gaps and research needs which is done in close co-operation with the European Noise Working Groups. This gives the input for the updating of the CALM Strategy Paper 2004, which is done twice within CALM II.

WP4 (Dissemination and exploitation of results) is focused on the information transfer and dissemination of results amongst all stakeholders, with a special focus on the new Member States and with specific workshops.

WP5 (Network management, coordination and administration) ensures an effective execution of the project including all administrative services like the organisation of meetings, reporting, etc.

Results

All results of CALM II are published on the project website. So far, the results comprise the reports of three workshops (one large workshop with RTD project coordinators for exchange of knowledge and results, and two specific workshops for identifying technology gaps and future research needs); the continuous updating of the CALM project database (with over 800 entries); the continuous maintenance of the homepage (now including a public calendar with major events on environmental noise in Europe) and the Blue Book, which is an inventory of 105 noise research projects and also contains a CD with all data in electronic format. An update (electronic, not printed) of the CALM Strategy Paper 2004 is under preparation and is to be published by the end of 2006. The update is focused on the latest information on the noise research road maps for air, rail and road traffic.

Keywords: Noise research, environmental noise, future noise policy

Latest outcome of CALM II: the Blue Book with CD-ROM

New Technologies and Concepts for all Surface Transport Modes
(Road, Rail and Waterborne)

Acronym:	CALM II
Name of proposal:	Advanced Noise Reduction Systems
Contract number:	TCA4-CT-2005-516237
Instrument:	CA
Total cost:	500,000 €
EU contribution:	500,000 €
Call:	FP6-2003-Transport 3
Starting date:	01.11.2004
Ending date:	31.10.2007
Duration:	36 months
Sector:	Multi
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Development of holistic noise abatement solutions
Website:	http://www.calm-network.com
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CANTOR

Coordinating Noise Transportation Research and Engineering Solutions

CANTOR brings together a number of the major European academic/research institutes in acoustic research, and engages a series of experts from government agencies and the vehicle manufacturing industry chain (from system to component level for both road and rail), to focus on a way of improving vehicle noise performance.

Background

Within the next few decades the European vehicle industry will face a formidable task concerning noise pollution in urban areas. In the past, the noise and vibration research efforts in vehicles have been considerable but, despite this, no real breakthrough regarding new solutions of noise reduction can be claimed. Sustainable development in vehicle engineering, i.e. to save natural resources with respect to material and energy, requires lightweight, low-drag design, etc. However, a strict lightweight design contradicts requirements such as low noise, safety and functionality. The main reasons for such poor results are the fragmentation of European research and the lack of lasting co-operation between universities and industry. This negative trend must be broken.

Objectives

The overall aim of CANTOR is to engage experts from the vehicle manufacturing industry chain from system to component level, government agencies and renowned research groups, to focus jointly on improved performance with a reduced impact on the environment, enabling a balanced system cost and maintaining comfort in road, rail and waterborne vehicles.

The means to achieve this goal is by accumulating and transferring the technology of existing knowledge and information on new prediction tools, measurement techniques, research plans and material data, as well as on new educational programmes applied to vehicle acoustics.

The aim is also to formulate new joint research programmes between industry and universities. The mobility of personnel within the consortium would be automatically stimulated by the partnership, enabling inter-research institute fast-track exchange and highly relevant cross-fertilisation effects. The results will be disseminated at seminars, meetings and workshops. The project, which has a research and educational base, will be complementary to such ongoing EU projects as EURNEX, CALM, SILENCE, QCITY and INMAR.

Description of work

The project seeks to reach its objectives through delivery studies on the nine principle areas of work in the project:

1. Coordination of industrial and SME partners
2. A catalogue of industrial and societal requirements
3. Information of ongoing research activities
4. Formulation and dissemination of a research strategy agreement
5. Short-term exchange of personnel
6. Marketing and coordination of educational programmes
7. Coordination of advanced short courses
8. Publicise prediction models, measurement techniques and a database of new materials
9. A catalogue of research laboratory facilities.

An exploitation and strategy plan, mainly based on the selection of topics and partners within industrial, academic and governmental bodies for specific applications within EU programmes will be organised. Furthermore, the consortium participants will use the newly developed knowledge for high-level teaching to their students and in running short courses aimed at wider academic and industrial audiences. They also expect to benefit in terms of possible participation in other transportation industrial research projects. Through integrated committees this CA will deal with exploitation plans.

The members of the Advisory Board are Bombardier and Scania (SE), Umweltbundesamt and Müller- BBM (DE), SNCF and Akeryards (FR), LMS (BE) and FIAT (IT), who will identify the main problem areas or bottlenecks facing the industry whilst pursuing the goals set with respect to the reduction of noise pollution. Within each CANTOR work package, reports will be completed on existing and possible future methods for solving these by the industry identified problems. Limitations, as well as ongoing modifications and improvements, will be summarised, together with proven and possible future applications. Ongoing and if possible planned research activities within each field will also be listed.

Results

The co-operation among the laboratories in CANTOR will enforce common best-practice protocols and experimental techniques in their work to make it possible for a better comparison between their results. These unified procedures, and material specimens possibly associated to them, may have a strong impact on facilitating the integrated work and advances in the RTD effort within the research community. Besides this, the jointly agreed techniques and material specimens may evolve into noise standards and reference materials, which may be later proposed to European institutions for further unified use in industry normalisation activities and environmental noise control.

Acronym:	CANTOR	
Name of proposal:	Coordinating Noise Transportation Research and Engineering Solutions	
Contract number:	TCA5-CT-2006-031331	
Instrument:	CA	
Total cost:	964,000 €	
EU contribution:	600,000 €	
Call:	FP6-2005-Transport 4	
Duration:	months	
Sector:	Multi	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Development of holistic noise abatement solutions	
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	Technical University of Berlin	DE
	KU Leuven - Research and Development	BE
	University of Southampton	UK

INQUEST

Information Network on QUiet European road Surface Technology

The project aims at coordinating the dissemination of research on the use of low-noise road surfaces in European countries that have less access and experience in that field. A complementary objective is to promote European harmonisation in the field of road-surface noise classification.

Background

Recent estimates indicate that more than 30% of EU citizens are exposed to road traffic noise levels above that which is viewed acceptable by WHO, and that about 10% of the population report severe sleep disturbance because of transport noise at night (EEA, 2003). The application of road traffic noise mitigation measures to address the problem of road traffic noise is by no means fully developed. Several problems exist which interfere with the effective control of noise emission from roads. In the EU Green Paper on future noise policy published in 1996 (Commission of the European Communities, 1996), it is estimated that in Europe the external costs of traffic noise, which take account of such factors as quality-of-life costs and effects on health, are 0.2-2% of GNP. In total, therefore, a rather significant part of the economy of Member States is affected by noise impact and noise reduction policies. In the same Green Paper, the significant potential for road traffic noise reduction by the use of special low-noise road surfaces was mentioned as a major issue. An EU-funded project, SILVIA, completed in August 2005, has developed a Guidance Manual that aims to make it possible to derive the full benefit from this kind of noise control approach by using noise-reducing surfaces.

Objectives

The general objective of the proposed project is to foster the use of low-noise road surfaces throughout Europe.

To that end, the first specific objective is to disseminate the knowledge, technology and guidelines developed by the SILVIA project as well as relevant aspects from other projects including SILENCE, ITARI, IPG and Leiser Strassenverkehr. This will be achieved by means of workshops for decision-makers, road authorities, contractors, road engineers and policy-makers in European countries that were not involved in SILVIA. Priority will be given to the new Member States, which, in general, have less experience in the field of traffic noise control.

The second specific objective is to set up a users' network and operate the equipment and procedures developed by SILVIA for classifying and labelling low-noise materials and technologies, testing their conformity of production, and certifying the testing and measurement apparatus. The purpose is to encourage European harmonisation of equipment and procedures and interchangeability of the results with a view to providing a strong base for the future standardising work at CEN level.

Description of work

The work is divided into three work packages (WP).

WP1 'Workshops': the organisation of regional workshops in six countries, with an invitation to the 14 neighbouring countries that were not involved in the SILVIA project. The programme of these workshops will mainly consist of presenting the most recent knowledge about using low-noise road surfaces for traffic noise control. It will also give local stakeholders a chance to present the views of their country.

WP2 'Users Group': setting up a users' network for the classification system proposed by the SILVIA project. The system associates a labelling (or type approval) procedure and a conformity of production testing

procedures. It also includes certification procedures for the equipment used in the classification activity. Expertise can also be exchanged and developed within the group so as to prepare the ground for future CEN standards.

WP3 'Management': this covers the general management of the project.

Results

The deliverables are:

D01 to D06: the six workshops and their proceedings

D07: the set up of the users group and the report of its initial meeting

D08: the final activity report of the project.

The impact of the project will be to develop the use of the principles and procedures of the SILVIA Guidance Manual as widely as possible across the EU. The project will provide road authorities with the necessary tools to procure low-noise road surfaces and raise the awareness of the decision-makers about the benefits of implementing low-noise road surfaces while encouraging, as a result of the users group, an effective implementation. Road authorities will be better informed and aware of the potential benefit of resorting to low-noise surfacing technology so that they will support the necessary standardisation work. Due to the knowledge disseminated through the workshops and to the initiation of a users group, they will be able to send competent, motivated experts in the appropriate standardisation and regulation groups at national, as well as European, level.

Acoustic classification, labelling and conformity of production procedures for road surfacing are currently on the agenda of standardisation organisations, namely ISO and CEN. In order to achieve a consensus on a standard, there are two basic prerequisites: namely that a majority of Member States have sufficient experience of the methods and equipment to be standardised and that those methods and equipment are already sufficiently similar and comparable. This is not yet the case. The project will stimulate the acquisition of measuring equipment and the use of procedures set up by SILVIA in those countries not already suitably equipped, and favour the harmonisation of those methods and equipment throughout Europe.

Thus the project will encourage the use of an effective instrument in the implementation of the EU Directive on Environmental Noise (particularly with regard to the action plans due by July 2008 and every five years thereafter).

Keywords: Transport infrastructure noise emissions road engineering

Acronym:	INQUEST
Name of proposal:	Information Network on QUiet European road Surface Technology
Contract number:	TCA5-CT-2006-031409
Instrument:	CA
Total cost:	199,996 €
EU contribution:	199,996 €
Call:	FP6-2005-Transport 4
Starting date:	01.06.2006
Ending date:	31.05.2008
Duration:	24 months
Sector:	Road
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Development of holistic noise abatement solutions
Website:	http://www.trl.co.uk/silvia
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Partners:	Danish Road Institute - Road Directorate DK Forum of European National Highway Research Laboratories BE

QCITY

Quiet City Transport

This project will develop an integrated technology infrastructure for the efficient control of ambient noise from road and rail. The activity supports the European noise policy to eliminate harmful effects of noise exposure and decrease levels of transport noise, especially in urban areas, deriving solutions that will ensure compliance with the constraints of legislative limits.

Background

The project objectives are fully compliant with the requirements and needs of the final end users: municipalities and industry. The municipalities and industry need, in order to comply with EC regulations, to create noise maps, identify and analyse the noise hot spots and quiet areas, and prepare proper action plans. The QCITY project addresses this need by providing the municipalities with the tools to meet these requirements (eventually through service providers) and to provide industry with products that enable them to carry out the provisions of the action plans. All the choices made in this work plan and in the partner selection have to be seen from this single point of view: the proposed solutions have to be relatively easy to implement in a short time by the municipalities (as part of the action plans), they have to be generally applicable, perform at low cost and be accepted by all parties involved. Solutions which require, for example, changes in the vehicle design (e.g. new powertrains) are not compliant with the above. This is why the involvement of vehicle manufacturers is small. Highly critical is the involvement of the tyre manufacturer, Goodyear, and wheel set manufacturer, Lucchini, since solutions at vehicle/infrastructure interface are much easier to implement in time and have a significant effect.

Objectives

QCITY proposes a range of measures and solutions that can realistically be integrated both from an economic, as well as a practical, point of view in the action plans, which the cities (municipalities) will have to produce as a consequence of the EC Noise Directive 2002/49/EC. QCITY starts with the identification of hot spots on existing noise maps from a large number of cities. Some noise hot spots are then researched in detail with specific software in order to find the root cause of the problems. Various solutions will be studied for each of the selected hot spots and their effects determined, also considering the number of people affected and the degree of impact. Besides addressing transport noise problems with conventional technical solutions, QCITY incorporates issues such as traffic control, town planning, architectural features, noise perception issues, intermodal transport, change between transport modes, traffic restrictions, enforcement measures, economic incentive measures, introduction of hybrid vehicles and new guided public transport vehicles. In the first phase, the emphasis will be on noise mapping, and on the conceptual design of the considered solutions and their potential impact. In the second phase, the most promising solutions will be designed in detail for a specific hot-spot problem selected in each participating city. The solutions will be implemented «in situ» and validated.

Description of work

QCITY is a four-year project divided into seven different subprojects (SP).

SP1: Noise maps and modelling - handles the analysis of hot spots on city noise maps, which includes detailed analysis with the aid of simulations and measurements.

SP2: Vehicle sources - aims at the development and validation of pertinent tools for noise control at source from road and rail traffic, including traffic control measures.

SP3: Vehicle/infrastructure interface - addresses the development and validation of tools for noise control that examine and can analyse measures for the vehicle/infrastructure interface for road and rail traffic (tyre/road, wheel/rail).

SP4: Propagation and receiver parameters - tackles the development and validation of tools that investigate the influence of sound propagation and receiver parameters, including measures relating to town planning.

SP5: Design and implementation of solutions at validation sites - uses the final detailed designs of all retained solutions and implements these solutions for validation in the cities concerned. The validation sites will also be used for dissemination and promotional purposes.

SP6: Consolidation – Action plans – Dissemination - collects and consolidates all data from the various SPs and bundles them into an action plan that will be disseminated to all interested stakeholders.

SP7: Management - maintains total oversight of the project.

Results

The QCITY project will produce two comprehensive action plans: the first one aims at the general improvement of the noise climate, whilst the second one addresses solutions to noise complaints. The noise action plan consolidates the noise reduction measures from the various SPs and provides overviews of reduction through traffic planning, through the reduction of emissions from road and rail traffic, through noise barriers and physical town planning. The overview will consist of lists of possible measures and a set of features associated with each measure. These include the expected noise reduction, the cost and limitations in applicability. The overviews are translated in such a way that, when used in conjunction with noise maps, cities can use them to make a first selection of possible measures for their noise action plan. The handling of complaints will be based on a toolbox with specific measures to reduce specific localised noise emissions from road and rail traffic. The toolbox will also include a set of features associated with each measure that includes the expected noise reduction, the cost and the limitations in applicability.

Acronym:	QCITY	
Name of proposal:	Quiet City Transport	
Contract number:	TIP4-CT-2005-516420	
Instrument:	IP	
Total cost:	13,529,711 €	
EU contribution:	7,399,662 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.02.2005	
Ending date:	31.01.2009	
Duration:	48 months	
Sector:	Multi	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Development of holistic noise abatement solutions	
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	Akron	BE
	Amec Spie Rail	FR
	Alfa Products & Technologies	BE
	Swedish National Rail Administration (BANVERKET)	SE
	Composite Damping Material	BE
	Havenbedrijf Oostende	BE
	Frateur de Pourcq	BE
	Goodyear SA	LU
	Head Acoustics GmbH	DE
	Heijmans Infra	BE
	Kungliga Tekniska Högskolan	SE
	Vlaamse Vervoersmaatschappij De Lijn	BE
	Lucchini Sidermeccanica SpA	IT
	NCC Roads AB	SE
	Stockholm Environmental & Health Administration	SE
	Société des Transports Intercommunaux de Bruxelles	BE
	Netherlands Organisation for Applied Scientific Research	NL
	Gothenburg - Traffic and Public Transport Authority - Environmental Office	SE
	TRAM SA	GR
	Traffic, Transportation & Environment Consultants Ltd	GR
	The Chancellor, Master and Scholars of the University of Cambridge	UK
	University of Thessaly	GR
	voestalpine Schienen GmbH	AT
	Zbloc Norden AB	SE
	Union of European Railway Industries	BE

SILENCE

Quieter Surface Transport in Urban Areas

SILENCE develops an integrated system of methodologies and technologies for the efficient control of urban traffic noise. This takes into account the overall needs of city authorities with respect to noise creation from individual traffic (on road) and mass transport (on rail and road). A holistic treatment is made of all traffic noise facets: urban noise scenarios, individual noise sources, infrastructure, traffic management, noise perception and annoyance.

Background

For decades, European policy-makers have concentrated on regulating noise emission from sources such as road and rail vehicles, aeroplanes and other equipment by fixing maximum sound levels, which has resulted in significant noise reduction from individual sources. For example, noise from individual cars has been reduced by 85% since 1970 and noise from trucks by 90%. However, no consideration has been given to reducing noise emission in urban areas and for some sources, such as railways, there was no EU legislation setting noise creation limits. As a result of this, and in response to the regulatory gap, the Commission Directive 2002/49/EC, relating to the assessment and management of environmental noise, was adopted. Its main aim is to provide a common methodology to address noise problems across the EU and it is in this context that the activities of SILENCE are to be seen.

Objectives

The main objective of SILENCE is the development of integrated methodologies and technologies to improve control of surface transport noise in urban areas.

The aspects are:

- control at source
- noise propagation
- noise creation
- human perception

for road, rail, infrastructure and cities.

SILENCE will provide:

- relevant and world-leading technologies to assure efficient control of surface transport noise
- innovative strategies for action plans for urban transport noise abatement and practical tools for their implementation
- a significant reduction of people's exposure to noise, especially under real urban conditions.

The expected outcome of the project is a reduction of noise emission in urban areas of up to 10 dB(A).

Description of work

SILENCE is divided into different subprojects (SP) and work areas, each concentrating on a specific noise-related issue. All the SPs form an integrated system with the participation of the various stakeholders: city authorities; public urban transport operators; national operators of railway traffic and road/rail infrastructure; public research institutes and universities; research and engineering companies; European associations; vehicle manufacturers and integrators; suppliers of equipment, systems and technology for vehicles/infrastructure; specialist SMEs.

The SILENCE subprojects are:

a. Noise perception, annoyance
b. Global modelling
c. Vehicle/tyre/road interaction
d. Road vehicle noise
e. Rail vehicle noise
f. Road surface
g. Railway infrastructure and operation
h. Road traffic flow
i. City planning
j. Dissemination and training
k. Consortium management

The SILENCE project is working in close co-operation with other complementary research initiatives and takes into account the outcome of previous research projects.

Results

The positive results of SILENCE will benefit the overall population of the EU and will contribute to an improved quality of life of European citizens. Advanced noise reduction technologies and methodologies, and the improvement of development processes by decreasing development time and cost, ensure the leadership of European stakeholders and the competitiveness of the industry. The dissemination and training activities will be aimed to stimulate young engineers interest in noise research activities.

Selected deliverables:

- Identification of annoying acoustic components of vehicles in order to develop guidelines for individual source-oriented noise reductions
- A global modelling tool for road and rail applications to predict noise radiation into the environment
- Design and hardware solutions for noise reduction with respect to vehicle/tyre/road interaction, under typical (sub-)urban conditions
- Experimental and calculation tools and advanced noise reduction technologies for road vehicles
- Highly efficient systems and technologies for trams, metros, freight and suburban trains for noise reduction and control
- Advanced integral design and maintenance of lower noise road surfaces
- Noise reduction solutions for rail infrastructure and operation
- A toolkit for cities with practical urban traffic management techniques for noise reduction
- Guidance for implementing noise action plans in cities.

For further information visit the website and participate in SILENCE dissemination events or international conferences with SILENCE presentations.

Keywords: Urban transport, environmental noise, noise reduction technologies and methodologies

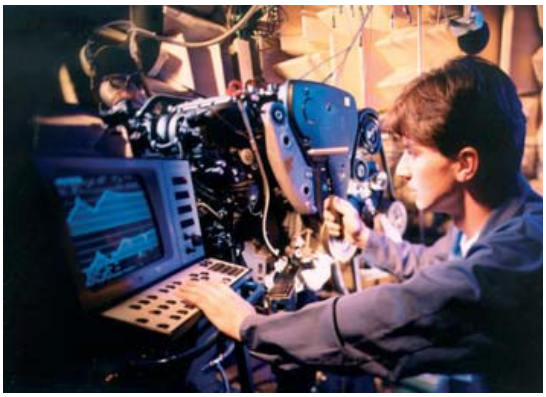

Photo by AVL

Engine testing

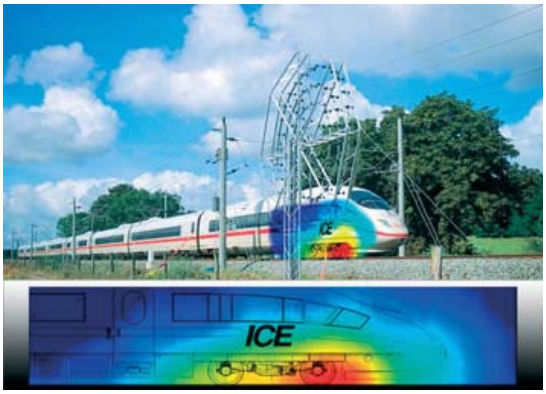

Photo by Deutsche Bahn

ICE train

New Technologies and Concepts for all Surface Transport Modes
(Road, Rail and Waterborne)

Acronym:	SILENCE	
Name of proposal:	Quieter Surface Transport in Urban Areas	
Contract number:	TIP4-CT-2005-516288	
Instrument:	IP	
Total cost:	15,808,885 €	
EU contribution:	8,900,000 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.02.2005	
Ending date:	31.01.2008	
Duration:	36 months	
Sector:	Multi	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Development of holistic noise abatement solutions	
Website:	http://www.silence-ip.org	
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	Continental	DE
	FEHRL - Forum of European National Highway Research Laboratories	BE
	SNCF - Société Nationale des Chemins de Fer Français	FR
	POLIS - Promotion of Operational Links with Integrated Services	BE
	Renault	FR
	Volkswagen	DE
	Volvo Technology	SE
	AEA Technology Rail BV	NL
	ALSTOM Transport	FR
	Bombardier Transportation	DE
	Brüel & Kjaer Sound & Vibration Measurement	DK
	Dynamics, Structures & Systems International	BE
	University of Southampton	UK
	Rieter Automotive Management	CH
	Sintef - Stiftelsen for industriell og teknisk forskning ved Norges tekniske høyskole	NO
	STIB - Société des Transports Intercommunaux de Bruxelles	BE
	Technical University of Berlin	DE
	Adam Mickiewicz University	PL
	AnsaldoBreda	IT
	Universita Politecnica delle Marche	IT
	Chalmers Tekniska Hoegskola	SE
	University of Hannover	DE
	Institut National des Sciences Appliquées de Lyon	FR
	Laboratoire de Mécanique et d'Acoustique (CNRS)	FR
	LUCCHINI SIDERMECCANICA	IT
	M+P Raadgevende Ingenieurs bv	NL
	RATP - Régie Autonome des Transports Parisiens	FR
	TÜV NORD Mobilität	DE
	Trenitalia	IT
	Corus UK Ltd, trading as Corus Rail	UK
	VIBRATEC	BE
	Kungliga Tekniska Högskolan	SE
	Administration de l'Equipement et des Déplacements Brussels	BE
	Comune di Genova, Unità di Progetto Piano Urbano della Mobilità e Trasporti	IT
	Autostrade per l'Italia	IT
	Skanska	SE
	Bristol City Council	UK
	Disseny de Sistemes i Desenvolupament, Barcelona	ES
	Brussels Institute for Environmental Management	BE
	Dublin Institute of Technology	IE
	City of Munich	DE
	BRUITPARIF - Observatory for Noise in the Ile-de-France region	FR

IMPECC2

Infrared Microsystem for Polluting Emission Control on Cars 2

An in-vehicle sensor, detecting hydrocarbons (HCs), carbon monoxide (CO) and particles in the exhaust is to be developed using the spectroscopic narrow-band absorption technology in infrared. The fast response will make it possible to control emissions during transient operating conditions.

Background

In order to address the future near-zero emissions for transport vehicles, a fast response, onboard measurement system for exhaust gas components is an excellent tool for the control of internal combustion engines (ICE) and advanced exhaust after-treatment systems, as well as the specific vehicle emission performances (on board diagnostics, for example). This system is intended to achieve accurate and reliable exhaust gas emission measurements for the detection of several gas species, respecting competitive costs as well as the necessary required durability. To be able to fulfil these stringent requirements an onboard gas sensor, based on the infrared optical technology, has been developed. Narrow band emitters, based on a resonant micro-cavity design, have been realised for the respective absorption bands of the various gas constituents to be detected and measured with a single broad spectral band detector, also developed within the framework of this project.

This technology is applicable for a variety of transport modes: road and railway, marine propulsion sector, as well as the aircraft industry. The sensor system specifications have been defined to comply with those various fields of applications. Beside exhaust gas particles, fast sensor response times are targeted to transfer the advantage of fast optical measurements into in-situ internal combustion engine control strategies.

Objectives

The sensor system specifications have been defined to comply with the various fields of applications. Fast sensor response times are targeted on one side to transfer the advantage of fast optical measurements into in-situ ICE control strategies. On the other side, accurate and absolute low-level exhaust gas concentration values are targeted for exhaust after-treatment control and diagnostics. The reference transparency measurements, necessary to correct for any opacity changes in the optical path, shall also be used to extract the information on the exhaust gas particle content. The sensor will comply with the typical automotive reliability requirements.

The entire sensor system was developed in respect of these technical boundary conditions but also to comply with the typical automotive environmental (packaging, temperature, vibrations, robustness, durability, etc.) specifications and the representative commercial targets.

Description of work

Narrow band emitters, based on a CdxHg1-xTe resonant micro-cavity design, have been realised for the respective absorption bands of the various gas constituents to be detected and measured. These emitters consist of a light-emitting active heterostructure layer and two multilayered Bragg mirrors of a thickness of about 5 um coupled directly onto a pumping laser diode. A low-cost detector, based on the bolometer technology and suitable to work with this sensor system, had been defined and realised in the frame of this project.

The sensor system integration into the engine exhaust system, together with the adequate electronics consisting of the emitter laser diode drivers, the detector amplifiers and the signal processing, have been developed.

A probing chamber containing the exhaust gases is inserted into the optical path between the narrow band emitters and the broadband detector. The exhaust gas is supplied to the probing chamber through a conditioning unit. The exhaust gas-conditioning unit controls pressure and temperature and prevents condensation, particularly in cold start conditions. Systems were developed to prevent particles from blinding the windows among which mechanical, aerodynamic or chemical systems.

Results

In summary, the signal at around 170 nV/ppm was rather strong, but with high noise content. Even with the complex temperature control, the long-term stability and repeatability were poor.

For the detection of particles, opacity measurements with the selected optical and the related signal processing system are projected to detect particles in the required area for current and future engine technologies.

In the frame of this project, the following risks had been identified:

- Sensor targeting tailpipe out application
- requires high sensor sensitivity, accuracy and robustness
- complex sensor temperature management required
- Emitters (micro-cavity)
- cross sensitivity to other gas species
- relatively low optical power
- increased requirements on sensor design (high sensitivity and accuracy), resulting in high system complexity
- Bolometer detector currently performs > 20% below requirements
- Data acquisition and signal processing
- new sensor requirements (tailpipe out) and the current performances of the emitters and detectors are considerably driving up the requirements on the electronics, i.e. modulation, sampling, etc.
- NO_x measurements are not possible because of the interaction with water vapour (H_2O) in the exhaust.

Acronym:	IMPECC2	
Name of proposal:	Infrared Microsystem for Polluting Emission Control on Cars 2	
Contract number:	TST3-CT-2003-506507	
Instrument:	STP	
Total cost:	3,703,629 €	
EU contribution:	1,399,814 €	
Call:	FP6-2002-Transport 1	
Starting date:	01.12.2003	
Ending date:	28.02.2006	
Duration:	27 months	
Sector:	Road	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Integration and validation of measurement and sensing technologies	
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	MicroComponents - The Swatch Group	CH
	CSEM Centre Suisse d'Electronique et de Microtechniques SA	CH
	Center for Research & Technology Hellas Chemical Process Engineering Research Institute	GR
	ULIS Uncooled Infrared Detectors	FR
	REGIENOV (Renault Recherche Innovation acting on behalf of Renault and its subsidiaries, in particular Renault Sport and SOMAC)	FR
	EM - Microelectronic Marin - The Swatch Group	CH

OPTO-EMI-SENSE

An Optical Fibre-based Sensor Intelligent System for Monitoring and Control of Exhaust Emissions from Road Vehicles

OPTO-EMI-SENSE involves the research and development of novel optical fibre-based sensors for monitoring exhaust gas emissions and temperature in modern road vehicles. Novel sensors will be deployed on board the vehicle to provide monitoring and control in order to minimise atmospheric pollution.

Background

The problem of pollution of the environment by road vehicles is well known to vehicle manufacturers and legislative bodies in Europe and the rest of the world. Successive legislations in Europe have required ongoing reductions in the levels of the pollutant gases NO, NO_2, SO_2, CO as well as hydrocarbons (HCs) and particulates in vehicle exhaust systems. Instrumentation and test procedures have been developed to measure these emissions, but these are currently conducted offline and at irregular intervals, e.g. once every one or two years. The OPTO-EMI-SENSE project is concerned with monitoring these emissions online and therefore sensors have been developed that can be mounted on the vehicle to continuously monitor the emissions. Sensors for detecting these pollutants have not previously been available and a major part of the novelty of this project has been the development of all optical (optical fibre) sensors for the detection of the above pollutants to Euro IV concentration detection limits and below, as well as monitoring the hot gas temperature (up to 1 000°C) using optical fibre temperature sensors.

The use of novel and state-of-the-art sensing technology provides a promising solution to the problem of onboard monitoring of vehicle pollution, which will ultimately enable this pollution to be minimised and allow European car manufactures to deliver the objective of environmentally clean cars whilst maintaining a commercial advantage in a globally competitive market.

Objectives

The main objective of OPTO-EMI-SENSE is to develop novel optical fibre-based sensors for monitoring vehicle exhaust emissions on board the vehicle with a view to controlling and reducing them.

The project's specific technical objectives are summarised as follows:

- to isolate and identify the optical signals arising from contaminants present in the complex mixtures of exhaust systems of a wide range of vehicles using advanced and novel optical fibre-based spectroscopic interrogation techniques
- to measure optically the temperature of the gases in the vehicle's exhaust system
- to develop novel optical fibre sensors that are miniature and robust in their construction and may be fitted and/or retro-fitted to the exhaust systems of a wide range of vehicles
- to interface and fully integrate the novel sensor systems into the existing data network of the vehicle, thus providing the driver and/or the engine control system with clear and unambiguous in-car information on contaminant levels of exhaust emissions.

The consortium's research activities are therefore designed to optimise their existing resources in a focused and precisely configured work plan in order to meet the technical objectives and hence address the issue of atmospheric pollution from road vehicles. Once developed, this technology will be highly portable to other vehicles, including rail and maritime.

Description of work

The project is concerned with investigating novel optical fibre-based sensing techniques for addressing the problem of environmental pollution in the surface transport area. Optical fibre sensors are used to measure the concentration of pollutant gases to a minimum level of about 10 ppm and temperatures up to 1 000ºC in the exhaust of road vehicles. The methodologies employed for the respective measurement techniques are direct optical absorption (with spectral resolution) for the gas sensors and Fibre Bragg Gratings for the temperature sensors.

The use of optical methods for gas sensing means that the response time of the sensor is rapid in comparison to other techniques currently being investigated, which are typically in the order of one second. As the spectroscopic absorption characteristics of the gases in the exhaust system are unique, they are not susceptible to cross interference from each other and other gases when in mixture. The sensors can also be made robust and cheap by using low-cost mass produced components (e.g. LEDs and photodiodes).

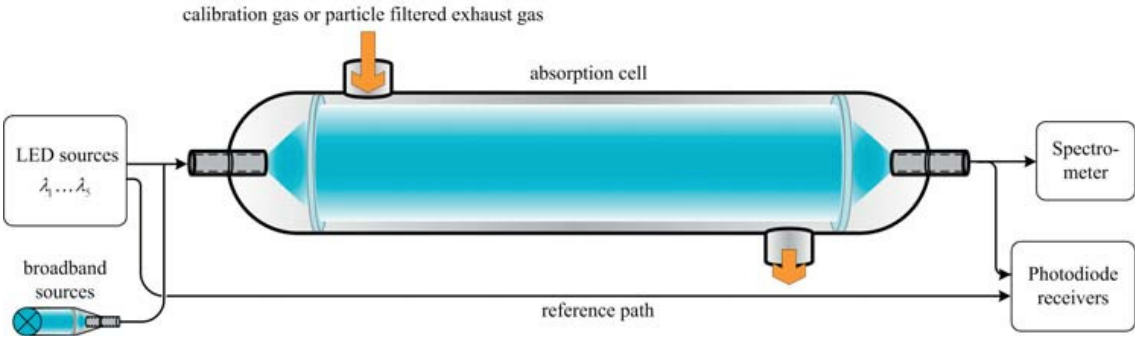
Signal analysis of the parameters is performed using standard techniques (e.g. direct calculation of the concentration from the absorption data) and advanced techniques (e.g. pattern recognition of spectra in mixtures). These will be mounted on a DSP or microcontroller and interfaced to the CANBUS of the car.

Results

The main deliverables from OPTO-EMI-SENSE are the sensors and associated systems for measuring temperature and gas concentration. These will contribute to the capability of online monitoring of gas pollutants from road vehicles within the European Union, as well as internationally. This capability will result in the means for reducing emissions through the appropriate closed loop control of the combustion process in the vehicle. The impact on society from the successful implementation of the sensor systems will be reduced harmful emissions to the atmosphere and hence a cleaner environment.

The sensor systems are assembled from conventional components and can therefore be fitted and retrofitted to a wide range of road vehicles. Development of policy through increasingly stringent legislation will drive the market for this type of sensor. The manufacturing of these systems is currently within the remit of many hi-tech SMEs within the EU and this would lead to the generation of employment within the hi-tech sector.

Keywords: Exhaust gas monitoring, optical fibre sensor, optical temperature sensors, intelligent sensors, optical gas sensors



The optical fibre gas sensor

Acronym:	OPTO-EMI-SENSE
Name of proposal:	An Optical Fibre-based Sensor Intelligent System for Monitoring and Control of Exhaust Emissions from Road Vehicles
Contract number:	TST3-CT-2003-506592
Instrument:	STP
Total cost:	2,450,783 €
EU contribution:	1,992,294 €
Call:	FP6-2002-Transport 1
Starting date:	01.01.2004
Ending date:	31.12.2006
Duration:	36 months
Sector:	Road
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Integration and validation of measurement and sensing technologies
Website:	http://www.liv.ac.uk/eee/research/rfma/optoemisense/index.htm
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CITYMOBIL

Towards Advanced Road Transport for the Urban Environment

The objective of the CITYMOBIL project is to achieve a more effective organisation of urban transport. At three sites, Heathrow, Castellón and Rome, large-scale demonstrators will be set up to supply proof of concept of innovative automated transport systems integrated in the urban environment.

Background

Every major city suffers from the problems that are related to increasing mobility demands. Cities have to deal with pollution, congestion and safety problems caused by increasing traffic. Traditional transport systems are not sufficient anymore to cope with these increasing problems.

With the exception of some automatically operated metro systems (Paris, London and Lille) and some recently introduced automated buses and people-movers (Clermont-Ferrand, Eindhoven and Capelle aan de IJssel), transport systems in the present-day European city are mostly of a traditional type.

CITYMOBIL will contribute to innovative solutions that will allow increased mobility in a well-controlled manner, using technologies with low pollution, high safety levels and a much increased efficiency, using either a separate infrastructure or existing roads. In future mobility scenarios, such new transport systems will be part of the urban environment. These new transport systems will be the answer to the new mobility demands of the future society. In our vision, the urban mobility will be greatly supported by new transport system concepts, which are able to improve the efficiency of road transport in dense areas while at the same time help to reach the zero accident target and minimise nuisances.

Objectives

CITYMOBIL's ambitious goals are achieved by:

- Developing advanced concepts for advanced road vehicles for passengers and goods. Most of the earlier projects addressed isolated aspects of the mobility problems of cities, whereas CITYMOBIL focuses on the overall urban transportation problem. However, CITYMOBIL will integrate the results of earlier projects in its deliverables.
- Introducing new tools for managing urban transport. CITYMOBIL will develop tools that can help cities to cross the thresholds that are preventing them from introducing innovative systems. For instance, the absence of certification procedures and the lack of suitable business models will be addressed.
- Taking away barriers that are in the way of large-scale introduction of automated systems. Some of these barriers are of a technological nature, some are of a legal or administrative nature: for example, the legal requirement for vehicles using public roads where the driver is responsible for the vehicle at all times, which effectively prohibits driverless vehicles from using public roads.
- Validating and demonstrating the concepts, methods and tools developed in CITYMOBIL in three European cities. These demonstrations (Heathrow, Rome and Castellón) will be real implementations of innovative new concepts. In a number of other cities, studies will be carried out to show that an automated transport system is not only feasible, but will also contribute to a sustainable solution for the city's mobility problems, now and in the future.

Description of work

CITYMOBIL is divided into sub-projects and each sub-project into work packages.

In Sub-Project 0: General management. Activities relating to the IP management and all dissemination and training activities are combined.

Sub-project 1: Demonstrations. This covers the CITYMOBIL activities related to the demonstrations. The demonstrations serve as a laboratory for developing and evaluating solutions and as a source for identifying problems that can be addressed in the project.

Sub-Project 2: Future scenarios. This will investigate how automated road transport systems fit into the expected scenarios for advanced urban transport in the future, in particular analysing how they will contribute to sustainability.

Sub-Project 3: Technological issues. This addresses the technological and HMI issues that are in the way of large-scale introduction of advanced urban transportation systems. In principle, it only addresses those issues that are typical for advanced transport.

Sub-Project 4: Operational issues. This will extend the current requirements, strategies and policies to the new advanced urban transport systems that CITYMOBIL is going to study. The challenge will be not only to achieve a level of service comparable to the one proposed by the current transport modes, but also to improve it.

Sub-Project 5: Evaluation aims at evaluating whether and under what conditions the project has been successful in meeting its objectives. Lines will be drawn for further development of road transport automation.

Results

At the end of the CITYMOBIL project, there will be at least three sites where an actual automated transport system will have been installed and where the first results will have been evaluated. These will not just be demonstrations of technological possibilities, but fully fledged integrated solutions that will be operated and maintained in the long term. For a number of other cities, plans will have been made and concepts will have been developed that will help the relevant authorities to make decisions concerning the introduction of automated transport systems. Legal barriers will have been identified, and political and administrative strategies will have been defined to remove these barriers, so that they will no longer be delaying implementation decisions. Remaining technical problems will have been solved, or at least brought closer to a solution. In general, the advantages of automated transport systems will be much better known and it will be easier for the relevant decision-makers to choose such systems if they offer the most advantageous solutions for their particular mobility problems and requirements.

Keywords: Autonomous vehicles, advanced transport systems

Advanced buses

Cybercars

Acronym:	CITYMOBIL	
Name of proposal:	Towards Advanced Road Transport for the Urban Environment	
Contract number:	TIP5-CT-2006-031315	
Instrument:	IP	
Total cost:	41,774,538 €	
EU contribution:	11,000,000 €	
Call:	FP6-2005-Transport 4	
Starting date:	01.05.2006	
Ending date:	30.04.2011	
Duration:	60 months	
Sector:	Road	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	More effective organisation of urban transport	
Website:	http://www.citymobil-project.eu	
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	Generalitat Valenciana	ES
	Fundacion Comunidad Valenciana Region Europa	ES
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	Uniresearch BV	NL

CONNECT

Coordination of CONcepts for NEw Collective Transport

The scope of this proposal is flexible collective mobility services (FCMS). This covers all forms of intermediate transport which may be classified as flexible and collective. The use of urban collective transport for passenger traffic and small goods traffic has important potential from the viewpoint of environment and city logistics. There are considerable possibilities to reduce (gasoline-fuelled) private traffic, save operating costs and increase the level of service experienced by the passenger whilst also encouraging the promotion of small alternatively-fuelled vehicles.

Background

The domain of flexible transport services (FTS) covers a broad range of mobility products usually – but not necessarily – operated by moderate and/or small capacity vehicles. The distinguishing feature of FTS is that one or more of the dimensions of the service can be adjusted to meet the actual needs of the users. This means that the route can be designed for the specific requests of the users for that specific trip, the time of departure or arrival could be brought forward or delayed to suit the customers, a bigger or smaller vehicle could be used depending on the number of passengers, and a specifically equipped vehicle or trained driver could be assigned if a customer has special needs.

Throughout Europe, a wide range of FTS has now been established, including:

- demand responsive transport (DRT) services for general use in rural areas
- DRT services for general use in peri-urban and suburban areas
- dedicated services for users who face difficulties using regular public transport (e.g. the elderly and disabled)
- flexible services to replace fixed-line services at evenings and weekends
- flexible services serving destinations of special demand, e.g. airports, shopping precincts.

However, such transport services to date do not yet exploit the true potential of flexible collective mobility and further work is required on the knowledge acquisition, analysis and dispatching functions of the intermediate transport solutions that are required in the pursuit of sustainable mobility.

Objectives

The main objectives of CONNECT are:

- to set up a continuously updated web-based 'virtual library'
- to support the development of skills and best practice in the field of FTS
- to provide guidelines and recommendations for supporting business development of FTS
- to organise thematic workshops for relevant user communities covering systems and operations, technologies, vehicles and vehicle technologies, and FTS businesses
- to increase the awareness of CONNECT among a broader audience.

Description of work

WP1 (Project Management) ensured that the project was carried out as planned and that all relevant deadlines were met.

WP2 (Knowledge Repository) set up a common information system, which gathered and managed information on on-going research, the state-of-the-art and good practice in flexible transport and its supporting technologies.

WP3 (Training and Skills) aimed to support the development of skills and best practice in the field of FTS through a number of actions, including provision of courses, training and educational resources, facilitation of personnel exchanges and collection, development and promotion of best practice.

WP4 (Business Development) generated and formalised the necessary knowledge to provide valuable guidelines and recommendations for supporting business development of FTS, from a multidisciplinary point of view and producing knowledge on business models, organisational issues and on regulatory, legal and policy aspects.

WP5 (User Community Workshops) organised four thematic workshops for the user communities involved in flexible and responsive forms of transport, generating and distributing advance relevant preparatory materials, and preparing key public reports on the workshop themes.

WP6 (Dissemination) had two main objectives: raising awareness about CONNECT, and especially the knowledge repository developed in WP2, and the dissemination of materials and information.

Results

CONNECT has achieved the following:

Established a continuously updated web-based virtual library on the domain of FTS. It is publicly available and designed as a resource to assist practitioners.

Supported knowledge transfer and training by developing materials for training courses on FTS based on a modular approach, organising study tours, identification and promotion of good practice.

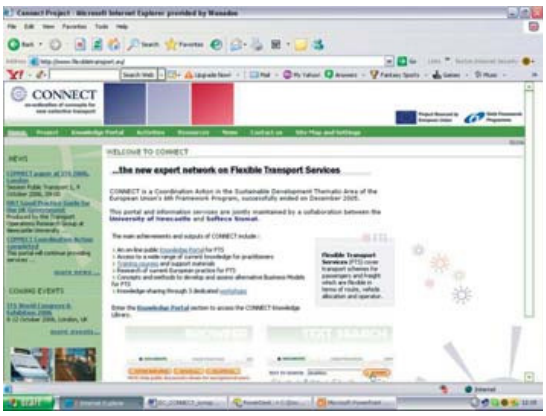
Researched current practice of FTS in Europe, with special focus on business models, institutional and organisational frameworks, and legal and regulatory frameworks.

Developed methods and resources for developing and assessing options for business models for FTS. This is original work as a result of CONNECT and looks very promising.

Organised four thematic workshops on FTS in three different countries, covering systems and operations, technologies for FTS, business models, and vehicles and vehicle technologies.

Disseminated and exchanged knowledge by making information publicly available and presenting this at a wide range of conferences and workshops.

The CONNECT Virtual Library: The virtual library contains documents, reports and presentations on many different aspects of flexible transport. It is accessible via the CONNECT website, making it a valuable, publicly accessible resource for all practitioners and user communities. The virtual library currently contains over 230 different documents on flexible transport and has a matrix structure, classified according to passenger transport, freight transport, urban transport and rural transport. Documents are characterised by metadata to improve searching. This expert database aids both the CONNECT consortium partners and external stakeholders in implementing and optimising flexible transport services. It is expected that a continuous process of updating and maintenance of the virtual library will be put in place.



the CONNECT project

The front page of the CONNECT website for the knowledge repository of flexible transport services

Northumberland County Council

Accessible vehicle used on demand responsive transport service in a sparsely populated area in North East England

Acronym:	CONNECT
Name of proposal:	Coordination of CONcepts for NEw Collective Transport
Contract number:	TCA3-CT-2004-506959
Instrument:	CA
Total cost:	902,446 €
EU contribution:	900,000 €
Call:	FP6-2002-Transport 1
Starting date:	01.01.2004
Ending date:	31.12.2005
Duration:	24 months
Sector:	Multi
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	More effective organisation of urban transport
Website:	http://www.flexibletransport.eu
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EURFORUM

European Research Forum for Urban Mobility

This project aims to help match the demand and supply side of EU research in the field of urban mobility, better assess the research needs of the sector, and validate (by stakeholder consultation) the research priorities for urban mobility, bearing in mind EU and national research programmes, notably the Seventh Framework Programme.

Background

Around 80% of European citizens live in urban areas, which is where 85% of European GNP is generated.

Urban public transport is a key issue for the EU. Efficient urban transport systems are critical for the functioning and sustainable development of urban areas. They ensure that:

- all citizens have proper access to all components of urban life (including education, employment, culture)
- the risk of social exclusion is minimised
- the distribution of goods is properly achieved
- the quality of urban life is improved.

Several EU policies are influenced by the decisions taken on urban mobility and could benefit from better coordination of actions in that regard: energy supply, safety and security, environmental policy, regional policy, internal markets and others.

The urban mobility sector needs research in order to be able to keep up with the pace of technological and societal changes, and to maintain the attractiveness of its offer for users.

The EU is already taking steps towards supporting research co-operation and stimulating research excellence in surface transport. This is being done notably through modal European technology platforms such as ERRAC (rail) and ERTRAC (road). However, urban transport transversal issues are not fully covered by those platforms, and stakeholders in the sector felt that there was a gap which needed to be filled.

Objectives

The project intends to achieve a full inclusion of urban mobility issues into the EU research agenda. The project will identify and develop innovative concepts and tools for organising a proper coordination at EU level between all relevant stakeholders concerning research on urban mobility.

This is going to be achieved through:

- identification of priority research areas in the field of urban mobility which would benefit from a better coordination of stakeholders at EU level, taking into account both technology- and policy-oriented research
- identification and promotion of innovative research strategies for sustainable urban transport, and of coordinated information and communication strategies targeting transport users and operators
- proposing instruments serving to improve the knowledge base on urban mobility Europe-wide
- promotion of tools supporting urban transport policy development, such as integration of land use planning, including technical harmonisation at the European level
- promotion of intermodality between existing mobility services and of innovative intermodal mobility services in urban areas
- building up appropriate links between existing modal technology platforms (ERRAC, ERTRAC) in order to cover transversal/intermodal issues addressing similar priorities.

Description of work

The project will be divided into five work packages. Three key work packages (WP1: State of the art and vision, WP2: Strategic research agenda, WP3: Stakeholder relationship management) will be inter-related through a matrix structure with four research areas: a) Data collection/demand analysis, b) Sustainable strategies/ traffic planning and management/land use, c) Integrated and harmonised systems and services, and d) User aspects – security, comfort, accessibility.

WP1 will look at the achievements of urban mobility research so far and formulate a vision for the future. Its crucial task is to determine the current status of research and technological development in the field of urban mobility.

The primary objective of WP2 will be to elaborate a strategic research agenda (SRA), i.e. a detailed action plan for the structuring and implementation of European research priorities in the field of urban mobility.

WP3 will ensure, through organising and moderating two EURFORUM plenary sessions (in 2007), the validation of key deliverables by relevant stakeholders from various urban mobility fields (operators, organising authorities, industry and users), selected according to their role and decision-making position in the sector, respecting proportions of European countries represented.

WP4 will be dealing with dissemination issues and WP5 with project management.

Results

State of the art: In order to develop forward-looking research approaches and questions, it is essential to assess the current situation of science and knowledge in the field of urban mobility, and to identify within the Member States the various categories of local, regional and national decision-makers who should be involved in European research on urban mobility at the European level. This deliverable will look at the current development status in technology and knowledge in this field in collaboration with all project partners and in consultation with the stakeholders.

Vision: This deliverable will provide a set of questions and answers concerning the future evolution of various factors having an impact on urban mobility. Furthermore, the vision will include considerations on how research can help to achieve sustainable urban mobility in the years to come.

Strategic research agenda (SRA) will be a detailed action plan for the structuring and implementation of European research priorities in the field of urban mobility. The SRA will serve as a 'groundwork' that initiates and goes together with the discussion among the relevant stakeholders concerned with urban mobility in Europe. For each research area, the following elements will be included:

- formulation of proposals for transversal (intermodal) topics,
- integration of modal topics, including those proposed by other technology platforms.

Keywords: Urban transport, urban mobility, transport policy, transport technology, metro, light rail, bus, intermodality, car sharing, cycling, walking, land use, passenger transport, urban freight

UITP

Acronym:	EURFORUM	
Name of proposal:	European Research Forum for Urban Mobility	
Contract number:	TCA5-CT-2006-031372	
Instrument:	CA	
Total cost:	399,980 €	
EU contribution:	399,980 €	
Call:	FP6-2005-Transport 4	
Starting date:	01.04.2006	
Ending date:	30.11.2007	
Duration:	20 months	
Sector:	Multi	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	More effective organisation of urban transport	
Website:	http://www.eurforum.net	
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	POLIS - Promotion of Operational Links with Integrated Services	BE
	CERTU - Centre d'Etudes sur les réseaux, les transports, l'urbanisme et les constructions publiques	FR
	ASSTRA - Associazione Trasporti	IT
	EMTA - European Metropolitan Transport Authorities	FR

FIDEUS

Freight Innovative Delivery in European Urban Spaces

The aim of the project is to provide a complementary set of vehicle solutions to support an innovative approach to the organisation of urban freight transport, in line with political strategies to safeguard the liveability of cities, while being compatible with efficient logistics. Urban freight delivery is both a contributor to and a victim of the growing congestion in urban areas, which exposes the population to noise, pollution and nuisance. The target of FIDEUS is to contribute to the economic livelihood of business and retail activities located in the city in a practical way, with policies oriented towards more sustainable mobility.

Background

The growing traffic problems in cities also involve the urban supply chain, which is both a cause and a victim of such problems. If no measures are undertaken in the future, statistics show the risk of a continuous increase in traffic volumes that will be due in part to freight flows (about 20%). Such a situation affects the quality of life as well as the environment, and means a loss of efficiency for the freight transport itself.

Today's solutions are often based on restrictive policies that include low emission zones, access control, road pricing or time limits for the logistic operations. It is only in the last few years that experimental initiatives have been going towards a positive approach, in which public authorities offer ad hoc facilities like freight villages or reserved lanes.

The 13 partners of the FIDEUS project, coordinated by Centro Ricerche FIAT and co-funded by the European Commission – DG Research, aim to develop a new approach for the freight delivery in urban space by proposing a family of vehicles with high performance, a reorganised logistic flow and a telematic tool for the logistics management.

The benefits expected are social (less congestion/environmental effects due to freight delivery) and economics (better efficiency in the operations). In terms of policy, the public authorities will have a greater degree of freedom in traffic control, with minimal effects on the operators.

Objectives

FIDEUS proposes a new approach to the freight delivery through three types of actions:

- the development of a complementary set of vehicles and equipment, specially conceived for undertaking urban deliveries and collection
- the proposal of a new approach to the organisation of urban logistics, involving the coordinated use of different vehicle types, an innovative goods container and support systems to improve the management of delivery operations
- the provision of tools and information, which will give practical support to city authorities in the planning and management of strategies for dealing with urban delivery traffic.

FIDEUS will be able to give a practical demonstration of the major features of a 'clean' logistics system which can:

- implement an urban handling standard in terms of delivery and collection
- provide a better level of control of urban delivery logistics
- reduce the costs of transportation and distribution

- enhance the quality of service (accuracy of deliveries, compliance with deadlines, etc.)
- free up the urban delivery circuits and limit the level of congestion
- make the best use of existing infrastructures, reducing the occupation of urban space
- limit the nuisance and damage caused to the community and the environment
- allow the city to be reclaimed by pedestrians.

Description of work

From a practical point of view, the FIDEUS project aims to develop a family of vehicles with high performance in terms of environmental impact reduction, noise level control and ergonomics. The basic idea is to exploit the different features of these vehicles to achieve an efficient logistic flow towards the cities. A specific strategy will be elaborated to move freight into city centres with fewer trips by medium-to-large vehicles, and to deliver the parcels using a micro-carrier that is able to circulate in pedestrian areas without any restriction. An alternative is a van with an ad hoc adaptation that could carry out deliveries in urban zones where low emissions and noise levels are mandatory.

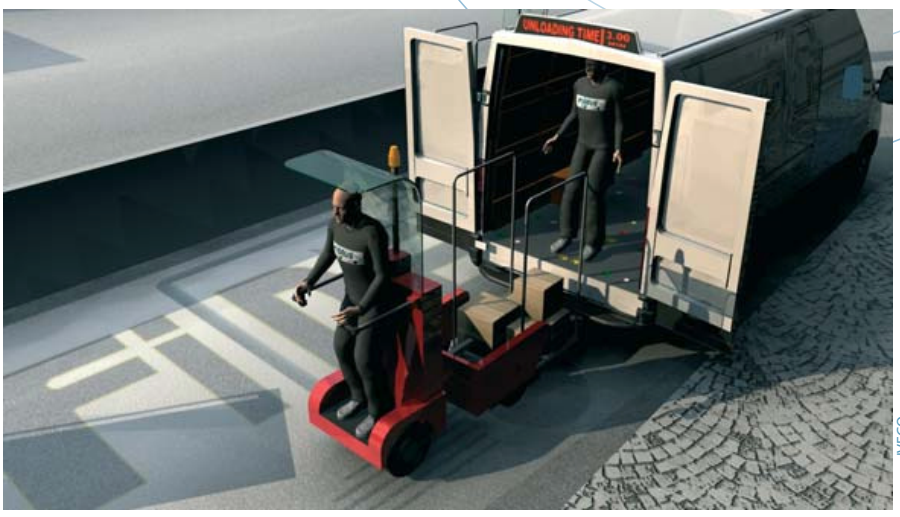
This approach requires some cross-solutions to enhance and complete the capabilities of the proposed set of vehicles. For this purpose, FIDEUS has identified a multimode container to facilitate the freight handling and delivery, and a telematic system to manage the logistic flow. Obviously this extended package will adopt other practical measures, for example to achieve easy loading/unloading operations, to have transhipment areas or reserved lanes, to enable the vehicles to exchange data, to track the goods, etc.

Results

Thirteen partners are involved in the FIDEUS project to design, develop and integrate all these solutions for a new approach to freight delivery. This challenge makes it essential to define an overall strategy to combine the use of each component and to exploit its specific features, so these offer benefits to the logistic chain. Technical solutions are not the only way to achieve sustainable urban logistics, but are tools to accept and collaborate with the policies in use in our cities. In this integrated approach, municipalities and public authorities can support the efforts made by the logistics operators by undertaking suitable backing measures, reserving, for instance, lanes at fixed times of day or creating transhipment areas in public spaces where the larger vehicles can unload their freight for consequent delivery in pedestrian areas with the Micro CUV.

The expected results therefore include the validation of the FIDEUS concepts, by demonstrating the feasibility, efficiency and sustainability of a freight flow based on the combined use of several platforms and co-operation between the players that make up the logistic chain in urban space.

Keywords: Freight delivery, urban mobility, logistics



Microvehicle transhipment to access pedestrian reserved areas

Acronym:	FIDEUS	
Name of proposal:	Freight Innovative Delivery in European Urban Spaces	
Contract number:	TST4-CT-2005-012405	
Instrument:	STP	
Total cost:	4,451,576 €	
EU contribution:	2,298,901 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.05.2005	
Ending date:	30.04.2008	
Duration:	36 months	
Sector:	Multi	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	More effective organisation of urban transport	
Website:	http://www.fideus.org	
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	MIZAR AUTOMAZIONE S.P.A.	IT
	IMPACTS EUROPE	FR
	Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.	DE
	Region of Hannover	DE
	Grand Lyon - Communaute Urbaine de Lyon	FR
	DSD - Disseny de Sistemes i Desenvolupament S.A.	ES

HOST

Human Oriented Sustainable Transport mean

The HOST project aims at developing a multipurpose transport mean. Due to the modularity of the chassis and powertrains, HOST is capable of being equipped with a variety of bodies, providing new services for mobility and goods displacement in towns, and organising urban motorised traffic in a more rational way.

Background

Today's European cities face many problems and transport is one of the most relevant, if not the most relevant. Mobility in cities gives problems of congestion, energy consumption, pollutant emissions, loss of green belts, occupancy of public spaces and, last but not least, health and safety. Although passenger transport is always perceived to be the main cause of mobility-related problems, recent studies proved that freight transport impact is also an issue: between 30 and 40% of energy consumed for transport in cities is due to freight transport. Any of the attempts made so far, for either research or demonstration purposes, to have a cleaner mobility based on low polluting vehicles have been successful in demonstrating that cleaner vehicles are technically feasible, but have failed to launch a real market for non-polluting vehicles. Low impact buses have been tested in many research projects and proved to be much less polluting than conventional ones, but have not been commonly adopted by city public transport companies because they are more expensive and problematic. To lower the impact of mobility on the cities, cleaner vehicles are not enough: an integrated passenger and freight strategy must be adopted. Cleaner vehicles must be specifically designed for the purpose and prove to be better than conventional ones under any aspect, including costs.

Objectives

The HOST objectives are:

- to subvert the vehicle design process and instead of designing the vehicle on the basis of the available technology, let it start from the real user needs
- to design a multipurpose vehicle which can be used for several tasks over a period of 24 hours, thus reducing the investment costs for an environmentally friendly vehicle
- to develop a modular powertrain with interchangeable power generation units so as to minimise the impacts of the vehicle circulation according to the task it is supplying
- to integrate a drive-by-wire steering system
- to design a modular chassis capable of changing length according to the capacity (in terms of volume of freight or number of passengers) it has to have for the task it is supplying
- to design different vehicle cabins which can be easily and automatically switched for passenger and freight transport
- to integrate in the vehicle chassis an advanced horizontal transhipment device capable of transferring pallets of freight as well as facilitating the cabin interchange
- to manufacture the HOST prototype and to test it, so to prove the concept.

Fulfilling all these objectives will lead to the design and construction of a vehicle which could supply freight and passenger services economically in cities and allow, if adopted in combination with some accompanying measures, city mobility to become more sustainable.

Description of work

HOST proposes to use one modular vehicle platform with four different cabins to accomplish four different transport tasks. To verify that such a concept was feasible and to dimension the low environmental impact of such a vehicle, a severe acquisition campaign was set up in three different European cities: Oeiras (PT), Rome (IT) and Stockholm (SE). The first act of the user needs analysis (UNA) provided the working methodology to be followed in data collection and analyses, aiming to introduce a new method to design vehicles: instead of starting from the technology and looking for a proper application of it, HOST investigated a number of services and defined the needs of each of them. The UNA deals with the needs identification, subdivided by user, market and driving needs: it concerns the definition of the vehicle technical specifications, capable of satisfying simultaneously all the needs and the identification of the potential market for such a vehicle. The three cities were asked to choose at least two (one freight and one passenger, and one night-time and one daytime) from among the four services identified since the proposal:

- night-time collective taxi
- daytime car sharing services
- daytime freight collection and distribution
- night-time garbage collection.

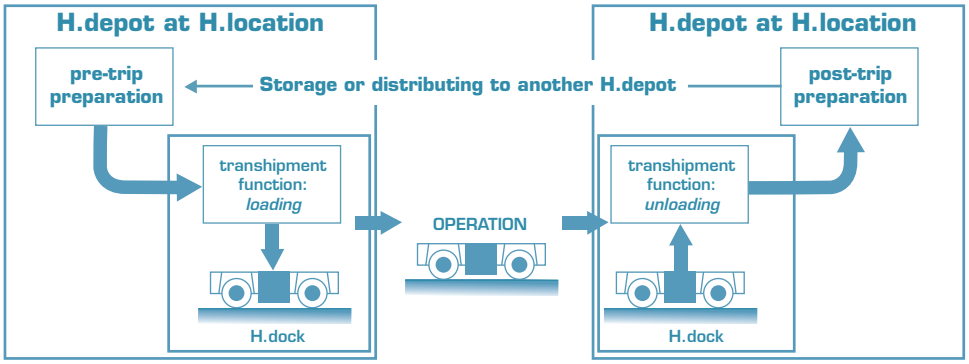
The technical specifications that have arisen constitute the basis for the design and the following construction phase.

Results

The progress made so far is mainly related to the definition of the vehicle's technical specifications, representing the guiding input for the whole design phase (enclosing both chassis and powertrain), which is now completed. The main achievements of the initial study were the definition of the HOST prototype as a whole, in terms of dimension and bulk of the platform (chassis and suspension) as well as the various boxes constituting the powertrain and the human machine interface (fig. 2). The results obtained confirm that a common powertrain can accomplish the four tasks selected by adding modules for extra energy storage or an auxiliary power unit. A particular reference has been reserved for the transhipment system where the HOST concept has to carry a device that enables the prototype to tranship the cabin and/or body vehicle as an intermodal transport unit in a practical way and therefore let the vehicle enter into logistic process flows (fig. 1). Fulfilling all these objectives will lead to the design and construction of a vehicle which could economically supply freight and passenger services in cities and allow, if adopted in combination with some accompanying measures, city mobility to become more sustainable.

Keywords: Sustainable transport, hybrids, low polluting vehicles

General assembly (member's decision-makers)



Acronym:	HOST
Name of proposal:	Human Oriented Sustainable Transport mean
Contract number:	TST4-CT-2005-012555
Instrument:	STP
Total cost:	3,017,119 €
EU contribution:	2,000,000 €
Call:	FP6-2003-Transport 3
Starting date:	01.01.2005
Ending date:	31.12.2007
Duration:	36 months
Sector:	Multi
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	More effective organisation of urban transport
Website:	http://www.host-vehicle.com
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NICHES

New and Innovative Concepts for Helping European Transport Sustainability

NICHES will facilitate the coordination of the research activities of academic institutions, industry, mobility operators and transport authorities regarding key urban transport innovations that lack broad deployment. NICHES aims to stimulate a wide debate between relevant stakeholders from different sectors and disciplines across the EU and Accession Countries in order to promote the most promising new concepts, initiatives and projects from their current 'niches' (sic) position to a 'mainstream' urban transport policy application.

Background

Over the last few years, scientists, transport operators, industry and policy-makers throughout Europe have developed a wide range of innovative concepts for making urban transport more efficient, competitive and sustainable. Despite significant progress, many of these efforts to date have not been implemented on a larger scale. A number of barriers have prevented these concepts from being widely deployed:

- no coordination of innovation initiatives in different countries and cities
- no integration with mainstream transport policy and development in relative isolation
- no concrete strategies for achieving a transition from R&D to common practice
- lack of dissemination outside their specific context
- clear guidance missing regarding the transferability to other urban contexts
- lack of awareness among stakeholders of the mutual needs and interests across transport modes and (public and private) sectors.

NICHES wants to remedy this by stimulating a wide debate on innovative urban transport and mobility between relevant stakeholders from different sectors and disciplines across Europe. NICHES will promote the most promising new concepts, initiatives and projects, moving them from their current niche position to a mainstream urban transport policy application.

Objectives

The high-level goal of the NICHES project is to support the development and adoption of innovative technology and policy-based urban transport concepts that will contribute to establish sustainable urban transport systems. This in turn is expected to contribute significantly to a more efficient and competitive transport system, a healthier environment and improved quality of life in urban areas.

The high-level project goal has been divided into five overall project objectives:

- enhance discussion and knowledge exchange between practitioners, experts and researchers in the field of urban transport in Europe, ensuring that different sectors will be involved (transport authorities, operators, industry, academics and other researchers as well as users)
- provide a forum for those involved in European research activities and projects as well as national, local and industrial initiatives in the area of innovative urban transport concepts to share their knowledge and experience
- develop an accessible document store and a knowledge base amongst urban transport experts and practitioners on innovative transport concepts, as well as integrated urban transport strategies, in which several innovative concepts are implemented in a combined way

- identify future research needs and pave the way for innovative transport concepts, meeting mobility needs in 2020
- develop a platform for capacity building (tools and content) for practitioners with guidance on developing and implementing innovative concepts in the framework of integrated urban transport strategies.

Description of work

For the implementation of the NICHES project, a tailored combination of methods and tools is employed, which will ensure all objectives can be achieved efficiently. The starting point is a precise definition of selection criteria for 'innovative concepts', clarifying the meaning of this term within NICHES. It allows establishing the concrete information basis (reference examples) that the project will analyse and advance by using:

- expert working group meetings – based on the focus group method
- personal expert interviews
- coordination of ongoing R&D activities
- validation and dissemination workshops.

In order to find 12 innovative urban transport concepts, four thematic working groups were defined, related to the following areas:

- new seamless mobility services
- innovative approaches in city logistics
- new non-polluting and energy efficient vehicles
- innovative demand management strategies.

Throughout the full duration of the project, the working groups follow four successive work packages:

1. State of the art and good practice
2. Feasibility and transferability
3. Design of integrated transport strategies
4. Visions for the future and recommendations.

Results

The main deliverables are:

- State of the art and good practice in developing innovative urban transport concepts: provides a structured overview of 12 selected innovative urban transport concepts, based on existing good practice. It deals with four different thematic areas that cover urban freight and passenger transport as well as non-polluting and energy efficient vehicles.
- Feasibility and transferability of innovative urban transport concepts: summarises the results of the second phase of the project. It is a working document, which provides a large amount of detailed information about the wide range of innovative concepts. It provides an important information basis that feeds into the next work steps.
- Integrated urban transport strategies: this proposes NICHES urban transport strategies as integrated packages combining the project's innovative concepts and mainstream measures.

JC Decaux / City of Lyon

Public bicycles in Lyon

Liftshare UK

Lift-sharing services

Acronym:	NICHES	
Name of proposal:	New and Innovative Concepts for Helping European Transport Sustainability	
Contract number:	TCA4-CT-2005-516332	
Instrument:	CA	
Total cost:	1,050,000 €	
EU contribution:	1,050,000 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.11.2004	
Ending date:	31.10.2006	
Duration:	24 months	
Sector:	Multi	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	More effective organisation of urban transport	
Website:	http://www.niches-transport.org	
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	Eurocities asbl	BE
	Council of European Municipalities and Regions / Conseils des Communes et Régions d'Europe	BE
	PTV Planung Transport Verkehr AG	DE
	City of Stockholm, Environment and Health Administration	SE
	Warsaw University of Technology (Politechnika Warszawska)	PL

TRANSPOWER

Supervised Implementation of Sustainable Urban Transport Concepts

The main goal of TRANSPOWER is to supervise the implementation of sustainable urban transport. TRANSPOWER provides municipal and regional decision-makers with properly evaluated scientific information about best practices and relevant experience in order to implement sustainable, cost-effective, environmentally friendly and efficient urban transport concepts.

Background

Environmental issues – such as air pollution or noise – are serious threats to the health of EU inhabitants. More than 75% of the population of the EU lives in urban areas and is affected by a deterioration of air quality as well as noise. The car is the dominant means of transport and decisively contributes to pollution and noise. Recent estimates foresee an increase of 40% in transport-caused CO_2 emissions by 2010, if current trends persist. Therefore the improvement of air quality is one of the fields in which the EU has been most active in recent years.

The project will serve as a stage for future investment projects as in-depth-analyses will detect investment potentials. Model instruments will be at the disposal of municipal policy-makers to be used in future actions. The joint implementation efforts will lead to a more efficient and rational use of motorised transport in the partner regions.

Objectives

The overall objective of TRANSPOWER is to contribute towards concepts for measuring and planning which is cost-effective, sparing, environmentally friendly and efficient in the field of urban transport.

The project will help decision-makers to implement existing ideas by accompanying their progress closely, and providing an exchange of experienced and professional supervision. Guidelines and practical recommendations for the targeted improvement of urban transport organisation will be given. The target groups addressed are specifically municipal authorities, but in a wider sense also traffic operators and inhabitants. The approach is tailored to small, manageable projects which represent realistic steps towards achieving the above-mentioned overall objective.

The supervised implementation of small, manageable and tailor-made projects and concepts which represent realistic steps, together with the exchange of experience and relevant personnel, shall enable the participating institutions to build up relevant capacities. Using a selection of 16 partners representing small and medium-sized cities (up to 500 000 inhabitants) from five Member States and two Accession Countries, policy-makers of municipalities and cities will be able to exchange knowledge with academia and business.

Description of work

The general instrument of TRANSPOWER is the coordination of actions, which are developed and implemented at a local level in European Countries.

A key aim of TRANSPOWER is to supervise the implementation of existing concepts in the field using innovative approaches. The supervised implementation of small, manageable and tailor-made projects and concepts, which represent realistic steps, together with the exchange of experience and relevant personnel will enable the participating institutions to build up relevant capacities.

The project will exploit synergies between small and medium-sized Eastern and Western European cities and link strengths and experiences by bringing relevant partners closer to each other – partners such as cities, municipalities, transport SMEs, research companies and universities, as well as regional development agencies.

TRANSPOWER will produce concrete policy recommendations opening new perspectives for a future-oriented, sustainable development in the field of urban transport by supervising European cities in the implementation of urban transport projects. The project will help to coordinate the transport activities of the partner cities and municipalities under the umbrella of sustainable transport aims.

Results

An advisory board will provide an external review of the quality of the project's processes and deliverables.

During the project a website will be established, in order to facilitate the exchange of information between the partners and with transport experts. It is also intended that city profiles will be published as a result of the project for dissemination to policy-makers.

The project will help to overcome differences by the exchange of experiences and the definition of requirements. It is expected to help establish standards in the connection of hardware from different suppliers by providing definitions of standard interfaces and information, such as OCIT (open communication interface for traffic devices).

TRANSPOWER will contribute to the aforementioned priorities, as far as urban transport is concerned. It will empower the cities to find those solutions which best match their needs, foster the pan-European discussion, and exchange and enlarge the European transport community.

City of Graz

Biodiesel bus in Graz, Austria

City of Groningen

Cycle path in Groningen

Acronym:	TRANSPOWER	
Name of proposal:	Supervised Implementation of Sustainable Urban Transport Concepts	
Contract number:	TCA5-CT-2006-031490	
Instrument:	CA	
Total cost:	800,000 €	
EU contribution:	800,000 €	
Call:	FP6-2005-Transport 4	
Duration:	months	
Sector:	Multi	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	More effective organisation of urban transport	
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	Forschungsgesellschaft Mobilitaet gemeinnützige GmbH FGM-AMOR Austrian Mobility Research	AT
	European Academy of the Urban Environment	DE
	ANEM SA (Development Company of Magnesia SA	GR
	Università degli Studi dell'Aquila	IT
	Provincial government of Styria, Department of spatial planning	AT
	City of Niš- Department for communal affairs, energetics and traffic	CS
	City Hall of Sibiu	RO
	Primaria Municipiului Timisoara	RO
	City of Görlitz	DE
	City of Graz	AT
	Gemeente Groningen (Municipality of Groningen)	NL
	Comune dell'Aquila	IT
	Municipality of Halandri	GR

STEPS

Scenarios for the Transport System and Energy Supply and their Potential Effects

The aim of this project is to develop, compare and assess possible scenarios for the transport system and energy supply of the future, taking into account the state of the art of relevant research and such criteria as the autonomy and security of energy supplies, effects on the environment and economy, and the interactions between transport and land use.

Background

The future framework of the transport system is intimately linked with the general energy supply of the future. The relatively cheap availability of petroleum oil has allowed great expansion of the transport system over the past hundred years. This relationship between energy supply and vehicle technology and the characteristics of the transport system is typified by the internal combustion engines that power much of the transport system.

However, circumstances are changing. There is an increasing concern about the environmental consequences of the fuel technology used. Just as important are the concerns over the future availability of the fuel required. The recurrent crises and even wars in some areas where oil and gas is produced and the instability of political systems in other fuel producing areas only add to this.

Driven by these issues, a wide range of new or improved fuel technologies are being proposed and developed, each with its issues over the wider consequences of its adoption.

The implications of the various futures are best considered by investigating a series of scenarios reflecting a range of 'best' estimates of future conditions in the energy, transport, economic and social fields. This explains the background behind the STEPs project.

Objectives

To achieve the overall objective, STEPs has chosen a two-way approach. The consortium has come up with a work plan consisting of two main activity 'lines':

- coordination activities (cluster meetings, dissemination, publications, etc.)
- supporting research activities (scenario development, evaluation and assessment).

These two lines of activities are closely related and constantly influencing each other. In all phases of the project, the interlinking of the two paths will ensure a fruitful cross-fertilisation. Moreover, the chosen approach offers a benefit to a project plan that is strictly confined to one of the two activities (research and coordination/dissemination).

To achieve the projects goals, a well-balanced consortium of renowned research institutes, experienced in the fields of scenario-building and modelling, transport research and energy has been composed. Together with external experts, representatives of governments and other relevant authorities, market parties, and transport and energy organisations, this consortium will make the possible consequences of transport systems and energy supplies of the future for the implementation of transport innovations, or the lack thereof, clear.

Description of work

The project started with mapping the state of the art and a description of relevant trends in transport and energy supply systems. With these outcomes, a basic set of scenarios was compiled. Two main variables

marked the scenario framework. The first was fuel price increases, which are directly related to energy scarcity. In the coming decades the fuel price increase may be as generally accepted as in current times, or energy may be subject to a greater scarcity (so pointing to a faster increase in the fuel price). The second variable is represented by the policies that various authorities deploy in response. This can be either 'business as usual' (not specifically meant to target transport systems and their energy supply) or there can be more targeted policies, (technology investment or use of more stringent demand management).

The scenarios were simulated with existing integrated land use – transport models, both on the European scale and on the regional scale (Edinburgh, Dortmund, Helsinki and Brussels with their surrounding regions, and the South Tyrol in Northern Italy).

The prognosis year was typically 2030 (in some cases 2020) and the outcomes were described in an extensive overview of their impacts. The modelling exercise provided indications about the development of several variables (transport demand, economy, energy consumption, emissions, etc.) over the period 2005-2020 or 2030 under the different scenarios.

Results

For details of the deliverables, please see the STEPs website: www.steps-eu.com

D1 State-of-the-art

D2 Overview of relevant trends and translation into parameters

D3.1 Framework of the scenarios and description of the themes

D3.3 A bee with a view – essay

D4.1 Modelling suite for scenarios simulations

D4.2 Scenario impacts

D5.1 Methodology for the assessment of transport and energy supply scenarios – database requirements

D5.2 Assessment and comparison of scenarios

D6 Conclusions, recommendations and need for further research

D8.1 Report on the first Cluster Meeting, Budapest, 25 November 2004

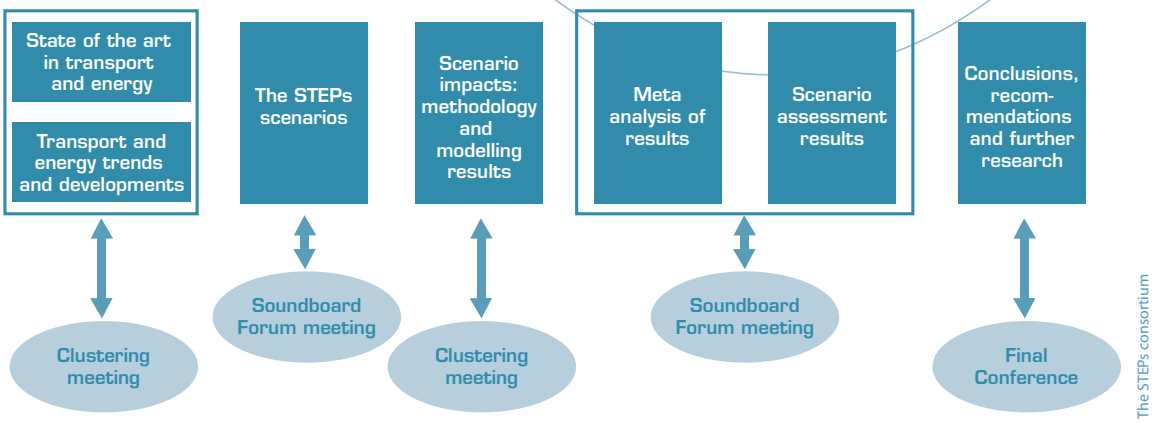
D8.2 Report of the second Cluster Meeting, Krakow, 29 May 2005

D8.3 Report on the third Cluster Meeting, Gothenburg, 15 June 2006

Furthermore, an integral final report was published:

Monzón A. and Nuijten A. (editors): 'Transport strategies under the scarcity of energy supply'. Buck Consultants International, Den Haag/Nijmegen/Brussels, ISBN-10: 90-9020880-1 and ISBN-13: 978-90-9020880-0, 2006.

Keywords: Transport, energy, land use, technology, policies, scenarios



The STEPs project tasks

Acronym:	STEPS
Name of proposal:	Scenarios for the Transport System and Energy Supply and their Potential Effects
Contract number:	TCA3-CT-2004-506310
Instrument:	CA
Total cost:	884,288 €
EU contribution:	884,288 €
Call:	FP6-2003-Transport 3
Starting date:	15.01.2004
Ending date:	14.07.2006
Duration:	30 months
Sector:	Multi
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)
Research domain:	Scenarios for the transport system and energy supply of the future
Website:	http://www.steps-eu.com
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Partners:	Research Centre of the Athens University of Economics and Business GR University of Leeds UK European Commission - Joint Research Centre - Institute for Prospective Technological Studies ES Katholieke Universiteit Leuven Research & Development BE WSP group / LT Consultants Ltd. FI SenterNovem NL Spiekermann & Wegener, Stadt- und Regionalforschung (S&W) DE STRATEC S.A. BE TIS.pt, Consultores em Transportes, Inovação e Sistemas, SA PT TRL Limited UK TRT TRASPORTI E TERRITORIO SRL IT Transport and Travel Research Ltd UK Universidad Politécnica de Madrid ES

TRIAS

Sustainability Impact Assessment of Strategies Integrating Transport, Technology and Energy Scenarios

Both transport and energy systems contribute to an ever-increasing quality of human life. On the other hand, adverse environmental impacts and insecurity of fossil energy sources and supplies constitute major risks for sustainable development. TRIAS develops and assesses integrated scenarios to adapt the transport-energy system to make it more sustainable in the future.

Background

Mobility becomes more and more important in today's life. This is reflected by European citizens continuously increasing their travel demand or by the employment opportunities generated by transport, for example the 7.5 million people employed in the transport service sector of the EU-25. The downside of this development becomes obvious when looking at the growing proportion of transport emissions against total human greenhouse gas emissions, which is almost 30% today, and the almost total dependence of transport on fossil fuels as an energy source.

Given this current framework, the requirement for changes in the transport system becomes obvious. Both behavioural and technological changes will be necessary to alter the harmful trends and make transport sustainable, delivering support to social development and providing fairness, economic growth and environmental stability.

A major step in making the transport system more sustainable would be a shift towards alternative fuels like biofuels or hydrogen generated from various sources. This requires a symbiotic transition of the transport-energy system towards the supply and use of such alternative fuels. Scenarios for such a matched transition process are developed and assessed by the TRIAS project. The focus of TRIAS is then to provide an integrated and quantitative assessment of the transport-energy system adaptations and their economic, social and environmental impacts.

Objectives

The strategic objectives of TRIAS are four-fold:

1. Develop and test strategies to reduce greenhouse gas emissions and noxious emissions from transport based on the trilogy ('trias') of transport, technology and energy scenarios. In particular, the introduction of biofuels and hydrogen as energy carriers for transport are analysed.
2. Base the assessment on an integrated model-based approach looking at environmental, economic and social impacts (sustainability impact assessment). The use of integrated models enables quantifying the impacts of scenarios, deriving new sustainability indicators from the quantitative model variables and creating consistent scenarios where all the numbers fit together avoiding contradictions within a scenario. The four models applied are POLES (world-energy system), ASTRA (economy-transport-environment interaction), VACLAV (transport network impacts), Regio-SUSTAIN (regional environmental impacts).
3. Provide an open field for both external scenarios and scenarios developed within TRIAS, by reviewing the scenario literature and providing interaction with stakeholders concerning scenario design.
4. Consider the life-cycle implications of all strategies investigated. For example, the use of biofuels or hydrogen has underlying restrictions on the available land to produce biomass, so that for each technology path tested its full life cycle has to be considered.

Description of work

The TRIAS project commences with an analysis of available scenarios from existing studies. Based on this knowledge the TRIAS scenarios are developed and these will be analysed in a final step.

A second starting point is the development of a technology database that provides the techno-economic data for alternative technologies related to biofuel and hydrogen use for transport. This data is required to update the applied models so that they dispose of the capabilities to simulate the technology diffusion and transition as part of the scenarios.

The four models, POLES, ASTRA, VACLAV and Regio-SUSTAIN, are upgraded to

1. incorporate the new technologies
2. extend their assessment capabilities, and
3. provide linkages between the models.

The models will then calculate scenarios until the year 2030, with an outlook until 2050 by POLES and ASTRA.

The scenario results will be provided on a detailed level consisting of both the single indicators of the various models (e.g. presenting results, for either a country or region, at a sectoral level) and the aggregate indicators relevant to describe sustainability of the scenarios.

Results

The main outputs of TRIAS are the significantly enhanced ability of developing and assessing scenarios of the future development of transport-energy systems, as well as the results of the assessment of the TRIAS scenarios concerning the introduction of biofuels and hydrogen into the transport-energy system.

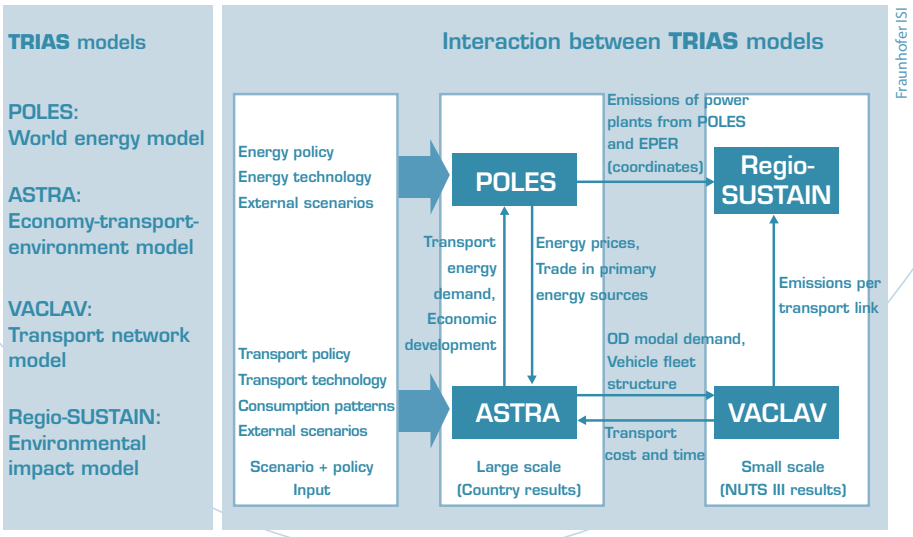
Further output belongs to two groups: tools and databases, and written reports.

Tools and databases: POLES, ASTRA and Regio-SUSTAIN will enhance their capabilities to model transport-energy related impacts. Model linkages between POLES-ASTRA, ASTRA-VACLAV, POLES-Regio-SUSTAIN and VACLAV Regio-SUSTAIN will be either be improved on or newly established. A database to describe the techno-economic characteristics of various biofuels and hydrogen-related pathways has been set-up.

The following written reports will be available at the end of the project:

1. External and internal scenarios for the socio-economic and transport-energy systems
2. Technology trajectories for transport and its energy supply
3. TRIAS outlook for global transport and energy demand
4. Alternative pathways for transport, technology and energy to promote sustainability in the EU
5. Final report of the TRIAS project.

Keywords: Transport-energy system, impact assessment, scenarios, sustainability, model integration



Interactions of TRIAS models for scenario analysis

Acronym:	TRIAS	
Name of proposal:	Sustainability Impact Assessment of Strategies Integrating Transport, Technology and Energy Scenarios	
Contract number:	TST4-CT-2005-012534	
Instrument:	STP	
Total cost:	1,090,348 €	
EU contribution:	642,884 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.04.2005	
Ending date:	31.03.2007	
Duration:	24 months	
Sector:	Multi	
Objective:	New Technologies and Concepts for all Surface Transport Modes (Road, Rail and Waterborne)	
Research domain:	Scenarios for the transport system and energy supply of the future	
Website:	http://www.isi.fhg.de/TRIAS/	
Coordinator:	Dr Schade Wolfgang Fraunhofer Institut für System- und Innovationsforschung (ISI) Unit Nachhaltiges Wirtschaften und Infrastrukturen Breslauer Strasse 48 DE 76139 Karlsruhe	
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Partners:	IWW - Universitaet Karlsruhe (TH)	DE
	TRT - Trasporti e Territorio Srl	IT
	IPTS - European Commission Joint Research Centre	ES

Advanced Design and Production Techniques




AUTOSIM

Development of Best Practices and Identification of Breakthrough Technologies in Automotive Engineering Simulation

The project will bring together major players from the automotive industry across Europe. They will discuss, debate and document various aspects related to the effective use of engineering simulation techniques such as finite element analysis, computational fluid dynamics and multi body simulation.

Background

Major organisations in the European automotive industry have seen substantial benefit from the integration of modelling and simulation into their design process. Today, there is a need for more widespread adoption of engineering simulation throughout the supply chain. At the same time, technology is being developed that offers the potential to reach a new generation of advanced applications.

A number of key issues are currently holding these developments back, including:

- a shortage of sufficiently skilled personnel and inefficiencies in their use
- smaller organisations not being ready or able to deploy the technology
- limits to the confidence placed on the reliability of analytical results
- suppliers using different procedures when supplying to different companies
- researchers needing a coordinated industrial view on priorities for the development of breakthrough technologies.

AUTOSIM will establish an international team of leading experts representing much of the European automotive industry. They will develop a preliminary set of best practice guidelines, standard analytical procedures and research strategies. They will then consult with the wider automotive industry to gain feedback on the preliminary documents and establish credibility on the final documents.

Objectives

The broad objectives of AUTOSIM are:

- to improve the quality and robustness of modelling and simulation in the European automotive industry within an integrated design and product development environment
- to facilitate the use of advanced simulation technologies (finite element analysis, computational fluid dynamics and related methods) within a multi-site, multi-organisational environment
- to improve technology and knowledge transfer between engineering practitioners within the automotive industry
- to identify potential breakthrough technologies which could have a profound effect on the use of simulation techniques for automotive applications
- to identify technology gaps and areas where RTD activity is needed.

The detailed objectives are:

1. to assemble and collate information which is focused on current practices in the application of modelling and simulation technology in the European automotive industry
2. to define best practices and standard procedures for the use of modelling and simulation
3. to identify barriers between current practices and best practices
4. to issue guidelines to help overcome the barriers
5. to ascertain areas in which breakthrough technologies could be of greatest use and prioritise their importance
6. to establish the current state of the art and its readiness to become state of practice
7. to promote RTD projects to address identified requirements
8. to actively and widely disseminate information about all the aspects listed above within the European automotive industry.

Description of work

AUTOSIM will form a new network of experts that will act as a working group to directly confront the industrial and technical issues briefly aired above. Members of the working group will all be leading individuals in their field, drawn from a selection of organisations representing many sectors of the European automotive industry, highly respected research institutions and technology providers.

This project will collate the best available knowledge and distil it into a series of preliminary reports. To ensure that the work is representative of the needs and views of all of the European automotive industry, a process of wide consultation will be incorporated into the project, providing a vehicle whereby all aspects of the work can be thoroughly discussed and the relevant issues debated.

Through a series of technical workshops, the preliminary reports will be revisited and critically reviewed in the light of feedback obtained during the consultation process. A series of final reports will then be developed which will be actively disseminated to users of simulation technology in the European automotive industry at large. Material will be made available in a variety of formats according to need and subject area. Examples include state-of-the-art reviews (STARs), best practice guides (BPGs) and requirements for RTD.

Results

This coordination action will deliver standard procedures for performing analysis. The impact of this will be to:

a. increase the efficiency of teams of engineers who are currently performing analysis

b. broaden the range of personnel who can make effective use of simulation technology, thereby helping to overcome future shortages of skilled personnel

c. improve the efficiency of companies within the automotive supply chain. Instead of being required to work with a number of different procedures when supplying to different companies, they will be able to adopt one common set of procedures.

It will also provide a series of best practice guidelines. The adoption of these guidelines will lead to:

a. an increase in the quality and robustness of the use of engineering simulation

b. improved confidence in analytical results.

The consequence of this will be an increase in the efficiency of the companies which adopt these best practices.

It will identify breakthrough technologies, which will be of maximum benefit to industry. This will allow:

a. the coordination of RTD activities to focus on the areas which will be of most benefit to industry

b. industry leaders to plan their implementation strategies for future simulation capabilities.

Through all of these, the project will strengthen the competitiveness of the European automotive industry.

Keywords: Finite element analysis, computational fluid dynamics, engineering simulation

Acronym:	AUTOSIM	
Name of proposal:	Development of Best Practices and Identification of Breakthrough Technologies in Automotive Engineering Simulation	
Contract number:	TCA4-CT-2005-012497	
Instrument:	CA	
Total cost:	599,610 €	
EU contribution:	599,610 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.09.2005	
Ending date:	31.08.2008	
Duration:	36 months	
Sector:	Road	
Objective:	Advanced Design and Production Techniques	
Research domain:	Integration and standardisation of enhanced product development tools (Developing new advanced design tools)	
Website:	http://www.autosim.org	
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	ABAQUS Europe BV	NL
	Consiglio Nazionale delle Ricerche	IT
	CAD-FEM GmbH	DE
	Österreichisches Forschungs- und Prüfzentrum Arsenal Ges.m.b.H.	AT
	TRL Limited	UK
	Easi Engineering GmbH	DE
	Cork Institute of Technology	IE
	Robert Bosch GmbH	DE
	TUN ABDUL RAZAK RESEARCH CENTRE	UK
	MSC.Software.GmbH	DE
	MECAS ESI s.r.o.	CZ
	AF MICADO	FR
	Pankl Suspension and Transmission Systems	AT
	Dynamore GmbH	DE
	LMS International NV	BE
	Componenta Pistons Ltd	FI
	INPROSIM GmbH	DE
	University of Manchester	UK
	Computational Dynamics Limited	UK
	PSA Peugeot Citroen	FR
	CAEvolution	DE
	TWT	DE
	VIF	AT
	P+Z	DE
	Volvo	SE

HTA

An Alliance to Enhance the Maritime Testing Infrastructure in the EU

The Hydro-Testing Alliance (HTA) will is an initiative that develops a formal and lasting structure to within the field of marine testing to coordinate the definition and introduction of novel measurement, observation and analysis technologies within hydrodynamic model testing environments. Coordination of development, the sharing of advanced equipment and dissemination of knowledge and guidelines will achieve a more integrated and efficient use of marine testing research capacities within Europe.

Background

The alliance is built on the needs arising from industrial and scientific demands. The marine industry demands trustworthy and cost-effective results. As such, the initiators of HTA have constructed a network that follow a bottom-up process which matches these needs in order to meet the excellent European research needs for industry and the scientific community. HTA holds a core of 12 major European hydrodynamic research centers that have a prooven records in instrumentation and measurement system development. In additon 7 Universities that excel within the related technologies will develop jointly.

HTA has a practical objective to optimise the:

- impact on its researchers
- support from a largely market-driven marine testing environment.

Significant activities within HTA are structured around joint research programmes. These programmes are formed with between four and nine core members together with related university expertise to focus on structures that will enable the joint development of a given new technology.

Objectives

The objective of HTA is to facilitate lasting alliances between its key actors in order to to establish an effective and flexible infrastructure of EU marine testing research capacity. This will be catalysed through cooperations that contribute towards competitiveness and excellence in the marine industry, and ensure a continued world leadership of the European hydrodynamic testing.

Description of work

HTA has defined a number of work packages (WP). Besides the coordination, HTA includes a 'vertical' Work Package comprising joint research programmes and three 'horizontal' Work programmes addressing broader integration issues.

The joint research programmes leading towards closer integration are:

- PIV operation in hydrodynamic experimental facilities
- Flow data analysis and visualisation
- 3D wave field measurements
- POD/dynamic forces
- Wireless data transmission
- High-speed video recording and analysis

- Intelligent materials and production methods
- Wetted surface
- Free-running model technologies

The horizontal activities are work packages to establish:

- Measurement policies for hydrodynamic and structural testing
- Knowledge management and communication
- Training and dissemination

Amongst the Network, the co-operation to develop novel measurement technology will create a need to share these results. The Networks legal structures enable this and it is expected that this will lead to more excellent expertise and more efficient use of advanced equipment amongst the partners.

Results

The results from the NoE will be:

- Lasting confidence between alliance members towards joint measurement R&D policys
- Lasting co-operation and coordinated research driven advances in technology.
- Strengthened competitive advantage for the EU against foreighn competition.
- A lasting network of excellence in skills and performance
- The faster availability of novel measurement and testing technologies towards on the marine market.

Acronym:	HTA	
Name of proposal:	An Alliance to Enhance the Maritime Testing Infrastructure in the EU	
Contract number:	TNE5-CT-2006-031316	
Instrument:	NoE	
Total cost:	7,440,000 €	
EU contribution:	6,500,000 €	
Call:	FP6-2005-Transport 4	
Duration:	60 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Integration and standardisation of enhanced product development tools (Developing new advanced design tools)	
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	Centrum Techniki Okrętowej S.A. - Ship Design and Research Centre S.A.	PL
	Development Centre for Ship Technology and Transport Systems	DE
	FORCE Technology	DK
	Istituto Nazionale per Studi ed Esperienze di Architettura Navale	IT
	Norwegian Marine Technology Research Institute	NO
	QinetiQ Ltd	UK
	VTT Technical Research Centre of Finland	FI
	University of Newcastle upon Tyne	UK
	Chalmers University of Technology	SE
	Norwegian University of Science and Technology	NO
	Delft University of Technology	NL
	Universiteit Twente	NL
	Centre National de la Recherche Scientifique - Délégation Normandie	FR
	Università degli Studi di Roma	IT

InterSHIP

Integrated Collaborative Design and Production of Cruise Vessels, Passenger Ships and RoPax

The project aims at increasing the competitiveness of EU shipbuilders with better integrating tools and methods for the design and manufacturing of complex one-of-a-kind vessels. InterSHIP will enable shipyard engineers to consider leading-edge knowledge in environmental aspects, safety, comfort and cost efficiency in simultaneous engineering, thus making sure that optimum solutions can be obtained for the total life cycle of complex ships.

Background

Several problems characterise the shipbuilding sector:

The working environment in shipbuilding is not fully integrated as far as the entire process chain is concerned, neither vertically, i.e. among the various shipbuilding actors: shipyards, suppliers, owner, and classification societies, nor horizontally, i.e. in the various phases from early design to the ship delivery.

Although 80% of the building costs of a ship are defined in the first design stages, the tools in the shipyards are not sufficient to estimate the cost reliably and to support the design for ease of production. Also, the tools used for an effective acquisition, storage and exploitation of knowledge under the conditions of short lead time, integration of an extreme high number of products and technologies, and one-of-a-kind production are currently not sufficient.

The increasing size of the passenger ships, together with strict safety requirements for intact and damage stability, requires thinner materials than before, complicating the hull production process (e.g. by additional shrinkages). While modularisation has increased in other industrial sectors, ships are still constructed in a traditional way with much outfitting work done onboard the ship.

Commissioning, procurement and logistics bear considerable potentials, not yet exploited, for a reduction of idle time in the process chain, as well as for reduced capital cost and an efficient exploitation of resources.

Objectives

The strategic objectives that are addressed by the technical cluster of subprojects are:

- significantly increasing the competitiveness of European cruise and ferry shipbuilders
- development of better products, considering the entire life cycle of complex ships
- drastic reduction of building and development cost as well as time-to-market of innovative solutions.

Description of work

InterSHIP is composed of 26 different subprojects, grouped together in six integrated clusters.

1. Integrated Collaborative Working Environment: concepts and tools are studied and developed for an enhanced integration among the main partners of the shipbuilding value chain, improving the efficiency and reliability of the document transmission between the actors. 'Early design methods' are developed in order to increase the level of information and details, relevant to the product, in the concept design phase.

2. First Principle Design Methods and Tools: conceptual design methods based on the innovative risk-based approach are studied to identify their feasibility and find out a possible way of implementation. Improved methods and tools identify and quantify the main cost drivers in the first phases of the shipbuilding design.
3. Knowledge Management and improved Quality Assurance: improved knowledge concepts and tools are developed to acquire, structure, retain and exploit knowledge relevant to the complex vessels building process. 'Total quality management' concepts and tools are studied to assure that best practice is used all over the process chain.
4. Advanced Hull Manufacturing Processes: advanced manufacturing techniques and tools are studied and developed, including concepts and tools to keep the deformation of steel parts under control during processing, the validation and adoption of advanced welding techniques and technologies, as well as the enhanced automation in the fitting and welding operations.
5. Modularisation and Automation of Pre-outfitting and Outfitting Work: particular focus is given to the study of concepts and modular solutions for the machinery and auxiliary equipment, accommodation and public spaces. The innovative solutions aim to effectively transfer complicated and congested work operations that are at the moment performed on board to the workshop, thus improving efficiency.
6. Logistics and e-Procurement: the development of a unified e-procurement system aims to improve and simplify the communications, shortening the procurement cycle timing. Improved yard logistics and production planning are studied for a more efficient exploitation of the resources, a reduction of the storage period of components and saving of storage areas and transport means usage. Onboard data transmission is studied in order to effectively reduce the number of cables for low voltage networks deployed onboard.

Horizontal actions cross the six clusters foster themes such as safety, environment, innovation and implementation of the results. The results will be disseminated inside the European shipbuilding community.

Results

The major expected results are:

An integrated collaborative working environment characterised by a new innovative web portal for external collaboration.

A tool for the early design process, suitable for the ship space management.

First principle design methods and tools such as:

- rules to CAD for quick generation of production information
- cost-estimation tools for hull production
- tools for shell plate optimisation
- simulation tools for space management and production lines
- concepts for risk-based design of commercial ships.

Knowledge management PDM tools.

Overall accuracy concepts/tools for hull production, including shrinkage management, laser-hybrid welding, and a fully automatic hull parts building area.

Concepts and solutions for increased modularisation in shipbuilding–the 'Euromodules'.

Application of mobile units and data networks for an improved yard logistics.

Shipbuilding e-trading and e-procurement systems.

Keywords: Shipbuilding, process, innovation

Acronym:	InterSHIP
Name of proposal:	Integrated Collaborative Design and Production of Cruise Vessels, Passenger Ships and RoPax
Contract number:	TIP3-CT-2004-506127
Instrument:	IP
Total cost:	38,644,280 €
EU contribution:	19,000,000 €
Call:	FP6-2002-Transport 1
Starting date:	01.11.2003
Ending date:	31.10.2007
Duration:	48 months
Sector:	Waterborne
Objective:	Advanced Design and Production Techniques
Research domain:	Integration and standardisation of enhanced product development tools (Developing new advanced design tools)
Website:	http://www.intership-ip.com
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Partners:	Aker Yards S.A. FR Fincantieri S.p.A. IT Meyer Werft DE Navantia S.A. ES Flensburger Schiffbau Gesellschaft mbH & Co. KG DE Estaleiros Navais de Viana do Castelo, S.A. PT

MARSTRUCT

Network of Excelence on Marine Structures

The objective of the network, which has a duration of five years, is to improve the comfort, effectiveness, safety, reliability and environmental behaviour of ship structures. This objective will be achieved by strengthening the European competitiveness aiming at a permanent organisation of a type of virtual institute, which will ensure the integration of the various European groups in a European centre of competence for the structural analysis of ships with improved safety, environmental behaviour and comfort.

Background

To improve the sustainability of Europe's transportation systems, the increased use of waterborne vehicles will be particularly important in transferring freight movement from roads and passenger movement from land-based and air transportation systems.

The safety and reliability of ships is much lower than that of land-based structures or aeroplanes, and this needs to be improved for the safety of passengers and crews, and to gain the confidence of companies relying on transporting their goods by ship. However, increases in safety need to be carefully justified; otherwise they will not be accepted.

Europe is leading the world in the building of large cruise ships. Europe is also head-to-head in competition in high-speed craft design and building with the non-EU industry, especially from Australia and the Far East.

Therefore, passenger safety on board these vessels is of paramount importance for the European designers, builders and operators. Moreover, foreseeable accidents, where personnel or cargo are lost or delayed, will not encourage freight agencies to use ships in place of road transportation. It is therefore important to the EC strategy that ships are designed, built and operated to be reliable and safe.

Objectives

The overall objective is to improve the comfort, effectiveness, safety, reliability and environmental behaviour of ship structures through the application of advanced structural and reliability assessment within design, fabrication and operation, leading to increased public and commercial confidence in the competitiveness and use of waterborne transportation.

The objective will be achieved through a programme of jointly executed research in the area of structural analysis of ships, the creation of research facilities and platforms, and a continuous programme of dissemination and communication of research results. The way in which the programme is designed contributes to the mutual specialisation and complementarity through building up strengths and reducing weaknesses amongst the participants.

Description of work

The activities of the network will cover the different areas related to advanced structural analysis such as:

- specification of the loading appropriate for the various modes of structural response and strength
- methods and tools for the analysis, both numerically and experimentally, of the structural strength and performance, including aspects such as ultimate strength, fatigue, crashworthiness, fire and explosion, resistance, and noise and vibration

- influence of fabrication methods, and new and advanced materials on the structural strength and performance of ships
- tools for design and optimisation of ship structures
- tools and methods of structural reliability, safety and environmental protection of ships.

Results

The results of the work will be made available to the public through publications which can be found in the project website: www.mar.ist.utl.pt/marstruct

Keywords: Ship structures, structural analysis, structural design, structural reliability

Acronym:	MARSTRUCT	
Name of proposal:	Network of Excelence on Marine Structures	
Contract number:	TNE3-CT-2003-506141	
Instrument:	NoE	
Total cost:	6,700,000 €	
EU contribution:	6,000,000 €	
Call:	FP6-2002-Transport 1	
Starting date:	01.02.2004	
Ending date:	31.01.2009	
Duration:	60 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Integration and standardisation of enhanced product development tools (Developing new advanced design tools)	
Website:	http://www.mar.ist.utl.pt/marstruct	
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	VTT Industrial Systems	FI
	Kvaerner Masa-Yards	FI
	Bureau Veritas	FR
	Principia Marine	FR
	SIREHNA	FR
	Germanischer Lloyd AG	DE
	TUHH-Technologie GmbH (representing the Technical University of Hamburg Harburg)	DE
	Flensburger Schiffbau Gesellschaft mbH & Co KG	DE
	Forschungszentrum des Deutschen Schiffbaus	DE
	National Technical University of Athens	GR
	CETENA - Centro Tecnico Navale	IT
	Università di Genova - DINAV	IT
	Netherlands Institute for Applied Scientific Research	NL
	Schelde Naval Shipbuilding	NL
	Norwegian University of Science and Technology	NO
	Det Norske Veritas AS	NO
	Technical University of Szczecin	PL
	Centrum Techniki Okrętowej S.A. - Ship Design and Research Centre S.A.	PL
	Lisnave Estaleiros Navais SA	PT
	Estaleiros Navais de Viana do Castelo, S.A.	PT
	University 'Dunarea de Jos' of Galati	RO
	IZAR Construcciones Navales S.A.	ES
	Chalmers University of Technology	SE
	Istanbul Technical University	TR
	University of Newcastle upon Tyne	UK
	University of Southampton	UK
	TWI Limited	UK

SAFEDOR

Design, Operation and Regulation for Safety

SAFEDOR will be the first project to develop a risk-based maritime regulatory framework and tools to achieve cost-effective safety by treating it as an objective and not as a constraint. Novel ship designs, which cannot be approved at the moment but are expected to be as safe as current ships, can then be approved.

Background

Sustainable development, related to conservation of the environment, the welfare and safety of people, has been the subject of increasing concern to society during the last decades. Allocations of available natural and financial resources are becoming progressively more focused. Therefore methods of risk and reliability analysis in engineering disciplines are gaining more importance as decision-support tools for railways, safety related electronic systems and aircraft, for example. Integration of risk and reliability analysis methods into the design process for ships leads to 'risk-based ship design', the subject of the integrated project SAFEDOR.

Innovation in the transportation industry has to a significant extent been driven by safety. As an example, cars with integrated crash energy dissipating elements and airbags for impact protection provide safety in accidents. On the other hand, ship safety has mainly been driven by individual events. Each major catastrophic accident has led to a new safety regulation imposed by the International Maritime Organisation (IMO) and the classification societies. This has been the case since the Titanic accident that initiated the development of SOLAS convention. SAFEDOR will now introduce a risk-based design methodology and regulatory framework that combines risk analysis with innovation thus offering to achieve cost-effective safety.

Objectives

Risk-based ship design and approval satisfy the European maritime industries' need to deliver ever more innovative transport solutions to their customers. Risk-based ship design and approval also satisfy European society's need to have increasingly safer transport. Increasing the safety of maritime transport cost-effectively is achieved by treating safety as design objective and not as a constraint, as in current ship design. Increasing the competitiveness of European industry is achieved by systematic innovation in design and operations, encouraged by modernising the maritime regulatory system towards a risk-based framework. Detailed objectives to meet the outlined global targets are as follows:

- develop a risk-based and internationally accepted regulatory framework to facilitate first principle approaches to safety
- develop design methods and tools to assess accidental and catastrophic scenarios, accounting for the human element, and integrate these into a design environment
- produce prototype designs for European safety-critical vessels and ship systems to validate the new methodology and document its practicability
- improve training at universities and aptitudes of maritime industry staff to attain a greater acceptance of risk-based approaches
- systematically transfer knowledge to the wider maritime community and add a stimulus to the development of a safety culture.

Description of work

SAFEDOR will be the first project attempting to develop a risk-based regulatory framework for the maritime industry and corresponding design tools to facilitate first principle approaches to safety. Though risk-based design methods have been developed before, the complexity of a comprehensive system has never been addressed before. The following issues are addressed:

- Proposal for a risk-based regulatory framework, for submission to the IMO, including risk acceptance criteria for ships, ship systems and requirements for documentation and qualification
- Four high-level formal safety assessment studies to document the current risk level for cruise ships, ferries, gas tankers and container ships
- Methodology for risk-based ship design including knowledge bases of risk-reducing measures, risk-cost models for decision-making and a prototype design platform
- Advanced methods and tools needed for risk-based ship design to predict probabilities of flooding, structural failure, intact capsize, collision, grounding, fire, and system failures
- A set of eight innovative ship design studies, applying the new approach, the best two of which will be refined and preliminarily approved later
- Innovative ship energy distribution system, bridge system and a range of life-saving systems
- Training course for professionals and four public conferences.

Results

SAFEDOR will have a large impact on the maritime safety regulations of the future. The current debate at the IMO on goal-based standards adopted a safety-level approach and embraced risk-based methods. With the risk-based regulatory framework in place, innovative ship designs, which are expected to be as safe as or safer than current ships, can be approved which today, for some formal reason in the current rules, cannot be approved.

SAFEDOR will enable the participating organisations to be among the first adopters of a new approach to ship and ship system design which embraces safety as a design objective. Advanced methods and tools will be developed to predict the safety performance of the vessel and their integration into a design environment, suitable to explore risk-reducing measures systematically and to assess their cost-effectiveness, are essential elements for the future maritime solution provider.

Eight innovative ship designs will demonstrate the practicability of the new risk-based approach. Two of these will be selected, refined and preliminarily approved in the second half of the project, resulting in ship designs that can be realised. Two novel ship systems and a range of life saving appliances will be also developed. Depending on market conditions at the end of SAFEDOR, some of the developed designs will be implemented.

Keywords: Maritime safety, risk analysis, risk-based design, risk-based regulation

Acronym:	SAFEDOR
Name of proposal:	Design, Operation and Regulation for Safety
Contract number:	TIP4-CT-2005-516278
Instrument:	IP
Total cost:	20,473,593 €
EU contribution:	12,000,000 €
Call:	FP6-2003-Transport 3
Starting date:	01.02.2005
Ending date:	31.01.2009
Duration:	48 months
Sector:	Waterborne
Objective:	Advanced Design and Production Techniques
Research domain:	Integration and standardisation of enhanced product development tools (Developing new advanced design tools)
Website:	http://www.safedor.org
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Partners:	Carnival plc UK Danish Maritime Authority DK Det Norske Veritas AS NO NAVANTIA, SL ES SAM Electronics GmbH DE University of Strathclyde UK Technical University of Denmark DK National Technical University of Athens - Ship Design Laboratory GR Instituto Superior Técnico PT Maritime Research Institute Netherlands NL D'Appolonia S.p.A. IT SSPA Sweden AB SE Safety at Sea Limited UK Deltamarin Ltd FI FINCANTIERI - Cantieri Navali Italiani S.p.A. IT Alpha Ship Design DK Flensburger Schiffbau-Gesellschaft mbH & Co. KG DE Lund, Mohr & Giaever-Enger Marin AS NO Aker MTW Werft GmbH DE GKSS Forschungszentrum Geesthacht GmbH DE Maritime Simulation Rotterdam b.v. NL ANSYS Europe Ltd UK DFDS A/S DK RFD Beaufort Limited IE Umoe Schat Harding AS NO Martec S. p. A. IT ITI Gesellschaft für ingenieurtechnische Informationsverarbeitung mbH DE University of Hull UK British Maritime Technology Ltd UK Color Line Marine AS NO Peter Döhle Schifffahrts-KG DE Centro per gli Studi di Tecnica Navale IT AVEVA AB SE Leif Höegh & Co. ASA NO Columbus Shipmamagement GmbH DE Harland & Wolff Heavy Industries Ltd UK Stena Rederi AB SE BRODRENE AA AS NO FiReCo AS NO Snecma Moteurs FR Napa Ltd FI NAVALIMPIANTI S.p.A. IT Fr. Fassmer GmbH & Co. KG DE Lloyd's Register UK RINA SPA IT RCL (UK) UK SIREHNA FR ASME GR FRESTI - Sociedade de Formação e Gestão de Navios, Lda. PT Alstom Chantiers de l`Atlantique FR Meyer Werft - Jos. L. Meyer GmbH DE V. Ships Consulting UK

VIRTUE

The Virtual Tank Utility in Europe

VIRTUE is an Integrated Project proposal in response to the call on virtual environment for an integrated fluid dynamic analysis in ship design. It constitutes an EU-wide initiative of leading marine CFD players to create a virtual basin by integrating advanced numerical fluid analysis tools to tackle multi-criteria hydrodynamic performance optimisation of ships in a comprehensive and holistic approach. It will aim to complement model testing in real basins and thus substantially enhance the provision of current services to the marine industry and to nurture development of innovative design techniques and concepts.

Background

Computational Fluid Dynamics (CFD) is becoming an increasingly important tool for analysing flows around ships and propulsors. CFD methods allow a better understanding of the flow phenomena around the hull, give physical insight in the flow characteristics and so can provide the background for design integration. Today's methods do, however, lack a final accuracy to match results obtained in experiments. The combination of improved accuracy applied in integrated design optimisation is the key to future ship design.

Facing an increased demand for seagoing freight and passenger transportation, the European shipbuilding and shipping industry will heavily rely on improved ships and ship design analysis tools. This project addresses particular aspects such as the improvement of performance, efficiency, safety and environmental friendliness. All of these are, to a large extent, influenced by the hydrodynamic behaviour of a vessel and will be addressed in VIRTUE's different work packages.

Objectives

VIRTUE will initially concentrate on the development of new, and the further improvement of existing, high-precision CFD tools, which will allow an integrated and complete numerical analysis of marine hydrodynamic behaviour in a virtual environment, the virtual tank utility. By improving the accuracy, flexibility and reliability of CFD predictions, and by integrating presently disparate tools into an integrated platform, VIRTUE promises to deliver important advantages to the shipbuilding industry, including:

- reduced manufacturing costs through shorter lead times and more focused designs
- improved design and product quality
- increased range and quality of service offered by European hydrodynamics service providers and an increased market share in the design and analysis of maritime products
- increased R&D capacity of the sector as a whole.

VIRTUE's scientific and technological objectives to achieve these ambitious goals include:

- formally integrating numerical tools, using proven approaches, into an environment for complete modelling and simulation of ship behaviour at sea

- providing smooth and versatile communication and data exchange link between marine CFD service providers, such as model basins, and the end user

- providing the means – CFD tools, integration platform and optimisation techniques – to cover the whole range of hydrodynamic problems and to facilitate and support multi-disciplinary design optimisation of new ships.

Description of work

Through large-scale international collaboration, bringing together the leading model basins in Europe, academia, software providers and marine consultants, VIRTUE will improve and integrate state-of-the-art, high-precision CFD tools from a number of origins in a virtual environment simulating ship behaviour at sea and providing an important complement to real test basins in the provision of marine hydrodynamic services. The project will be integrating services and CFD tools from four different virtual tanks:

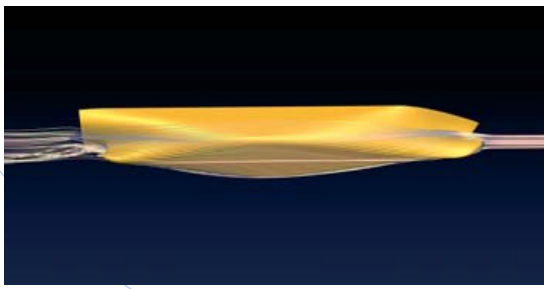
- the virtual towing tank
- the virtual sea-keeping tank
- the virtual manoeuvring tank
- the virtual cavitation tank/tunnel.
- a fifth work package, the integration platform, will provide the prerequisites for an integrated optimisation based on common standards for data provision and the presentation of results.

Results

CFD developments and improvements are progressing according to plan. No new fully operational codes are expected after the first project year. More significant demonstrations of new software are foreseen for the mid-term milestone of the project in Month 24. At the end of the first year, a functional prototype of the integration platform could be presented. This should cover basic functionalities of the various software packages involved, e.g. CAD, CFD solvers and visualisation. The prototype will be continuously improved and enhanced over time so more results will become available soon. Project results are being presented in conferences and publications, and dedicated workshops are planned in 2007/8. News on project events is available from the project website.

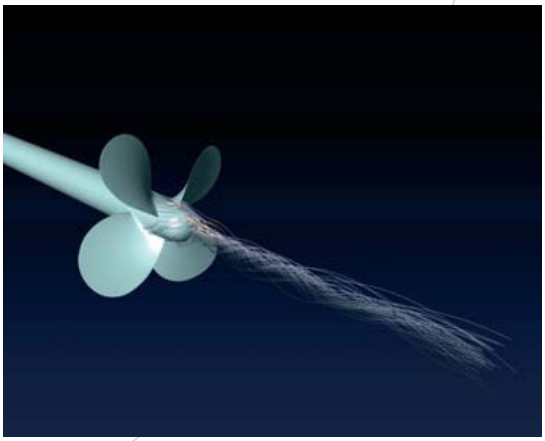
This coherent and all-embracing hydrodynamic analysis system will help increase the competitiveness of EU shipbuilding and shipping industries, and promote a truly European co-operation with strong structuring and integration effects, strengthen SMEs through involvement in leading-edge developments as a means to gaining and sustaining competitive advantage and leadership, and enhance quality and safety in waterborne transportation.

Keywords: Computational fluid dynamics (CFD), shipbuilding, design, integration



HSVA / ZIB 2006

Computed streamlines on a container ship hull from a free surface RANSE prediction



HSVA / ZIB 2006

RANSE prediction of the viscous flow around a propeller - visualisation of hub vortex

Acronym:	VIRTUE	
Name of proposal:	The Virtual Tank Utility in Europe	
Contract number:	TIP4-CT-2005-516201	
Instrument:	IP	
Total cost:	17,029,890 €	
EU contribution:	10,500,056 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.01.2005	
Ending date:	31.12.2008	
Duration:	48 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Integration and standardisation of enhanced product development tools (Developing new advanced design tools)	
Website:	http://www.virtual-basin.org	
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	University of Strathclyde	UK
	WS Atkins Consultants Ltd	UK
	Technische Universität Hamburg-Harburg	DE
	Chalmers University of Technology	SE
	Instituto Superior Técnico	PT
	Ecole Centrale de Nantes	FR
	BASSIN D'ESSAIS DES CARENES	FR
	Bureau Veritas	FR
	VTT Technical Research Centre of Finland	FI
	SIREHNA	FR
	Germanischer Lloyd AG	DE
	Istituto Nazionale per Studi ed Esperienze di Architettura Navale	IT
	FRIENDSHIP-Systems GmbH	DE
	Konrad-Zuse-Zentrum für Informationstechnik Berlin	DE
	Asociacion Centro de Tecnologias de Interaccion Visual y Comunicaciones	ES
	Napa Oy	FI
	Principia Recherche et Developpement	FR
	FLOWTECH International AB	SE
	Helsinki University of Technology	FI

BaWaPla

Sustainable Ballast Water Management Plant

The movement of some 3 to 12 billion tonnes of ballast water (BW) in ships internationally each year has been responsible for the translocation of 10 000 aquatic species across biogeographical boundaries. The aim of this project is the development of a BW treatment technology (UV, filters and electrolysis) into a completely self-controlled system.

Background

Maritime transport is of fundamental importance to Europe and the rest of the world. Over 90% of the European Union's external trade goes by sea and more than 1 billion tonnes of freight a year are loaded and unloaded in EU ports (European Maritime Safety Agency). The transfer of species in ballast water has been going on for as long as the shipping trade. The movement of some 3 to 12 billion tonnes of ballast water in ships internationally each year has been responsible for the settlement of about 100 million tons of sediment. Its cleaning and the disposal of the ballast sludge produced involve enormous costs as well as job hazards and time. Furthermore, as the sediment cannot be removed, the freight capacity of the ship decreases with time and stability problems arise.

Besides these economic aspects, ballast water has been recognised as a major vector for the translocation of aquatic species across biogeographical boundaries. It is estimated that as many as 10 000 alien species of plants and animals are transported per day in ships around the world. As ships travel faster and world trade grows, organisms are better able to survive the journey, using the settled sediments as a substrate, but the threat of invasive species from ballast water increases. Thus with a reduction of sediment settlement in ballast tanks, a significantly reduced danger from alien organisms can be expected.

Objectives

Various ballast water treatment options have been considered in the last 10 to 15 years, including biological, chemical, physical and mechanical treatment techniques or a variation thereof. However, common sense is one treatment step that is not at all sufficient for a thoroughly sustainable cleaning of all types of ballast water around the world on all types of ships.

The aim of the proposed project is the implementation of known treatment technologies (UV, filters and electrolysis) into a completely self-controlled ship's ballast water (BW) system. A central issue of the proposed project is the invention of a final treatment technology incorporating non-permanent, self-generated active substances as the BW needs to be disinfected and this is not possible with UV technology alone. Chemically, these may consist of ozone, chlorine, hydrogen peroxide, free oxygen and other disinfectants, and by producing these substances through electrolysis they need not be stored, carried and produced on land, thus reducing the risk of spill and other accidents. Chlorine produced directly on site by electrolysis represents an extremely economical alternative to other chlorine products, and without the need to store hazardous chemicals.

Description of work

The major technical objective of this project is the development and construction of a ballast water (BW) treatment plant in realistic conditions on board seagoing vessels with minimal environmental effects and adhering to the International Maritime Organisation's guidelines for ships' ballast water and sediments. The project consists of seven work packages:

Work Package 1: Technological and regulatory review

Work Package 2: Electro-chemical technology

Work Package 3: Development of full-scale BaWaPla system

Work Package 4: Automation and integration of BaWaPla system

Work Package 5: Full-scale ship installation of the BaWaPla and field tests

Work Package 6: Dissemination and exploitation

Work Package 7: Project management

Results

Keywords: Ballast water, UV, filter, electrochemical

Acronym:	BaWaPla	
Name of proposal:	Sustainable Ballast Water Management Plant	
Contract number:	TST5-CT-2006-031529	
Instrument:	STP	
Total cost:	2,578,985 €	
EU contribution:	1,699,956 €	
Call:	FP6-2005-Transport 4	
Duration:	months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Application of advanced design and manufacturing techniques (Using advanced design tools, new products and systems generation)	
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	Bureau Veritas	FR
	Ballast Safe Filtration Company	IL
	LVPG International GmbH	DE
	OptiMarin AS	NO
	BALance Technology Consulting GmbH	DE
	Willand UV Systems Ltd	UK
	Lisnave Estaleiros Navais SA	PT
	Business Corlett - Three Quays Ltd	UK

GIFT

Gas import floating terminal

The project concerns the development of an offshore floating LNG (liquefied natural gas) storage and re-gasification terminal in which a large hull is moored to the seabed by means of a turret mooring system that allows the terminal to move freely around it in accordance with the prevailing weather conditions.

Background

Today, the LNG industry is operating mainly inshore coastal terminals that lead to large onshore facilities, raising increasing safety concerns and traffic congestion issues.

New alternatives solutions are proposed:

- offshore gravity base structure (GBS) terminals consist of a concrete or steel gravity structure, sitting directly on the seabed. It can integrate all the basic functions of an onshore LNG terminal (protected berth and unloading facilities, storage capacity for LNG, re-gasification unit, etc.)
- a platform-based terminal does, which does not store LNG but is just used to provide a berth for the carriers and to support the facilities used to refill the LNG and export the natural gas onshore. It does not offer any protection for the carrier from wave and swell, and can only be used in sheltered areas
- converted LNG carriers: this solution uses specialised LNG carriers equipped with a turret mooring system that can be disconnected and a conventional HP gas swivel connected to a flexible gas riser. The gas production is exported from the carrier via a PLEM (pipeline end manifold) and a sub-sea export gas line. The gas production is interrupted once the LNG carrier is discharged before the next one is connected.
- FSRU (floating, storage, re-gasification unit) with turrets, is an offshore LNG receiving terminal which resembles a LNG carrier permanently moored at a given location. The mooring system is similar to the ones used for mooring FPSOs (floating production storage and off-loading). The concepts can move freely around a single point mooring system. The LNG carriers unload the LNG onto the FSRU using two techniques: side by side (in a benign environment), or in a tandem arrangement (the LNG export hose still has a technological gap).

Objectives

The objective of the project is to prove the feasibility of the concept and to increase knowledge on a specific innovative design of the LNG import terminal.

The hull and moorings are to be designed so that transverse thrusters are able to rotate the hull so that it is held almost transversely in the direction of the prevailing seas. In this way the hull acts like a breakwater and creates a calmer area in its lee in which the LNG carrier berths, discharges and unmoors safely.

When a LNG carrier is not alongside, the terminal moves freely, thus minimising the loads acting on the terminal and its mooring system in all weathers.

Therefore the challenge and the technological objectives of the GIFT project are to design a terminal, which:

- can berth the LNG carriers side-by-side in an extended range of weather conditions
- reduces relative movements of the terminal and the LNG-carrier so that the offloading operations are close to those traditionally used in sheltered coastal terminals, allowing for the existing cryogenic loading arm design to be used
- is located at some distance off the coast in order to achieve safe, environmentally friendly, fast and efficient offloading operations, and to avoid traffic congestion and to respond effectively to safety concerns presently raised by the approach of increasing traffic of LNG-carriers to shore
- is cost-effective, constructed and delivered in a shorter time than inshore terminals.

Description of work

The programme of work has the following objectives:

- To define the position of concept with respect to other alternatives and to understand its value and attractions to the end customer. Potential end users of LNG terminals are attending design review meetings from the beginning of the project. Their contribution is of paramount importance, since they will give input, opinion and criticism throughout the design process. They have participated in the definition of the design criteria and functional specifications.
- To carry out the necessary design work to validate the perceived advantages of the concept as outlined above.
- To validate the design work by both hydrodynamic testing and by computer analyses.
- To examine the structure and related systems in sufficient detail so that the unexpected issues resulting from innovation are covered and resolved.
- To identify the way in which the structure could be fabricated, assembled, installed and operated in order to provide a cost-effective alternative to existing technologies. To generate the appropriate outline methods and cost evaluations to allow end users to examine these proposals.
- To take the conceptual analysis and design to a point where there is sufficient technical and commercial development to allow a potential end user to have confidence that the concept can be included in comparative evaluation of alternative development scenarios.

Results

The project methodology is based on close co-operation between the participants, and the membership of the consortium carrying out this work bridges the marine offshore industries and covers the range of skill and capabilities required without duplication.

The project output will bring the concept from its present conceptual form to a state of maturity where it can be confidently considered by oil and gas companies for their future developments. It will have gained the confidence of the engineers, certification authority, builders and potential owners for future presentation to local authorities. The planned output and deliverables will give the concept sufficient maturity to be robust in evaluation by the operators and be in a state where it is sufficiently developed to be usable in the required time-scale.

Keywords: Berthing, floating, LNG, LNG terminal, mooring, side by side, thrusters, turret, unloading-

Acronym:	GIFT	
Name of proposal:	Gas import floating terminal	
Contract number:	TST4-CT-2004-012404	
Instrument:	STP	
Total cost:	3,179,989 €	
EU contribution:	2,295,094 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.02.2005	
Ending date:	31.01.2007	
Duration:	24 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Application of advanced design and manufacturing techniques (Using advanced design tools, new products and systems generation)	
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HANDLING WAVES

Decision-Support System for Ship Operation in Rough Weather

The aim of the project is to develop a decision-support system that will help shipmasters to deal with their ships' performance in waves, improving the operational factors connected to operability and availability.

Background

The shipmaster's ability to optimise a ship's performance at sea is connected with his capability to select the best operational conduct, taking into account the following:

- the weather routing: the ability to choose a route that is an optimal choice along the length of the route and the roughness of the seas
- ship handling: the ability of the shipmaster to optimally conduct the ship in heavy sea states, maintaining the required ship speed, and thus keeping the foreseen delivery schedule, while reducing the likelihood of incurring structural damage
- cargo loading conditions: the precise knowledge, available in real time to the master, of the amount of cargo stored in each hold, the wave-induced dynamic loads induced on the ship structures and on the cargo supporting equipment
- hull strength: the ability of the shipmaster to assess the actual hull strength, taking into account the condition of corrosion and fatigue of the main hull elements in order to judge the ship's vulnerability to high loads induced by heavy weather.

Some recent research projects have addressed the present topic based on using the state-of-the-art wave estimating technology, resulting in the wave spectra from the analysis of the image of navigation X-band radars, but this is an expensive solution.

Objectives

The objective of the project is to develop an onboard decision-support system for tactical decisions of ship handling in waves, which enables the master to improve the ship performance while minimizing the likelihood of structural damage. Besides monitoring the actual ship responses in real time, the system will predict the near-term motions and structural loads due both to weather changes and to possible changes in course and speed by the shipmaster. It is a system for tactical decisions of ship handling covering particular situations of rough weather. The innovation compared to existing systems lies in the prediction capability, which will be based on various computational methods.

The project will be based on a new consortium, benefiting from previous projects within navigation and seaworthiness, and aiming towards creating a decision-support tool for passenger comfort on ships.

Description of work

Scientific objectives:

Objective 1: development of the theoretical background necessary to properly forecast the occurrence and effects on ship structures of abnormally severe waves.

Objective 2: development of a methodology allowing the assessment of the severity of the sea state from the measured ship motions, thus avoiding the use of radar-based monitoring systems, which are costly and operationally demanding to use.

Objective 3: development of a model, here named 'ship response model', which automatically carries out all the required analyses and provides, in real time, the information necessary for optimal ship handling in heavy weather.

Objective 4: development of a representation of the ship's current structural conditions that is simple and synthetic enough to be of real and concrete support to the shipmaster's decisions.

Technical objectives:

Objective 5: development of monitoring devices able to measure accurately the motions of the ship.

Objective 6: development of a decision-support system integrating the various elements required for optimal ship handling in heavy weather and proof of concept through a full size operational system operating at sea.

Results

The decision-support system to be developed in the project will have a positive impact on the competitiveness of EU industry and maritime transport efficiency. In fact the system will be conceived for installation on both new constructions and existing ships, thus addressing the competitiveness of both the EU ship manufacturing sector (new ships) and the EU maritime transport operators (existing ships).

Regarding the manufacturing sector, equipping a new ship with the decision-support system would improve its performance in terms of perspective operability. This would give a competitive advantage to the EU maritime manufacturing industry for both shipyards and equipment manufacturers.

A not-trivial percentage of ship accidents at sea are due to rough weather, which result in commercially adverse effects such as: delayed schedule, damages to cargo and/or passengers and the need for repair. Reducing the occurrence of these accidents would result in an increase of maritime transport efficiency.

Keywords: waves Innovative concepts ship operations maritime handling rough weather decision support

Acronym:	HANDLING WAVES	
Name of proposal:	Decision-Support System for Ship Operation in Rough Weather	
Contract number:	TST5-CT-2006-031489	
Instrument:	STP	
Total cost:	3,037,898 €	
EU contribution:	1,699,964 €	
Call:	FP6-2005-Transport 4	
Duration:	36 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Application of advanced design and manufacturing techniques (Using advanced design tools, new products and systems generation)	
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	Technische Universität Berlin	DE
	Hamburgische Schiffbau-Versuchsanstalt GmbH	DE
	PORTLINE - Transportes Marítimos Internacionais, S.A.	PT
	Navigation Maritime Bulgare plc	BG
	GRUPPO GRIMALDI NAPOLI	IT
	St Petersburg State University	RU

IMPROVE

Design of Improved and Competitive Products using an Integrated Decision-support System for Ship Production and Operation

The principal objective of the IMPROVE project is to develop three new generations of ships in an integrated multiple criteria decision-making environment. This will use advanced design synthesis and analysis techniques at the earliest stage of the design process, which innovatively considers structure, production, operational aspects, performance and safety criteria on a concurrent basis.

Background

European ship building has achieved an important market share through its ability to innovate. This is achieved both through new concepts and the structural optimisation of the entire ship development cycle. Such optomisation has the possibility to produce smarter ships, that are better booth in terms of operation and cost. Improve applies this innovation to produce critical innovative improvements to three product categories. These are:

1. Gas carriers (LNG)

   Europe has constructed several LNG gas carriers of between 72 000 and 140 000 m^3. Several key issues are associated with the development of new LNG structural concept:

   - how to combine fatigue assessment reliably within the early design stage
   - Developing concepts concerning new markets for very large LNG gas carriers
   - Optimising design for production in terms of workload distribution between the different workshops

2. Large RoPax, Ropax is an increasingly important class and in the last five years. This has been an important sector for some yards such as the Uljanik Shipyard. To be competative against strong global competition the ship concept must be in line with with ship owners needs in terms of the current and future market conditons.

3. Chemical tanker

   Basic tankers are ordered by owners for the short term. Most tankers are used for a very short time by the operator that orders the ship and is the resold. Such ships are constructed by low cost producers, typically outsde of the EU and are purchased only on the basis of short term cost. Designs on this basis are not relevant to integrating long-term operational and maintenance costs in the design. However concepts for chemical tankers that are optomised for a long operational life(>15 years) will have lower total life cycle costs. These are attractive concepts for ship owners, both in terms of the direct operational cost and higher resale values

Objectives

The generic objectives of the project are:

- to develop improved generic ship designs based upon multiple criteria mathematical models (LNG gas carriers, chemical tankers, large RoPax)
- to improve and apply rational models for estimation of the design characteristics in the early design phase
- to use and reformulate basic models of multiple criteria ship design, and include them into an integrated decision-support system for ship production and operation.

In addition, there are some specific objectives for each new product.

1. Gas carriers (LNG)
   - Develop a new market with the design of very large LNG gas carriers. It is important for Aker Yard to investigate such new products so as to be able to compete against Korean shipyards, which have already designed such large vessels.
   - How to perform reliable fatigue assessment at the early design stage.
   - Determine the optimum sequence of production and the workload distribution between the different workshops.
2. Large RoPax The arrangement of a large space without pillars requires sophisticated structure solutions. The benefits will be:
   - reduced light ship weight
   - better stability
   - smaller gross tonnage

   The challenge is to improve on the rule of structural design at an early stage of design (concept stage), find an optimal design solution with the IMPROVE tools and continue the design process in the preliminary stages with a better starting point/design.
3. Chemical tanker How to improve the earliest design steps:
   - intelligent models to assess fatigue, ultimate strength, vibrations, design and accidental loads
   - rational approach to integrate these models with the design and estimate overall life cycle savings.

Description of work

The IMPROVE RTD tasks include:

- identification of new product concepts and stakeholders' requirements, establishing problem and model definitions (WP2)
- identification of structural load and response calculation modules (WP3)
- assessment of production and operational aspects (WP4)
- integration of identified models from above-mentioned work packages (WP5)
- application of an integrated IMPROVE platform for the design of three new generations of products (WPs 6-8):
- exploitation and dissemination activities of the project results, and their coordination within WP9.

Results

Improve will generate:

1. a new generation large LNG gas carrier to enhance the competitiveness of European shipyards
2. a new innovative concept optomised large RoPax vessel
3. a new generation of chemical tanker that is expected to prove a valuable niche market for certain shipyards within the consortia.

The new design optomisation methodology applied within IMPROVE will be validated towards the martime design community though the development of practical innovative concepts obtained by:

- defining the ship attributes and measures of design quality early in terms of:
  a. robustness, cleanliness, safety and comfort of product and its service
  b. reduced operational/maintenance costs and energy consumption
  c. integration of advanced, low-mass material structures in the vessel design
  d. rated performance at low initial and maintenance costs;
- generating a set of efficient designs and displaying them to the stakeholders for the final top-level selection. These designs will exhibit the following measurable and verifiable indicators :
  a. an increase in carrying capacity of a minimum of 5-7% of the steel mass
  b. a decrease of steel cost of at least 8%
  c. a decrease of production costs corresponding to standard production of more than 8-10%
  d. an increase in safety measures due to the rational distribution of material
  e. a reduction in FO consumption of more than 12%.
  f. an improvement in the vessel’s operational performance and efficiency of around 10-15%, including a benefit of 5 to 10% on the maintenance cost related to structure and machinery.

Keywords: Ship structure, optimisation, decision support, Gas CArrier, ROpax, Chemical Tanker, Ship Production, Improve

Acronym:	IMPROVE	
Name of proposal:	Design of Improved and Competitive Products using an Integrated Decision-support System for Ship Production and Operation	
Contract number:	TST5-CT-2006-031382	
Instrument:	STP	
Total cost:	4 293 890 €	
EU contribution:	2500000 €	
Call:	FP6-2005-Transport 4	
Duration:	months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Application of advanced design and manufacturing techniques	
	(Using advanced design tools, new products and systems generation)	
Website:	http://www.anast-eu.ulg.ac.be/index.html	
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	SSN (Stocznia Szczecińska Nowa Sp. z o.o.)	PL
	Grimaldi Group	IT
	Exmar Marine NV	BE
	TPZ (Tankerska plovidba d.d. Zadar)	HR
	Bureau Veritas	FR
	Design Naval & Transport	BE
	Ship Design Group Galati	RO
	MEC (Insenerilahendused OÜ)	EE
	Teknillinen korkeakoulu - Helsinki University of Technology	FI
	University of Zagreb Faculty of Mechanical Engineering and Naval Architecture	HR
	Universities of Glasgow and Strathclyde	UK
	Center of Maritime Technologies e. V.	DE
	BALance Technology Consulting GmbH	DE
	WEGEMT - A European Association of Universities in Marine Technology and Related Sciences	UK

MODURBAN

Modular Urban-guided Rail Systems

The main target of the MODURBAN project is to design, develop and test an innovative and open common core system architecture and its key interfaces, in preparation for the next generations of urban-guided public transport systems.

Background

According to the ERRAC (European Rail Research Advisory Council) study, "Light Rail and Metro Systems in Europe: Current market, Perspectives and research implication", there are 170 LRT networks and 36 metro networks in Western Europe. It is expected that the number of new LRT systems could expand by more than 50% over the next 20 years. For metros, the number of new systems is expected to be limited to around five, whereas 55% of existing metro networks are currently extending existing lines or planning new lines. Most of the existing metro systems will have their rolling and signalling equipment replaced over the next 20 years and/or transformed from driver to driverless operation. These figures are in line with the target of the ERRAC Railway Business Scenario 2020 and will be dwarfed by the number of new systems being put into operation in the rest of the world, which are being built using European norms and expertise. This could account for more than 50% of the production of the European rail industry over the same period.

Passenger trips are expected to grow by 40% over the next two decades, across all the transport modes. ERRAC's vision is that the rail market share could double and that the rail market volume could increase by more than a 150% in passengers over current volumes. To meet this expectation – which means a reverse in the current trends of the last 20 years – it is of utmost importance to develop reliable, affordable, attractive and even more energy-efficient urban rail systems for use in European cities. This calls for innovative and interchangeable constituents and subsystems with common harmonised interfaces. This will reduce the cost of ownership as well as the operation and maintenance of rail installations. It is vital in view of the growing complexity of new IT based subsystems that new products are developed along common interchangeable modular principles.

Objectives

The main target of the project is to design, develop and test an innovative and open common core system architecture and its key interfaces (this covers command control, energy saving and access subsystems), paving the way for the next generations of urban-guided public transport systems. This approach will apply to new lines as well as the renewal and extension of existing lines, and will encourage cost-effective migration from driver to driverless operation. This integrated approach will avoid the risk of new rolling stock and subsystems being built from unproven prototype sub-assemblies. With regard to passenger information and exchange at platforms, the objective is to harmonise the displays and push buttons as much as possible, as well as the operational procedures. Moreover, various energy saving methods (e.g. optimisation software, lightweight materials) will be developed.

Description of work

The MODURBAN IP will define the necessary functional, electrical and mechanical interfaces, and validation procedures necessary to deliver the range of interchangeable modules that will make the next generation of affordable urban guided public transport a reality.

The principal elements to be defined in MODURBAN using end-user requirements and validation are:

- onboard intelligent interfaces
- wayside intelligent interfaces
- passenger and access-related items
- communication systems
- energy savings related aspects
- system approach for functional requirements and technical specifications and global risk assessment.

Results

One of the main objectives for the first phase is to lay down the basic functional requirements for the entire MODURBAN system. This is crucial, as it will then allow adequate technical integration of the critical elements of the different subsystems.

Some other main achievements are the following:

- The ATP (automatic train protection) onboard specification and interfaces with the wayside, including the definition of the functional interfaces with the onboard ATP to other subsystems, determining their inputs and outputs to/from the onboard ATP.
- The data communication system functional requirements defined to meet all the operator needs, so that a single communication system can be used instead of multiple communication systems often used in today's mass-transit systems.
- The list of relevant standards and requirements related to passenger information systems. This preliminary analysis addresses the functionalities of the passenger information system devices installed onboard for both metros and trams, giving special attention to emergency situations.
- Description and specifications of the applicable solutions for onboard energy storage systems. Basic principles are presented and compared to one another. The given data of different vehicle types, various models of operational cycles and several train control strategies create a basis for deciding which combination of technologies is considered to be the most efficient.
- First network report for the users group (European operators who are non-consortium members): the principal targets of the users group are to promote knowledge, stimulate debate and reach consensus – Europe-wide – for the MODURBAN functional requirements and its technical specifications, safety concepts and procedures developed by the project at the various project stages.

Acronym:	MODURBAN	
Name of proposal:	Modular Urban-guided Rail Systems	
Contract number:	TIP4-CT-2005-516380	
Instrument:	IP	
Total cost:	19,418,225 €	
EU contribution:	10,400,000 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.01.2005	
Ending date:	31.12.2008	
Duration:	48 months	
Sector:	Rail	
Objective:	Advanced Design and Production Techniques	
Research domain:	Application of advanced design and manufacturing techniques (Using advanced design tools, new products and systems generation)	
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	Bombardier Transportation (Holdings) Germany GmbH	DE
	VOSSLOH	DE
	ANSALDOBREDA S.p.A.	IT
	CSEE Transport SA	FR
	ALCATEL CIT	FR
	KNORR BREMSE Systeme für Schienenfahrzeuge GmbH	DE
	KNORR BREMSE Rail System (UK) Ltd	UK
	Freinrail SA EUROTELEC	FR
	FRENSISTEMI srl	IT
	DIVISION IFE Doorsystem Knorr Bremse GmbH	AT
	DIMETRONIC S.A. Representing Invensys Rail	ES
	NAVECOM	FR
	Esterel Technologies	FR
	Régie Autonome des Transports Parisiens	FR
	Union Internationale des Transports Publics asbl	BE
	Berliner Verkehrbetriebe	DE
	London Underground Limited	UK
	Metropolitano de Lisboa	PT
	METRO DE MADRID S.A.	ES
	Agenzia per i Trasporti Autoferrotranviari del Comune di Roma	IT
	Ferrocarril Metropolità de Barcelona S.A.	ES
	Dopravni podnik hl. m. Prahy, a.s.	CZ
	Budapest University of Technology and Economics	HU
	European Commission - Joint Research Centre	IT
	KITE Solutions s.n.c.	IT
	Technische Universität Dresden	DE
	Institut National de Recherche sur les Transports et leur Securite	FR
	Université de Valenciennes et du Hainaut Cambrésis	FR
	University of Newcastle upon Tyne	UK
	Universidad de Chile	CL
	ALMA Consulting Group S.A.S.	FR
	RHEINBAHN	DE
	RHEINCONSULT	DE
	Metro Warsaw	PL
	ALCATEL TAS Canada	CA

PLUG

Power Generation during Loading and Unloading

PLUG is a new concept of power interface between LNG or container carriers, using electric propulsion and terminals, which allow them to provide or receive power from the local grid. PLUG is focused on the development and qualification of a quick connect/disconnect 6 600 volts 'hands off' concept and its associated power line with a power exchange capability of up to 25 MW.

Background

Up until now, power interfaces between carriers and terminals have had limited capabilities (less than 1 MW), they do not meet LNG or crude carriers safety requirements and operate at a low voltage (440 volts). Furthermore they involve risky manual handling of heavy cables by the crew.

There is an emerging requirement to allow a higher power exchange between carriers and terminals in order to:

- reduce local harbour emissions by supplying the carriers from the shore via onshore RES (renewable energy sources) (wind-powered) when available
- use the carrier's onboard power generation capability as a 'shadow' power source to meet power consumption demands if RES are not available.

Objectives

The PLUG project aims at developing a 'hands off' concept were a single crewmember can perform the connection/disconnection task without directly handling the power connector and the power cables. It will also feature the quick emergency safe disconnection capability required for LNG and crude carriers.

In addition, PLUG will address the development of operational crew and terminal procedures and of data exchange systems between all the stakeholders (charter companies, crews, ship owners, customs, terminal operators, power traders, power networks, power consumers or providers, etc.) in order to allow an easy and user-friendly power exchange operation without impairing cargo handling systems.

Description of work

The following work will be carried out during the project:

- design, manufacture and test of 6 600 volt connector
- design and manufacture of a full-size power line demonstrator
- develop safety analysis to meet LNG carrier and terminal safety requirements
- establish operational procedures relevant to both crews and terminals
- develop a 'link to the market' data exchange system between all the stakeholders to support their power exchange strategy.

Results

The expected results are:

Full-size demonstrator tests of the whole power line.

Inputs to regulatory bodies, such as the International Maritime Organisation, to establish relevant guidance rules and standards for power interface between crude and LNG carriers and terminals.

Keywords: Power network, RES, LNG carriers

Acronym:	PLUG	
Name of proposal:	Power Generation during Loading and Unloading	
Contract number:	TST5-CT-2006-031477	
Instrument:	STP	
Total cost:	1,742,000 €	
EU contribution:	800,000 €	
Call:	FP6-2005-Transport 4	
Duration:	24 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Application of advanced design and manufacturing techniques (Using advanced design tools, new products and systems generation)	
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	SINTEF Energiforskning AS	NO
	Leduc	FR
	Wavespec	UK
	Staubli	FR

SAFE OFFLOAD

Safe Offloading from Floating LNG Platforms

There are substantial advantages in liquefying the natural gas on an offshore production platform and offloading it to a shuttle gas carrier. Such a system is usually referred to as floating liquefied natural gas (FLNG). FLNG systems have been considered globally as a development option for a number of offshore gas fields, but due to perceived operational difficulties none has yet been developed.

Background

Conventionally, offshore gas fields are developed by building a gas line to shore. If there is no local market for the gas, it may be liquefied and loaded onto LNG carriers for export. There are several difficulties in applying this system, including:

- the large size of the cryogenic plant for liquefaction of the natural gas entails the use of a very large ship – 400 metres would be typical – which makes the reliability of the mooring system particularly critical
- the operation of the plant sets limits on the motion of the ship. Pitch or roll of one or two degrees reduces efficiency and larger motions will close down the process equipment - due to the cryogenic nature of LNG, conventional floating hoses cannot be used for offloading. The use of LNG loading arms requires the carrier to approach very close to the production barge and probably moor side by side, a practice only possible in very mild conditions
- when the vessels are moored, relative motions induce high tensions in the lines between the vessels and large angles in the offloading arms. Both aspects limit offloading.

The vessel motions that limit FLNG operations are excited by the environmental winds, waves and currents. If the weather windows that allow production and offloading are sufficient, the system has the potential to work safely and efficiently.

Objectives

This project addresses the environmental conditions that influence the whole FLNG system: the interaction between the environment and the production and shuttle vessels, and the responses of the vessels. The goal is to optimise the system to maximise operability and safety. The objectives of this project are to:

- maximise the weather windows during which FLNG barges can be offloaded and FLNG can be operated. An optimised hull design and an active heading control strategy may reduce motion levels.
- maximise the safety and efficiency of the offloading operation, and minimise the possibility of collision or breakage of cryogenic lines
- have the capability to predict the behaviour of vessels during offloading
- have the capability to make the best, rational, real-time, risk-based decisions whether to proceed with approach and offloading
- understand the physical processes that govern the vessel motions during offloading
- have the capability to analyse the offloading process for design: specify environmental criteria, perform dynamic analysis, and optimise hull shape, moorings and systems
- provide motion ranges for design of high-pressure, cryogenic pipes and flexible connectors for offloading
- provide a prototype method of a decision support system that continuously monitors the environment and combines this information with weather forecasts and simulations of vessel motions.

Description of work

Design concepts will be considered in the project and improved designs will be developed based on the results of hydrodynamic analysis and model tests.

Long-term data will be analysed in terms of the persistence of severe conditions that prevent operations and weather windows in which operations may be performed. Probabilistic models of relevant wave parameters will be developed.

A sophisticated wave diffraction theory will be extended to treat multiple, closely spaced, large bodies that can move independently. A non-linear boundary element method will also be developed and tested against the diffraction theory. A code will be developed for the low speed manoeuvring of the tankers. All the hydrodynamic models will be tested against physical model tests.

The approach manoeuvre of the tanker for offloading and the effect of the environmental disturbances will be studied, and the role of dynamic positioning will be investigated.

A procedure to aid real-time decisions concerning approach, mooring and offloading will be developed. It combines the environmental models and the hydrodynamic and simulation models with weather forecasting and probabilistic decision tools.

A risk assessment will be made, design criteria will be prepared, and an assessment of the operability of the system in terms of production and offloading.

Results

The expected results are:

- A set of LNG platform designs and a set of alternative hull configurations to minimise motions.
- A method to predict near-future waves from spatial or temporal structure.
- A method to predict near-future wind, wave and current events relevant to decision-making for offloading.
- An efficient second order diffraction method for multiple bodies in waves.
- A boundary element method for vessels in waves, and comparison with second order frequency domain results.
- Methods of estimating forces due to winds and currents.
- Method to predict low speed manoeuvring.
- Measurements of wind forces on individual vessels and typical offloading configurations.
- Model test results of the modified hull designs for the vessels.
- Model tests with two bodies subject to current, wind and waves.
- Numerical simulations of approach and mooring, limiting sea states for approach and connection.
- Methods of station keeping, minimising vessel-relative motions, limiting sea states for disconnection, methods for the prediction of near-future weather.
- A decision support methodology.
- Design and operational risk and acceptance criteria for all phases.
- Short and long-term statistics of vessel responses.
- Assessment of frequency and duration of intervals in which approach is safe.

Keywords: FLNG, FSRU, wind, waves, currents, risk assesment, diffraction, hydrodynamics, LNG, model

Acronym:	SAFE OFFLOAD	
Name of proposal:	Safe Offloading from Floating LNG Platforms	
Contract number:	TST4-CT-2005-012560	
Instrument:	STP	
Total cost:	3,451,458 €	
EU contribution:	1,999,912 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.01.2006	
Ending date:	31.12.2008	
Duration:	36 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Application of advanced design and manufacturing techniques (Using advanced design tools, new products and systems generation)	
Website:	http://www.mar.ist.utl.pt/safeoffload/	
Coordinator:	Dr Ewans Kevin Charles SHELL International Exploration and Production B.V. Carel van Bylandtlaan, 30 NL 2501 CR The Hague	
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Partners:	Instituto Superior Técnico	PT
	DHI Water & Environment	DK
	Det Norske Veritas	NO
	Imperial College of Science, Technology and Medicine	UK
	Nobel Denton Europe Ltd	UK
	The Chancellor, Masters and Scholars of the University of Oxford	UK
	Lisnave	PT
	Ocean Wave Engineering	UK

SMOOTH

Sustainable Methods for Optimal design and Operation of ships with air-lubricaTed Hulls

Air lubrication of Ship hull a large potential gain in hull effciency of up to 20%. SMOOTH seeks to fill missing technology gaps and enable air lubrication of hulls within normal European shipbuilding and operation practice for both inland and coastal ships.

Background

While the basic concept of air lubrication is old, limited serious research has been performed. It was the PELS project, a Dutch national project that made a positive change. This project demonstrated that a positive overall energy gain can be achieved in all operational conditions with air lubrication. The required technology itself is new and requires further exploration. Based on the findings from the PELS project, the SMOOTH consortium estimates that ship hull efficiency improvements of up to 20% will be feasible. Such a step forward would be beneficial to the environment since the considerable reduction of fuel consumption will have its effect on the CO_2, NO_x and soot discharges. A reduction of fuel consumption will, of course, also be welcomed by the European shipping business since it will result in a reduction of costs.

European policies are addressed in a number of ways: the noticeable reduction of the operational costs by reducing the ship's resistance, the enhancement of the quality and operational safety of the transport process, and the safer transport of crude oil and other dangerous and potentially polluting goods. The SMOOTH project facilitates the inter-European knowledge exchange, by providing a platform of co-operation for SMEs, companies and research institutes from six different European states, including and candidate country Turkey.

Objectives

As air lubrication has been successfully tested for model ships, new products (in terms of suitable ultra repelant painting systems, ambient and functional air distribution and control systems) need to be developed further to apply this technique to vessels. The resulting verifiable and measurable objectives for the Smooth project are:

- to provide validated (finally tested on model scale) computational tools for a real ship design
- to validate scale effects of air lubrication
- to evaluate the economy of air lubrication in practice and demonstrate the concept at full size on an inland vessel
- to prepare the safe introduction of air-lubricated ships in practice.

The strategic objective of SMOOTH is to apply air lubrication to ships and to provide the necessay new products in terms of control and paint systems to introduce air-lubricated ships. These ships may utilise micro-bubble (MB), air-film or air-cavity systems (ACS), for inland and coastal navigating ships with relatively shallow drafts.

Description of work

SMOOTH has defined a number of work packages.

WP1: Project management

WP2: Experiments on air films

WP3: Scale effects and sea trials

WP4: Model tests on air films

WP5: Model tests on micro-bubbles and air-cavity ships

WP6: Economic plus risk evaluation

WP7: Evaluation and dissemination

The techniques surveyed in SMOOTH for practical application and implementation in the coming generation of European ships will include in addition to improved drag and power-reduction , other innovations such as better stopping and manoeuverability.

Novel painting systems for ships and new air-control systems aboard ships will strengthen the position of the European shipbuilding industry represented within the Smooth consortium.

Results

SMOOTH has the following deliverables:

D1.1 Project manual

D1.2 Management reports every six months, short summary reports every three months

D1.3 Mid-term report of the projects

D1.4 Project progress reports with cost statements, every 12 months

D1.5 Work package progress reports, i.e. mid-term, and final reports on each one

D1.6 Project completion reports

D2.1 Overview of the state of the art

D2.2 Overview applicable to super water-repellent (SWR) coatings for maritime applications

D2.3 Stability of air films and parameters that influence it

D2.4 Theoretical description of the phenomena

D3.1 Scale effects on air-film lubrication

D3.2 Scale effects on air lubrication in general

D4.1 Stability of air films on curved surfaces

D4.2 Effectiveness of air films in service

D5.1 Optimised design of an air-lubricated ship

D5.2 Validated design strategies

D6.1 Initial risk assessment for air-lubricated vessels

D6.2 Final risk assessment of air-lubricated ships

D6.3 First full-scale results on micro-bubble lubrication

D6.4 Equipped with a complete SWR coating of Akzo Nobel, the same barge is tested with air-film lubrication

D6.5 First large-scale tests with integrated air-supply system.

D7.1 Workshops, seminars and international conferences for dissemination of results and demonstrations

D7.2 Design guidelines for air-lubricated vessels

D7.3 Website

Keywords: Air lubrication, drag reduction, micro-bubbles, air cavities, super water-repellent coating, fuel saving, air films

Acronym:	SMOOTH	
Name of proposal:	Sustainable Methods for Optimal design and Operation of ships with air-lubricaTed Hulls	
Contract number:	TST5-CT-2006-031392	
Instrument:	STP	
Total cost:	2,525,500 €	
EU contribution:	1,438,250 €	
Call:	FP6-2005-Transport 4	
Duration:	36 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Application of advanced design and manufacturing techniques (Using advanced design tools, new products and systems generation)	
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Partners:	International Paint	UK
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	Damen Shipyards Group	NL
	Istanbul Teknik Universitesi	TR
	Ketting Compressoren B.V.	NL
	New-Logistics GmbH	DE
	SSPA Sweden AB	SE
	Development Centre for Ship Technology and Transport Systems	DE
	Thyssen Krupp Veerhaven	NL
	Imtech	NL

VISIONS

Visionary Concepts for Vessels and Floating Structures

VISIONS is the new 'think tank' of the European maritime industry and has implemented an annual process for the definition and validation of visionary concept outlines for vessels and floating structures (i.e. potential products for the next 5-15 years).

Background

Europe's maritime industry is at the leading edge of innovations. However, to defend this position, future challenges have to be picked up as early as possible. Many ideas for long-term maritime products and services appear quite futuristic today and are rarely systematically investigated. On the other hand, without such project-based investigation, it is difficult to identify and define the possible R&D tasks necessary before commercialisation. In times of constantly decreasing cycles of technology and increasing speeds of innovation, it is essential to work on future challenges early enough, even if they may appear visionary today.

Objectives

The project has been implemented to organise a systematic, scenario-based, pre-competitive 'think tank' process to increase the number of ideas for potential products, validate them and identify possible necessary R&D efforts early enough to be prepared for future needs. The scenarios, which are input for the annual 'ideas contest' and which are created with the help of professional users, enable a link to business reality.

The process, which will be repeated three times during the proposed NoE duration, is open for teams of students and experts from Europe's maritime universities (annual idea contest and open call for validation experts). The definition of all concept outlines and possible R&D gaps is done based on professional market and society scenarios created in the NoE, which are the basis of the process. The results of the annual process will be presented to the maritime industry, which is invited to team up with the 'idea-creators' for further development by annual showcase events and will be used as input for the definition of R&D strategy of the maritime industry, linked to its actual and future European Advisory Council and technology platform structures.

The project will also provide a closer link between the European maritime universities and industry.

Description of work

The annual process ('innovation loop') has the following elements:

a. creation of professional market and society scenarios by a dedicated scenario group including external key user interviews

b. a 'call for ideas' answering the scenario challenges to student teams from the European maritime industry. The best five to seven ideas will be short-listed by the core partners and will be subject to further investigations.

c. evaluation of the short-listed tasks done according to identified tasks and by selected experts (tender process). Compilation of a comprehensive report per idea (including 'distance to market')

d. selection of three winners by a high-level industry jury, with an industry-sponsored contest award and the presentation of all ideas ('showcase').

The process is vertically structured and managed in five business areas:

- maritime tourism/leisure
- intermodal transport (short sea shipping, inland shipping, deep sea shipping)
- floating infrastructures

and horizontally structured in seven expertise fields:

- market/society needs
- technical feasibility/design
- production
- equipment/systems
- operation/security
- infrastructure/logistics
- safety/environment.

The organisation and main decisions during the project will be done by leading industrial and research core partners.

Results

The expected results are:

- systematic scenario work in all relevant business areas ('think tank' function)
- a greater number than today of scenario-based visionary concepts, which are discussed, presented and considered by the industry as a basis for further development work, including floating infrastructure projects
- systematic, project-based early identification of R&D needs
- closer link and practice-based co-operation between the European maritime industry and the European maritime universities, using the creative potential in an organised and business-relevant way.

VISIONS will keep European maritime industry and R&D resources at the leading edge of innovation for global competitiveness, but also contribute to the quick and sustainable solution of transport problems in Europe.

Keywords: Market and society needs, visionary concept outlines, maritime tourism, intermodal transport, marine resources, floating infrastructures

VISIONS consortium

Business Area 1: Maritime tourism/leisure

VISIONS consortium

Business Area 5: Floating infrastructures

Acronym:	VISIONS	
Name of proposal:	Visionary Concepts for Vessels and Floating Structures	
Contract number:	TNE4-CT-2005-516216	
Instrument:	NoE	
Total cost:	5,000,000 €	
EU contribution:	5,000,000 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.04.2005	
Ending date:	30.09.2008	
Duration:	42 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Application of advanced design and manufacturing techniques (Using advanced design tools, new products and systems generation)	
Website:	http://www.maritime-visions.eu	
Coordinator:	Mr vom Baur Michael Community of EU Shipbuilders Association a.s.b.l. Rue Marie de Bourgogne 52 BE 1000 Brussels	
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Partners:	IMAWIS - Maritime Wirtschafts- und Schiffbauforschung GmbH	DE
	Alstom Chantiers de l'Atlantique	FR
	Centro per gli Studi di Tecnica Navale	IT
	Development Centre for Ship Technology and Transport Systems	DE
	Conoship International BV	NL
	Aker MTW Werft GmbH	DE
	Norwegian Marine Technology Research Institute	NO
	JAFO Technologie, Zweigniederlassung der Blohm+Voss international GmbH	DE
	EVIMAR A/S	DK
	University of Rostock	DE
	NAVANTIA S.L.	ES
	Center of Maritime Technologies e.V.	DE
	Rolls-Royce Power Engineering Plc	UK
	Wilhelmsen Marine Consultants AS	NO
	British Maritime Technology Ltd	UK
	SSPA Sweden AB	SE
	Ship Design and Research Centr Gdansk	PL
	University of Strathclyde	UK
	BALance Technology Consulting GmbH	DE
	Germanischer Lloyd AG	DE
	WEGEMT	UK
	European Oil and Gas Innovation Forum	BE

DE-LIGHT Transport

Developing Lightweight Modules for Transport Systems featuring Efficient Production and Life-cycle Benefits at Structural and Functional Integrity using Risk-based Design

DE-LIGHT Transport aims to develop new solutions, methods and tools for the design, production, integration and testing of complex modular lightweight structures in ships, intermodal transport containers and railway vehicles. Focus is given to the development of multi-material modules with a higher degree of pre-outfitting, as compared to the optimization of structural components which was mainly done in previous projects. Results will be used and demonstrated in large scale prototypes for six application cases.

Background

The project is based on previous national and European projects which largely focused on the development of structural lightweight components. DE-LIGHT Transport will use this results, but focus more on the development of modular pre-outfitted units and the technologies and knowledge required for their design, manufacturing, assembly and operation.DE-LIGHT Transport aims to overcome the following challenges and obstacles identified in previous projects, such as the Coordination Action SAND.CORe:·Available lightweight solutions in the maritime and rail sectors mainly focus on the use of lightweight materials (e.g. fibre reinforced plastics, polymeric foam panels etc) or innovative designs better utilizing traditional materials (e.g. laser welded metallic sandwich panels).

- Insufficient design tools and design data make optimum design for end-users difficult and time consuming. The project will complement and combine algorithms and dedicated engineering design tools developed primarily in the HYCOPROD and SANDWICH projects.
- Lightweight applications for commercial ships are currently limited to non load-bearing components and the superstructures of large ships. In the rail sector, these applications are restricted to non- or semi-structural components.
- Currently available lightweight components for transport systems are expensive one-off products. Their properties do sometimes not fit to the extreme operational requirements in transport systems. They are primarily designed to fulfil single purposes and do not integrate multiple functions.
- Joining, onboard assembly and onboard outfitting are complicated and expensive, operational cost and potential benefits are not sufficiently specified. This puts the life cycle cost efficiency of available lightweight solutions at risk.
- Potential benefits of lightweight solutions for the transport industry are not fully used, because product and production concepts do not support the application or because safety and commercial risks cannot be controlled.

Objectives

The project aims to produce a number of new design solutions using risk based design methods. Furthermore a sophisticated design tool will be developed based on results of previous research projects such as Sand. Core, Sandwich and HYCOPROD.The overall objective of the DE-LIGHT Transport project is to elaborate and

demonstrate innovative integrated lightweight modules (integrating load-bearing and other functionalities) as well as the design, production and testing methods and procedures. The solutions developed will feature significant operational benefits as well as reduced building cost, i.e. decreased life cycle cost. Risk management and the application of risk based design methods will allow to develop highly innovative solutions exceeding the range of existing classification rules by exploring new material combinations, innovative joining, assembly and pre-outfitting techniques. The strategic objectives can be summarized as:

- To make better use of innovative materials and material combinations in multi-functional lightweight components (DESIGN SOLUTIONS)
- To improve reliability, quality, cost and lead time in developing and designing lightweight solutions and to make knowledge more easily accessible (DESIGN TOOL)
- To improve cost efficiency and quality and to reduce lead time in production and service of integrated lightweight modules (PRODUCTION, MAINTENANCE and SERVICE TECHNIQUES)
- To elaborate and harmonize efficient and reliable testing, validation and life-cycle cost assessment methods and procedures (TEST PROCEDURES)
- To control the safety and commercial risks related to the development and application of innovative lightweight modules and to prove fitness for purpose of the developed solutions (RISK BASED DESIGN METHODS)
- To foster a wider and more efficient industrial application of integrated lightweight modules and structures (INDUSTRIAL APPLICATION) The scope of applications followed by DE-LIGHT reaches from passenger and RoRo ships, through cargo and short sea ships, to intermodal transport units and railway carriages

Description of work

Six industry driven application cases showing high potential benefits for lightweight modules as well as a high degree of innovation will be studied and demonstrated in DE-LIGHT Transport. Those cases will drive, apply and validate the new technology development, grouped in three generic work packages.The application cases comprise in particular:

1. Deck house for inland waterway and sea cargo ships.
2. Side and deck structures for RoRo vessels.
3. Composite deck structures for marine applications.
4. Sandwich superstructures for offshore patrol vessels.
5. Intermodal cargo units for freight transit.
6. Rail vehicle driver's cab.Key technologies, methods and tools needed for the application cases will be developed in three scientific work packages focusing on design, production and testing.

Those are:

- WP1: Development of new design algorithms against various failure modes and their integration into an innovative multi-material sandwich design tool. DE-LIGHT Transport will, compared to previous work which has often focussed on a particular type of sandwich construction, implement a more generic design approach that will allow the evaluation and optimisation of a wide range of material and structural mixes according to the requirements of a given application.
- WP2: Strategies for joining, assembly and outfitting – the bringing together and integration of separate sandwich panels and/or sub-components to produce finished structures.
- WP3: Testing and validation procedures – to provide accurate and reliable methods of determining fitness for purpose with advanced testing methods.The work package structure of DE-LIGHT Transport is shown in the scheme attached.

Results

The research work performed in the generic work packages will be adapted and applied within the six application cases, including passenger ship decks, RoRo decks, cargo and short sea shipping, intermodal transport units and a railway cab. A full scale prototype will be developed in each application case. It will address characteristic and critical areas focused on safety, pre-outfitting, joining and assembling. To support this work a design tool building on previous work will be produced with a range of realistic design scenarios of use for the designer in the real world. The design tool will be based on the algorithms developed in previous research project as well as on new algorithms developed within in the scientific part of the project. As a result of delight sandwich materials are expected to be applied with confidence in real world transport applications. The overall results can be summarized as follows:

- A multi-material sandwich design tool,
- Strategies for joining, assembly and outfitting – summarized in a manufacturing handbook and applied in the application cases
- Testing and validation procedures – summarized in recommendations for new testing standards and applied in the application cases
- Direct application of the results in the transport sector and proven by full scale prototypes

Keywords: Research, sandwich, lightweight, SANDWICH, SAND.CORe, DE-LIGHT, transport, ship structures, rail vehicles, intermodal containers

Acronym:	DE-LIGHT Transport
Name of proposal:	Developing Lightweight Modules for Transport Systems featuring Efficient Production and Life-cycle Benefits at Structural and Functional Integrity using Risk-based Design
Contract number:	031483
Instrument:	STP
Total cost:	3,707,797 €
EU contribution:	2,497,518 €
Call:	FP6-2005-Transport 4
Starting date:	01.11.2006
Duration:	36 months
Sector:	Multi
Objective:	Advanced Design and Production Techniques
Research domain:	Development of advanced, low-mass material structures and systems
Website:	http://www.delight-trans.net/
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Partners:	'Ovidius' University of Constanta - Center for Advanced Engineering Sciences RO Uljanik Brodogradiliste, d.d. (Uljanik Shipyard) HR University of Zagreb Faculty of Mechanical Engineering and Naval Architecture HR Meyer Werft GmbH DE Institut fuer Holztechnologie Dresden gGmbH DE Schelde Naval Shipbuilding NL APC Composit AB SE SICOMP AB SE Anthony, Patrick and Murta Lda PT Bombardier Transportation FR Det Norske Veritas AS NO Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. DE BALance Technology Consulting GmbH DE University of Newcastle upon Tyne UK Teknillinen korkeakoulu FI Riga Technical University LV Technical University of Gdansk PL Noske Kaeser DE

LITEBUS

Modular Lightweight Sandwich Bus Concept

Multimaterial technology (sandwich and/or hybrid materials) is becoming increasingly important in new vehicle design. Public service vehicles (buses and coaches) are regarded as primary targets for application of sandwich construction and multimaterials, which play a major role in the transportation industry of both industrialised and developing countries. The proposed project will be focused on the development of a novel technology to manufacture bus/coach bodies using multimaterial sandwich panels.

Background

Bus manufacturing is a niche market compared with the car market. It is estimated that there are more than 500 000 buses in circulation in EU countries alone. The bus industry uses extensively welded fabrication, which is labour intensive in nature. In order to stay competitive and maintain employment, bus/rail manufacturers will have to produce more attractive products and reduce production costs, thus new concept designs, materials and assembly methods will have to be developed and applied. Currently there are no buses/coaches or rail rolling stock in the market using the design concepts and composite sandwich materials to be developed within this project.

The project aims to explore the potential benefits offered by integrated composite sandwich material in passenger buses/coaches as a case study for other potential applications in trains, ships, trucks, cars, vans, etc.

The new vehicle concept will be benchmarked with current steel vehicles through a life cycle analysis (LCA) in order to implement the new Integrated Product Policy (IPP) principles, leading to a more environmentally friendly vehicle.

Objectives

The main overall objectives of the project are:

- to solve the problem of reducing weight and production costs of land transport vehicles through the development of a technology of modular bus/coach construction, using 'all composite' multimaterial sandwich panels instead of a steel/aluminium spaceframe lined with sheets of different materials (metallic or non-metallic)
- to devise design methodologies that decrease production lead time through reducing the number of components and functional integration, and allowing for dismantling, easy repair and recycling
- to develop high quality urban transport
- to contribute to the shifting of balance between modes of transport
- to contribute to improved road safety
- to contribute to improved quality in the road transport sector.

Description of work

The work plan is divided into several tasks that will cover the development of a novel modular architecture of a bus structure based on composite sandwich materials. The following aspects will be researched:

- develop new vehicle architecture, based on modularity guidelines
- study concepts of sandwich materials available in the market or produced in other EU-funded projects; compare their properties with requirements of stiffness, crashworthiness and manufacturability for bus and rail; study the possible processing methods and select the most applicable processes for large structural components
- provide a validated and safe design technology for joining sandwich panels, fibre-reinforced composite sheets and metallic inserts
- develop numerical models based on FEM to analyse the static, dynamic and modal behaviour of the body of the vehicle in order to guarantee that the 'all composite body-in-white' of the vehicle has the same flexural and torsional stiffness and modal behaviour of state-of-the-art metallic bodies
- demonstrate the crashworthiness of the concept vehicle and ensure that the bus structure meets the requirements of the European Directives and regulations (rollover, seat and belt anchorages)
- develop lifetime prediction techniques for the sandwich structural concepts developed in the project
- produce a design which minimises the total whole-life cost of the vehicle
- validate the concepts developed experimentally through the testing of a bodywork cell section.

Results

The following results are expected at the end of the project:

- novel concept of a vehicle structure based on composite sandwich materials with a higher functional integration
- database of sandwich material properties and manufacturing processes, process simulation, material constitutive equations suitable for vehicle manufacturing
- development and test of a fibre-optic health monitoring system
- database on structural adhesive properties suitable for bonding composite sandwich structures and concepts for load introduction/transfer
- collapse behaviour of the sandwich concept material and body-in-white
- physical models of the static and dynamic behaviour of sandwich structures
- analysis of life cycle costs.

Keywords: Composite sandwich material, vehicle structures, adhesive bonding, crashworthiness, eco-design, FEM modelling

Acronym:	LITEBUS	
Name of proposal:	Modular Lightweight Sandwich Bus Concept	
Contract number:	TST5-CT-2006-031321	
Instrument:	STP	
Total cost:	3,455,074 €	
EU contribution:	1,999,998 €	
Call:	FP6-2005-Transport 4	
Starting date:	01.10.2006	
Ending date:	30.09.2009	
Duration:	36 months	
Sector:	Road	
Objective:	Advanced Design and Production Techniques	
Research domain:	Development of advanced, low-mass material structures and systems	
Website:	http://www.litebus.com	
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	NTET S.p.A	IT
	Centre International de Mètodes Numèrics en Enginyeria	ES
	Universidad Politécnica de Madrid	ES
	Royal Institute of Technology	SE
	Suministrosy Servicios Unificados de Carroceria SL	ES
	Politecnico di Milano	IT
	The Chancellor, Master and Scholars of the University of Oxford	UK
	Diseno Industrial ITALDESIGN	ES
	FiberSensing - Sistemas Avançados de Monitorização, S. A.	PT
	Technical University, Clausthal	DE

SAND.CORe

Coordination Action on Advanced Sandwich Structures in the Transportation Industry

SAND.CORe aims to foster the application of innovative sandwich structures in European transport systems, particularly in the maritime and rail sectors. This will be done by:collecting available information with regard to metallic, hybrid and composite lightweight structures conducting benchmark studies for dedicated application cases defined by the end users identifying knowledge gaps and research needs elaborating a best practice guide for sandwich design, manufacturing, assembly, approval and application.

These results will be made available through the project website (www.sandcore.net), public dissemination events and a dedicated user group.

Background

Various R&D projects aiming to develop sandwich structures have been carried out in several sectors at European, national and company levels. These projects have produced results but they are difficult for industrial users to access and compare. SANDCORe aims to collect and compare available solutions, benchmark possible sandwich solutions for concrete application cases in the rail and maritime fields, and produce a best practice guideline for potential end users. Along with a number of public workshops, this will improve the application of results from previous projects.

In general, sandwich panels offer a number of advantages for transport systems, such as being lightweight (increased payload), having a reduced space consumption, structural safety and reduced assembly cost.

Objectives

The scientific-technical objectives of SAND.CORe are:

- producing a collection of current knowledge on sandwich structures related to applications, design methods, test procedures, production, rules and regulations
- creating a sandwich solutions and data catalogue
- performing benchmark studies and comparisons of different sandwich panels in possible sandwich applications, focusing on RoRo decks, superstructures, balconies (maritime) as well as a rail vehicle cab
- elaborating a best practice guideline on sandwich design, production, repair and maintenance, rules and legislations as well as applications
- generating new RTD ideas to further develop the composite sandwich technology
- promoting knowledge and application transfer within the related sectors and beyond.

Description of work

The work plan of the Coordination Action comprises the following steps:

WP1: Analysis of the current state of technology in sandwich applications, design, production and in related rules and legislation using information from the partners' previous work as well as public domain information.

WP2: Structuring the available information, for example in a sandwich selection tree for potential users as well as on the project website.

WP3: Benchmark studies by applying available best practice knowledge and solutions in concrete cases defined by the industrial partners.

WP4: Elaboration of a best practice guideline for potential external users comprising available information and recommended practices.

WP5: Networking activities, such as public workshops, and the establishment of an external user group for the exchange of information and discussions with external parties.

Results

The project results include:

- a list and abstracts of public domain information on sandwich design, production and application as well as test results accessible through the project website and contact through the coordinator
- a best practice guide focused in particular on the maritime industry, which will be available on the project website and can also be obtained as a CD-ROM from the coordinator
- a directory and links to suppliers and users of sandwich panels are available on the website
- concrete design solutions for five application cases defined by the end users in the project, which will be available to project partners and user group members.

The project finished in June 2006. Please contact the coordinator for further information.

Keywords: Sandwich, lightweight, design, application, production, maritime, transport

CMT

January 2004

Acronym:	SAND.CORe
Name of proposal:	Coordination Action on Advanced Sandwich Structures in the Transportation Industry
Contract number:	TCA3-CT-2004-506330
Instrument:	CA
Total cost:	849,987 €
EU contribution:	849,987 €
Call:	FP6-2002-Transport 1
Starting date:	01.01.2004
Ending date:	31.12.2005
Duration:	24 months
Sector:	Multi
Objective:	Advanced Design and Production Techniques
Research domain:	Development of advanced, low-mass material structures and systems
Website:	http://www.sandcore.net
Coordinator:	Dr Roland Frank Center of Maritime Technologies e.V. Bramfelder Strasse 164 DE 22305 Hamburg
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Partners:	University of Newcastle upon Tyne - Advanced Railway Research Centre UK BALance Technology Consulting GmbH DE Bart Boon Research and Consultancy NL Bureau Veritas FR CORUS Technology BV NL Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb HR Flensburger Schiffbau Gesellschaft mbH & Co. KG DE Helsinki University of Technology FI Meyer Werft GmbH DE Riga Technical University LV Schelde Naval Shipbuilding NL A-ROSA Flussschiff GmbH DE Technical University of Gdansk PL TUHH-Technologie GmbH (representing the Technical University of Hamburg-Harburg) DE University of Southampton UK

AC-DC

Automotive Chassis Development for 5-day Cars

The prime objective of AC-DC is to develop a concept, which radically enhances automotive manufacturing in order to achieve the high level of responsiveness required for a 5-day car according to customer specifications, and to validate/demonstrate the novel approach using the characteristic component lightweight chassis as a master.

Background

To date, a clear hierarchic structure dominates automotive manufacturing assuring a 100% delivery of components and systems just in time and just in sequence. However, new challenges emerge, such as:

- a steep increase in modularisation and interdisciplinary technologies
- a market pressure for variability and flexibility to customers
- the cost pressure demands a reduction of stocks on the supply side
- a highly flexible mastering of global production and delivery, which will mean a rapid development of an efficient 'networked' production scheme.

This calls for both a determined step forward in motor vehicle technology combined with a dynamic planning process involving the full supply chain. In order to break with the traditional hierarchic manufacturing, revolutionary concurrent elements must be introduced that reduce stocks and allow last minute configuration of new products in higher variations and quality and at lower costs.

Objectives

The prime objective of AC-DC therefore is to develop a concept that radically enhances automotive manufacturing in order to achieve the high level of responsiveness required for a 5-day car process according to customer specifications, with the development and introduction of individual and highly reactive planning loops in the supply chain. The efficiency of this future system needs to be validated realistically by considering the emerging step-change in component technology (technology convergence of 'Mechatronics' for customer neutral modules of high parameterisation).

Description of work

Emphasis is placed on a vehicle system that promises maximum impact and reward regarding the transfer-suitability to other parts of the vehicle that can be achieved within the duration of the project:

- technically, highly mechatronic and individualised automotive chassis modules hold considerable challenges to demonstrate the transfer of customer-neutral module design methodology to ample applications, including new drivetrains, electrical propulsion and new wheel systems. Technical progress in intelligent software and sensor-actuator technology combined in customer-neutral mechatronic chassis modules paves the way to the next generation of automotive chassis, which needs to be taken into account by new automotive production processes.
- AC-DC develops the requisite 'dynamic supply chain collaboration concept' that promotes the conventional automotive terms of delivery to a highly reactive 5-day, capable system that cuts down inventories in the supply network while maintaining the 100% guarantee of delivery as an uncompromised constraint. Leaving hierarchic production concepts behind by building on multiple planning loops, the dynamic supply network management is paramount for the integration of both the requisite high-tech module technology and the appropriate process configuration features. All aspects of complementary concern, such as fail-safe real-time event management, collaborative demand prediction and planning consistency, modular production technology processes, as well as distributed quality control and testing form crucial building blocks to form the dynamic and reliable supply loops network.

Results

AC-DC will develop a highly dynamic and robust supply loop concept, which is superior to the conventional hierarchic system in reactivity, reliability and costs while maintaining the 100% guarantee of delivery. From the proof-of-concept a characteristic next-generation automotive modular system will be developed, which will convert different technologies (in this case mechanics and electronics) into high-quality modules to reduce part count and cost (first cost and stocks) and to achieve a customer-neutral component/supply concept.

Acronym:	AC-DC	
Name of proposal:	Automotive Chassis Development for 5-day Cars	
Contract number:	TIP5-CT-2006-031520	
Instrument:	IP	
Total cost:	12,072,727 €	
EU contribution:	7,000,000 €	
Call:	FP6-2005-Transport 4	
Starting date:	01.10.2006	
Ending date:	30.09.2010	
Duration:	48 months	
Sector:	Road	
Objective:	Advanced Design and Production Techniques	
Research domain:	Integration of clean and economic manufacturing techniques	
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	Siemens VDO	DE
	Fundacion CARTIF	ES
	CEA - Commissariat à l'Energie Atomique	FR
	European Research Programme Consulting	DE
	Fraunhofer Gesellschaft	DE
	ZF Friedrichshafen	DE
	University of Modena and Reggio Emilia	IT
	VDIVDE-IT	DE
	AT Bremen	DE
	INESC Porto	PT
	Magyar Tudományos Akadémia Számtactechnical	HU
	Volkswagen	DE
	Mandator	SE
	Centre for Research and Technology Hellas	GR
	Autoliv	SE
	University of Paderborn	DE

CREATE3S

Production to improve total efficiency of new generation short sea shipping

CREATE3S aims at developing a new generation of ships for short-sea operations using an innovative modular concept of separate (ship) platform modules and interchangeable cargo-containing modules. Though the use of advanced manufacturing techniques, production lead-times and costs are expected to be reduced by approximately 10%.

Background

Economy and society cannot function without the efficient movement of goods and people; transport is therefore a key factor in modern economies. The challenges of providing an effective transport system across Europe remain acute, particularly as governments try to balance conflicting demands for increased access and mobility with solving traffic congestion, pollution and rising costs. Short-sea shipping has already demonstrated its ability to solve transport problems within an expanded EU, for absorbing increasing demand for intra European transport and for reducing congestion on European roads.

Short-sea shipping is a crucial European market for; waterborne transport, the shipbuilding/ship repair industry, logistic chains of hundreds of ports and terminals, some 3 460 ship owners and their 10 000-ship fleets. Short-sea shipping is thus key to enhancing competitiveness and solving transport problems within a growing EU; there are few issues that serve both these strategic goals.

Short-sea shipping volumes are expected to increase by 50% between 2000 and 2020. Since 40% of the current fleet is older than 25 years, Short-sea shipping needs a new generation of innovative ships to meet this potential market. These ships need; enhanced economic, safety and ecological performance, fitting into future innovative logistic chains and providing a major role for EU shipbuilders.

Objectives

Traditionally ship concepts contain two physically inseparable main function groups: platform functions (buoyancy, power generation, propulsion, hotel, etc.), and cargo functions (cargo containment/treatment/handling). CREATE3S aims to develop a ship concept consisting of two basic modules: a ship-platform module and ancillary interchangeable cargo-containing modules. At sea, ship-platform and cargo-containing modules are joined (linked) together. Once at the destination the entire cargo-containing module is discharged and replaced by a new cargo-containing module, much the same as a truck chassis/container combination. The shorter the time spent in ports for loading and unloading will allow for more voyages while reducing port fees per voyage; the risk is the eventual higher cost of implementing this new concept.

To meet this risk, CREATE3S will develop standardisation and modularisation concepts in ship-platform design that will enable the use of advanced manufacturing techniques, thereby reducing lead-time and labour costs. Introducing low-mass hull structures will enhance payload capacity, thus obtaining additional economic gain.

Description of work

CREATE3S work programme of one management and four RTD work packages will follow an end-user driven, problem-solving approach in five sequential steps. The first step outlines the concept of economic boundaries from the end-user/operator's point of view: the economic/operational parameters for the new concept will

be identified and quantified. Then the problem-solving process proceeds in two sequential cycles of analysis – synthesis – evaluation steps: initial concept (step 2), first assessment (step 3), modification and pilots (step 4) and final assessment (step 5).

These five steps form the work plan 'back-bone' or main R&D flow (Work Package 2), a structured process where the new modular concept is being developed and where inputs from different disciplines are integrated. These disciplines are contained within the three other work packages: Critical Technologies – hydromechanics and structures (Work Package 3), Operations, logistics, economy and ecology (Work Package 4), and Advanced manufacturing techniques (Work Package 5).

There are four distinctive innovation categories:

- product-related innovation: modular ship concept of platform and cargo modules, better hull form and lighter structure
- operational innovations: short turn-around cycle in ports, more flexibility and faster cargo delivery method
- manufacturing innovations: shorter lead times, reduced risk, modular approach in production, distributed process and new production organisation model
- business model innovations: different ways of capturing value through a shipbuilding distributed process.

Results

The complete list of deliverables is:

Dissemination Plan, 3 Dissemination reports,

Challenger report on challenges from new generation vessels,

Basic definitions,

Cargo systems.

Integrated concept

First assessment

Pilot concepts

Final assessment

Hull modules form

Performance analysis at sea

Operational requirements

Assessment model operations

Environmental assessment

Modular concept manufacturing

Manufacturing strategy

CREATE3S will make advances with respect to the state of the art in:

Ship concepts:

- cargo unit (module) containing the entire ship cargo carrying capacity
- cargo unit with no buoyant capability, loaded/unloaded directly to/from land-side
- the interface between ship hull and cargo modules and the loading/unloading system

Hydromechanic performance:

- ship hull forms for a number of ship families, offering better hydromechanic performance

Ship structures:

- lighter and cheaper ship hull-structure families, industrialised production manner
- large cargo modules fitting the ship-platform modules

Shipping operations:

- less time spent in ports
- more flexibility in short-sea shipping operations

Ship production:

- reduced man-hours in the entire process chain
- reduced lead time and more flexibility to cope with customer requirements
- improved working conditions
- improved product quality through pre-tested standard components
- modular products which can easily be adopted to short-term changes in the market.

Acronym:	CREATE3S	
Name of proposal:	Production to improve total efficiency of new generation short sea shipping	
Contract number:	TST5-CT-2006-031488	
Instrument:	STP	
Total cost:	4,217,990 €	
EU contribution:	2,500,000 €	
Call:	FP6-2003-Transport 3	
Duration:	36 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Integration of clean and economic manufacturing techniques	
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	LogIT a.s	NO
	Center of Maritime Technologies e. V.	DE
	Norwegian Marine Technology Research Institute	NO
	Maritime Research Institute Netherlands	NL
	Delft University of Technology	NL
	University of Newcastle upon Tyne	UK
	Bureau Veritas	FR
	Centrum Techniki Okrętowej S.A. - Ship Design and Research Centre S.A.	PL

CarCIM

Integration of Two-component Ceramic Injection Moulding for Large-scale Production of Novel Multifunctional Ceramic Components for Automotive and Railway Applications

The aim of the project is the integration of the two-component ceramic injection moulding (2C-CIM) as a low-cost and large series production technique into the development of complex shaped ceramic components for automotive and railway applications, offering a high degree of structural and functional integrity.

Background

During the last decades, ceramic manufacturers have proposed several alternative, high-performance ceramic engine parts to automotive producers. The most important benefits offered by ceramic materials over metallic ones are lower density, lower thermal expansion coefficient, superior mechanical resistance at elevate temperatures, higher wear resistance and chemical inertia. Future emission regulations require more effort towards a general friction loss reduction and the weight reduction of alternately moving engine parts contributes directly to an improvement in the engine's efficiency.

The role of advanced ceramics in engineering structures largely depends on the possibility of reliable mass production of complex-shaped components at acceptably low costs. Because of the near-net-shape production and the economic efficiency of a large series, powder injection moulding (PIM) is the shaping technique of choice for metal/ceramic parts of complex geometry.

The co-injection moulding of two synthetic materials is applied to a great variety of automotive components. The ability to manufacture components to net-shape and surface engineer in a single manufacturing process by powder co-injection moulding should provide a further incentive for additional exploitation of this technique by generating new markets and providing more cost-effective manufacturing.

Objectives

The main goal of the project is the development of novel ceramic components with a high degree of functionality, longer life cycles and shorter production times, which can be easily implemented into automotive and railway systems. For achieving this main goal, the following objectives must be attained:

- adaptation of powder surface properties to the requirements of feedstock production
- development and supply of new feedstocks suitable for low/high pressure 2C-CIM and an environmentally friendly debinding process
- development and supply of material combinations for co-debinding and co-sintering processes
- using simulation techniques for a more flexible and cost-saving production of 2C-CIM parts enclosing simulation tools for the complete processing chain, i.e. tool design, injection moulding, debinding and co-sintering

- developing and providing advanced debinding and sintering concepts for 2C-CIM parts;
- improving tool making technologies for 2C-CIM tools with tight tolerances and high precision without reworking
- development of high-throughput 2C-CIM processes for prototype multifunctional ceramic parts
- introduction of new advanced ceramic components with complex shape and combined functionalities
- development of prototype systems for testing the developed automotive parts.

Description of work

2C-CIM will allow the production of advanced ceramic products on a large scale with increased functionality and a high degree of complexity, but at a lower cost level in comparison to other shaping techniques. The reason is that ceramic materials offer the possibility to combine properties like electrical conductivity with electrical isolation, transparency with opacity, high toughness with extreme hardness and wear resistance, magnetic properties with non-magnetic properties, porosity with density, etc. Moreover, all these property combinations can be achieved in just one shaping step without additional joining processes by 2C-CIM. This project will launch 2C-CIM as a high-throughput production process for complex shaped ceramic components in Europe. As well as for automotive and railway applications, this new technology will be of enhanced interest for all branches requiring ceramic materials or property combinations as mentioned above, because novel products could be produced by using 2C-CIM which cannot be achieved today for technical or economical reasons. In this way 2C-CIM will reinforce the competitiveness of the European PIM industry and of many industrial banches which will be able to provide new or improved products.

Results

Four case studies related to automotive applications and to railway application will be carried out in this project: 1) ceramic braking pads for high-speed trains, 2) ceramic glow plug, 3) ceramic gear wheel, and 4) ceramic valve seat.

European automotive and railway industry will derive direct benefit from the project by gaining experience with the prototypes, which will be developed in the case studies, by material and feedstock combinations, which are adjusted to the requirements of the consumers, and from the complete 2C-CIM processing chain. Beside the above-mentioned prototypes, the following deliverables will be provided by this project:

- powders with modified surface properties for improved feedstock preparation
- high-pressure and low-pressure feedstocks adapted to 2C-CIM
- interface for linking the simulation tools
- FEM analysis results of the composite materials behaviour
- debinding concepts for new developed materials and feedstock systems
- processing guidelines for 2C-CIM prototype parts
- report on life cycle and techno-economical assessment.

Launching 2C-CIM technology in the production of multifunctional advanced ceramic parts will strengthen the competitiveness of the European ceramic producers, which are mostly SMEs of which a large extent already use CIM for manufacturing one-component parts. 2C-CIM technology will open new market segments for the ceramic producers.

Fraunhofer IKTS

2C-CIM testing component consisting of black and white zirconia

Acronym:	CarCIM	
Name of proposal:	Integration of Two-component Ceramic Injection Moulding for Large-scale Production of Novel Multifunctional Ceramic Components for Automotive and Railway Applications	
Contract number:	TST5-CT-2006-031462	
Instrument:	STP	
Total cost:	3,763,566 €	
EU contribution:	2,000,000 €	
Call:	FP6-2005-Transport 4	
Starting date:	01.09.2006	
Ending date:	31.08.2009	
Duration:	36 months	
Sector:	Multi	
Objective:	Advanced Design and Production Techniques	
Research domain:	Integration of clean and economic manufacturing techniques	
Coordinator:	Dr-Ing. Moritz Tassilo	
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	Centro Ricerche FIAT Società Consortile per Azioni	IT
	Degussa AG	DE
	Fundiciones del Estanda, S.A.	ES
	FOTEC Forschungs- und Technologietransfer GmbH	AT
	INMATEC Technologies GmbH	DE
	Riga Technical University	LV
	Ernst Wittner GmbH	AT

Cleanmould

Boat Hulls with Enhanced Performance

This ambitious project aims to develop new environmentally friendly manufacturing processes using lightweight fibre reinforced thermoplastic for the production of composite structural vehicles. As an example, the technology will be be used to produce an innovative semi-trailers and boat hull at lower cost, with enhanced performance and inherent recyclability.

Background

Composite materials offer the designer the ability to manufacture lightweight structures coupled with high strength/stiffness and excellent corrosion resistance. Composite materials are widely employed in the manufacture of work and leisure boats; however, these composite materials are predominantly based on room temperature curing resins such as polyester, vinyl ester, etc which emit a solvent during processing and are difficult to recycle. In recent years, the same materials have been increasingly used within road vehicles such as cars, trucks and semi-trailers. The key problem addressed by this project is the manufacture of large surface area structures (e.g. boat and semi-trailers) utilising liquid thermoplastic composite resins, which contain no solvents and which polymerise within the mould to form a high performance environmentaly stable structures that have better results over conventional thermoset resins. These thermoplastic structures are easier to recycle into short fibre reinforced components for re use across a wide range of industries.

Objectives

This project aims to use an innovative form of thermoplastic composite resin based on polybutylene teraphthalate (PBT) oligomer technology to address the shortcomings of the above products and processes.

This technology involves using PBT oligomers that melt at low temperatures (160ºC) into low viscosity liquids (i.e. 20 centipoise), which can then be used to impregnate or wet-out the fibres and thereby achieve a high fibre content (50% by volume) and thus a product that has enhanced structural performance. The PBT oligomers are polymerised in the mould using a catalyst in the melt. Once the PBT oligomer polymerises in the mould, fibre-reinforced PBT polymer composites are formed that have exceptionally good mechanical properties and a melting temperature of 260ºC.

PBT oligomer technology enables composite structures to be processed utilising conventional liquid thermosetting resins processes (i.e. vacuum infusion, preimpregnation, etc.) but with all the benefits of thermoplastics.

Description of work

Basmiler and Halmatic will provide detailed product specifications for the 13.6 m flat bed semi-trailer and 8 m boat hull respectively. These specifications will form the focus of the project against which the developed thermoplastic composite case study applications will be measured. Cyclics will develop the low melting point and low viscosity thermoplastic PBT oligomers. These compounds will include the catalyst, pigmentation and fire resistance compounds. Cyclics will work closely with Ahlstrom and supply the PBT oligomers in a form suitable for incorporating with continuous fibre reinforcement fabrics. Ahlstrom will develop all the necessary fibre-coupling agents and sizes necessary to achieve good fibre-resin interfacial strength. Ahlstrom will also develop techniques to incorporate the PBT oligomers into the fibre fabrics for ease of handling and use by Halmatic and EPL during processing trials. EPL and IKV will determine the optimum processing windows (time, temperature, pressure) and process conditions for achieving good wet-out of the fibres and low voidage. IKV will determine the mechanical properties of test laminates moulded under optimum conditions. This data will be used by EPL to design the 13.6 m semi-trailer and 8 m boat hull. In order to validate the design, critical

sections of the semi-trailer and boat hull will be moulded by Halmatic and tested by IKV. Critical sections include measuring the pullout strength of inserts and joints, etc. Having determined a design, Halmatic will produce prototype moulds for the semi-trailer and boat hull. Halmatic will then manufacture the semi-trailer and boat hull case study structures that will be tested by Basmiler and Halmatic respectively. Throughout the course of the project, IKV will develop techniques to recycle and reprocess all the thermoplastic composite materials produced during all the various processing steps, including the final moulded parts.

Results

Key deliverables will be:

1. Confirmation of the technical, economic and environmental benefits
2. Development of PBT oligomers with low melting point (150°C) and low viscosity (20 cP)
3. Development of PBT composites with up to 50% Vf with excellent mechanical properties
4. Demonstration that critical sections of two case study components can be manufactured
5. Two moulded case study components (boat hull and semi-trailer) that have been evaluated under in-service conditions.

Socio-market benefits include:

Trailer

Lower weight means more payload, fewer journeys, fuel savings, emission and CO_2 reductions, less road damage when empty, improved air quality. The integrated design means reduced cost, more efficient design and better crash structures. Socio-economic factors include increased competitiveness, recyclable product, longer life (40 vs. 20 years) raw material savings, aerodynamics provide 7.5% fuel savings equal to £3 000 per year and 8.5 tonnes CO_2, and no volatile organic compounds (VOCs).

Boat

Physical benefits include increased toughness, impact resistance and longer life. Manufacture benefits include reduced labour, and the automated process provides knowledge and technical advantage over cheaper imports. Socio-economic factors include it being recyclable, has no VOCs and a clean technology.

Keywords: Plastic recycling boat semitrailor road maritme chemistry

Euro-Projects LTTC Ltd

Large heavy goods vehicles offer great scope for weight reduction

VT Halmatic

Composite boats benefit greatly from composite materials

Acronym:	Cleanmould	
Name of proposal:	Boat Hulls with Enhanced Performance	
Contract number:	TST5-CT-2006-031528	
Instrument:	STP	
Total cost:	2,579,116 €	
EU contribution:	1,389,520 €	
Call:	FP6-2005-Transport 4	
Duration:	36 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Integration of clean and economic manufacturing techniques	
Website:	http://www.cleanmould.net	
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OFIENGINE

Development of the New Thermal Spraying Equipment and Technology for Production of Components for Marine Transport Engines

The improved maintenance and reliability behaviour of two-stroke diesel engines are becoming the key factors for final users and industrial suppliers. The project objectives, therefore, are as follows:

- to develop the technology of manufacturing marine engine components with improved technical and service characteristics using novel thermal spraying techniques
- to develop the new thermal spraying equipment for production of the components for marine transport application.

In order to achieve these objectives, an oxy-fuel ionisation (OFI) installation will be developed that gives the best coating structure and in-service performances but with 1.5-2.0 times reduced process costs in comparison with HVOF spray techniques.

It is intended that the oxy-fuel ionisation technology will be developed up to a prototype unit for marine transport application.

Background

The two-stroke large bore diesel engine is recognised as the most economical and reliable prime mover for the marine fleet with a long running time. Many parts of the diesel engine are being currently critically reviewed with the purpose of increasing their durability and reliability with a minimum of maintenance requirement. The exhaust system is a cost-intensive part of the engine and its operation under extreme load conditions forces the need for engineered materials, maintenance and reconditioning services for these components. Expensive materials are required to endure erosion at high temperatures, pressures and corrosion deposits, Nimonic alloy being the most renowned material for this application but the standard valve spindles are manufactured out of heat-resistant steel with a hard-faced seat area. The cost of these materials, and the need to reduce service intervals, are a significant proportion of the price of an exhaust valve, justifying the need for effective maintenance and reconditioning procedures. The usual procedures involve the welded satellite recharge of valve seats and HVOF application of cermets on to a valve spindle.

Objectives

The purpose of this project is to solve this situation, thus increasing the durability of the exhaust system and the global engine, by the development of a new oxy-fuel ionisation (OFI) thermal spray technology. This is able not only to generate the technically required coatings to fight the identified wear mechanisms but also to compete with the current processes in cost, reliability and industrial affordability.

Summarising, the objectives should be:

- to increase the durability of critical exhaust components (valve spindles, seats, etc.) and other pieces of two-stroke diesel marine engines by the use of advanced coatings

- to reduce the cost of manufacturing coated components
- to increase the number of suppliers offering these services and thus increasing the effective quality of the components used in marine diesel engines
- to develop the technology of manufacturing marine engine components (valve spindles, valve seats, piston rods, cylinder cover and connecting rods) with improved technical, economic and service characteristics using novel thermal spraying techniques
- to develop the new thermal spraying equipment for producing the components for marine transport application.

Description of work

The project's work is divided into seven technical work packages.

Work Package 1: Specifications: A complete data collection and compilation of the specifications will be performed on the existing practices and desirable product properties.

Work Package 2: Development of the new thermal spraying equipment: The objective is to develop, design and manufacture the prototype oxy-fuel ionisation (OFI) unit.

Work Package 3: Development of OFI coatings and procedures: The coatings will be developed, evaluated and compared to coatings applied by conventional HVOF and HFPD spraying.

Work Package 4: Manufacturing the coated marine engine components: The objective concerns manufacturing and testing the marine engine components.

Work Package 5: Testing of the developed coated marine engine: The objective is integration of the developed marine engine components and testing in the industrial partners' system.

Work Package 6: Mathematical modelling of thermal spraying process and optimisation: The objective deals with the modelling of a pressurised diffusion flame, which will include the interaction of the high-velocity and high-temperature plasma-flame exiting from the Laval nozzle with the surrounding gas at atmospheric pressure and with the substrate, as well as the kinematic and thermal behaviour of powder particles injected within the jet.

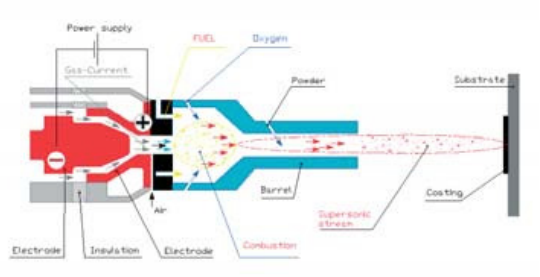
Work Package 7: Dissemination and exploitation of results: The objective is awareness raising and providing information to the main stakeholders, and these are research and expert institutes, industry managers, policy-makers and main environmental and technology associations.

Results

The expected results of OFIENGINE are the following:

- Reduction (2-3 times) in the maintenance and service requirements for diesel components.
- Reduction in the process cost of coated components by 50%.
- Increasing the range of materials deposited starting from low-melting Al and Cu without oxidation to metals, superalloys, carbides and oxides.
- Increase of the wear-corrosion resistance of valve spindle components.
- Increase the thermal isolation and corrosion resistance of pistons crowns, valve bottom-heads, etc.
- New developed equipment made available to the market.
- Engine components manufactured by the new process made available to the market.

Keywords: Thermal spraying, coating, marine engine, valve spindles, valve seats, piston rods, cylinder cover



Schematic diagram of the OFI spraying process

Acronym:	OFIENGINE
Name of proposal:	Development of the New Thermal Spraying Equipment and Technology for Production of Components for Marine Transport Engines
Contract number:	TST5-CT-2006-031092
Instrument:	STP
Total cost:	2,257,950 €
EU contribution:	1,000,000 €
Call:	FP6-2005-Transport 4
Duration:	months
Sector:	Waterborne
Objective:	Advanced Design and Production Techniques
Research domain:	Integration of clean and economic manufacturing techniques
Website:	http://www.ofiengine.net
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RC2

Reduction of Cycle and Cost

The RC2 project goal is to reduce manufacturing costs and production lead time. RC2 will deliver not only an innovative manufacturing process based on the combination of rapid prototyping with the most suitable finishing but also

Background

RC2 results will permit a drastic decrease in cost and lead time for the manufacturing of functional prototypes used in R&D for the new products required by the transport sector and especially by industries working in gas turbines.

In collaboration with PEP, TURBOMECA has recently succeeded in manufacturing a complex-shaped rough part by the laser sintering of metal powder (i.e. without tools).

However, because of sintering limits, finishing techniques are necessary to meet market technical requirements for the following:

- surface condition and size tolerance
- thermo-mechanical properties.

From both an economical and technical point of view, finishing processes for these will have to be developed due to the differences in surface condition and in porosity of the rough parts, obtained either by rapid prototyping or by conventional machining.

The RC2 process will lead to a reduction in the time taken to design and to fabricate a functional prototype by 50%, involving a reduction in time to market by 10%.

The application of RC2 results would lead to a 20% reduction in time to market in the maritime sector.

The RC2 process will also reduce the waste linked with conventional manufacturing process.

Objectives

The first goal of the RC2 project is to speed up the time to market of new products for the transport industry but also to boost innovation by reducing both cost and lead time of functional prototypes by 50%.

The RC2 strategy helps in the development of a specific manufacturing process, including a methodology to be applied for any kind of complex-shaped mechanic part, and through a proven manufacturing reference.

The research activities in the RC2 project will be focused on:

- the development of parameters for the rapid prototyping (RP) machine in order to obtain rough parts using raw materials through a single operation
- the development and adaptation of the usual finishing techniques for parts made by RP
- the development of a MMP process specific to parts made by RP
- the development of the process that associates RP and the most suitable finishing process permitting a reduction in cost and lead time by 50%, while obtaining final parts which respond to engine manufacturers' requirements.

This work will be completed by detailed researches on the correlation between the matter phase and surface quality.

The consortium will work on several gas turbine components but more specifically on static and rotating complex-shaped parts of the gas path (for compressor and cold turbine test bench), and of the fuel system. These components are parts of helicopter, train or vessel engines.

Description of work

The main research strategy of the RC2 project is to focus on developing the finishing techniques applicable to parts manufactured with laser sintering/melting technologies. Contrary to many other projects, RC2 will not focus on developing laser sintering and melting technologies but on implementing them as soon as they become fully operational.

The RC2 project is composed of the following work packages:

- selection and modification of parts due to be manufactured with future RC2 processes
- development of an original experimental method based on the optimised combination of the techniques of rapid prototyping, and innovative and usual finishing techniques
- manufacturing of selected components through rapid prototyping
- development of the innovative finishing MMP on selected components
- development of innovative machining, thermo-chemical and mechanical finishing on selected parts
- validation of the new manufacturing process capability to meet thermo-mechanical requirements for functional prototype applications
- dissemination of the results.

Results

The reduction of cost and lead time for manufacturing functional prototypes will lead to a reduction in time to market of 10%, and this in a highly regulated industrial sector such as the aeronautical sector. In maritime sectors, where the regulations are less constraining, a qualification phase needs less time than an aeronautical certification. The application of RC2 results would lead to a 20% reduction in time to market in the maritime sector.

To elaborate a part with conventional manufacturing techniques, it is necessary to start from a block and to remove material, which generates a lot of waste such as chips and cutting oil. The RC2 process involves the creation of a part by adding material. By doing so, we will reduce the quantity of industrial waste.

In the longer term, we estimate that rapid prototyping will replace the type of machining currently used, for example like high speed machining (HSM).

Even if, for various reasons, rapid prototyping was to be reserved for only the small series and for technical prototypes in good matter, the RC2 results will be exploitable in many other sectors, like for example:

- aeronautics
- automotive
- medical sector
- industries that must regularly renew their models or that work by collections or seasons.

The use of the RC2 process in production will pave the way for new designs and for new markets, which are represented by parts that were unavailable due to the previous techniques, either due to their complexity or for physical reasons.

Acronym:	RC2	
Name of proposal:	Reduction of Cycle and Cost	
Contract number:	TST5-CT-2006-031236	
Instrument:	STP	
Total cost:	4 223 806 €	
EU contribution:	2 000 000 €	
Call:	FP6-2005-Transport 4	
Duration:	months	
Sector:	Multi	
Objective:	Advanced Design and Production Techniques	
Research domain:	Integration of clean and economic manufacturing techniques	
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	FUNDACION TEKNIKER	ES
	SPASA	ES

SLC

Sustainable Production Technologies of Emission-reduced Lightweight Car Concepts

SLC pools the expertise and resources of 38 organisations to develop new lightweight vehicle concepts up to 50% lighter than present high-volume cars. SLC will address present limitations on advanced material processing, multi-material joining technologies and simulation tools (crash, fatigue, cost and sustainability).

Background

The European Commission estimates in its White Paper, European Transport Policy for 2010: time to decide, that the demand for passenger transport in the EU will rise by 24% between 1998 and 2010, with an expansion of the car fleet by 3 million vehicles a year. This, together with the fulfilment of the EC directive on end-of-life vehicle recycling of 95% recycling rate, is a key challenge for the European transport industry if it is to enable a sustainable mobility in Europe.

As 28% of the emissions of CO_2 are related to transport (of which 84% are by road transport), reduction of CO_2 emissions in road transport is crucial to achieve the targets agreed in the Kyoto Protocol. Weight saving is one of the most effective ways to reduce fuel consumption and thus CO_2 emissions of road transport. An example for the potential environmental impact of weight saving in SLC is described in the figure below.

Addressing these challenges while maintaining a vehicle's safety performance is crucial for the competitiveness of the European automotive industry, which employs over 12 million EU citizens. Only by maintaining the knowledge-intensity of automotive manufacturing at a maximum level can the EU avoid massive transfers of car production to lower wage regions in the world, so it is imperative to preserve and increase the high-quality employment.

Objectives

Today it is possible to construct vehicles with considerable weight reductions in expensive small/medium volume series. SLC focuses on drastically reducing the weight of mass-produced vehicle structures (e.g. Golf, Astra, Megane, Punto, etc.) and addresses specific challenges such as a low acceptance rate of risk and quality variance, short production cycle times, low manufacturing costs, short time-to-market and recyclability.

SLC's main objective is to develop the integrated knowledge and technological capabilities required to design, engineer and manufacture multi-material car bodies at mass volumes (1 000/day) with a substantial weight reduction of up to 50% of body-in-white (BIW), combined with reduced raw material consumption of up to 30%. This will compare to series vehicles at manufacturing and assembly costs that do not significantly exceed those of state-of-the-art series cars of the same class (i.e. average costs of up to €5/kg weight savings).

To overcome these challenges, knowledge and technological capabilities will be developed in three main areas:

- concepts and design (for parts, modules and BIW)
- forming and joining technologies (including surface quality)
- tools and enabling technologies (design, simulation and multi-parameter optimisation tools).

Description of work

The multi-material concepts development approach avoids any mono-material-driven design methodology. It puts the overall vehicle's functionalities first, and then deploys them to sub-modules/parts, making the optimal material choice on a part-by-part basis based on overall vehicle performance. This is the driving force steering the research in other areas, favouring functional requirements-based competition among different materials and technologies.

In parallel to concept development, SLC will research on advanced material processing (FRP, light weight alloys, advanced steel, etc.), multi-material joining technologies (e.g. welding, brazing, adhesive bonding, mechanical joining and others), design/simulation tools needed for multi-material vehicles/parts (crash and fatigue behaviour, LCA and costing) and recycling technology applicability. Finally, the SLC front structure demonstrator will be built up, and virtually and physically tested.

SLC is structured around four technical subprojects covering the following domains:

- vehicle design and engineering
- forming and joining technologies
- design, simulation tools and other enabling technologies
- the actual development of a front-end structure demonstrator and virtual car body.

The exploitation of the research results will be supported to ensure that the first high volume series cars can be on the road in 2012.

Results

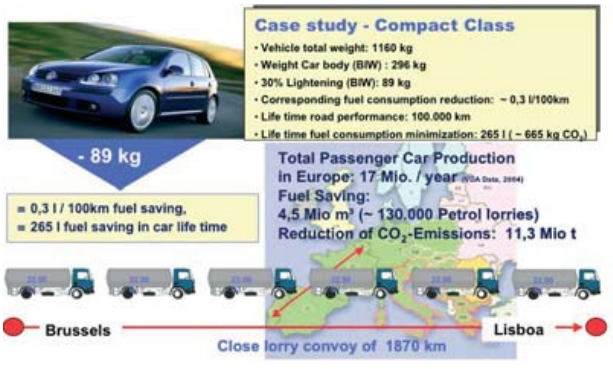
The main result of SLC will be a virtually designed multi-material lightweight affordable car-body concept (including a front structure demonstrator for results validation) fitting in with the scenario of up to 1 000 cars/day offering 30% reduction in weight compared to the 2004 benchmark cars on the market. SLC experiences will also result in a library of multi-material architectures.

SLC will deliver forming technologies with reduced manufacturing cost and/or cycle times. Other forming technologies shaping high performance external panels (while providing A-class surface quality) and new joining technologies for cost-efficient high-volume multi-material assembly will also be delivered. The body assembling sequence will be optimised. Moreover, SLC will analyse their applicability in less stringent mid-volume vehicle classes as well as in other transport modes (including rail).

Finally, SLC will provide the tools and technologies required for multi-material concept design under industrial conditions. These will be shaped as databases and toolboxes integrated in simulation software for crash, fatigue, static, costs, LCA, and offering robust and accurate predictions for multi-material designs developed in SLC.

Through a large participation of the automotive industry and through coordination of R&D exploitation by EUCAR, the SLC results will find their way to the engineering departments and production sites.

Keywords: Lightweight vehicle, car body structures, multi-material concepts, multi-parameter optimisation, forming, joining, design for life-cycle sustainability, CO_2 emissions reduction



Volkswagen AG

Potential reduction of CO2 emissions of a compact class car

SuperLIGHT-Car project

Preliminary lightweight body concept

Acronym:	SLC
Name of proposal:	Sustainable Production Technologies of Emission-reduced Lightweight Car Concepts
Contract number:	TIP4-CT-2005-516465
Instrument:	IP
Total cost:	19,142,404 €
EU contribution:	10,419,790 €
Call:	FP6-2003-Transport 3
Starting date:	01.02.2005
Ending date:	31.01.2009
Duration:	48 months
Sector:	Road
Objective:	Advanced Design and Production Techniques
Research domain:	Integration of clean and economic manufacturing techniques
Website:	http://www.superlightcar.com
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DaimlerChrysler AG	DE
Porsche Engineering Group GmbH	DE
Institut für Kraftfahrwesen Aachen der RWTH Aachen	DE
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.	DE
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IVM Automotive Bad Friedrichshall GmbH	DE
Ricardo UK Limited	UK
Ove Arup & Partners Limited	UK
Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE
ALCAN Airex AG, Werk Altenrhein	CH
ARCELOR	LU
Commissariat à l'Energie Atomique	FR
DIEFFENBACHER GMBH + CO. KG	DE
DOW EUROPE Gmbh - Freienbach Branch	CH
LASER ZENTRUM HANNOVER E.V.	DE
Politecnico di Torino	IT
Polytec Composites Italia s.r.l.	IT
Sistemas y Procesos Avanzados S.L.	ES
Netherlands Organisation for Applied Scientific Research (TNO)	NL
UNIVERSITA´ POLITECNICA DELLE MARCHE	IT
University of Perugia	IT
Chalmers University of Technology	SE
Engineering Research Nordic AB	SE
ESI Software	FR
Technische Universität Darmstadt	DE
Technische Universiteit Delft (Delft University of Technology)	NL
University of West Bohemia	CZ
PE Europe GmbH	DE
Materials Engineering Research Laboratory Ltd	UK
Comau S.p.A.	IT
HEATform GmbH	DE
ALSTOM Transport SA	FR
Corus Technology B.V.	NL

ALERT

Assessment of Life-cycle Effect of Repairs on Tankers

The ALERT project (Assessment of Life-cycle Effect of Repairs on Tankers) will undertake a thorough examination of the current practices of European industry in the field of ship repair, and to propose improvements to the underlying processes in consultation with industry.

Background

Tankers carry close to 40% of the world's seaborne trade. In 2003, 57% of all the oil consumed in the world was transported by sea – approximately 2 200 million tonnes.

The tanker Prestige suffered a structural failure in November 2002 in heavy seas off northern Spain and developed a severe list. One of the outcomes of this casualty was the expression of a new doubt by some regulators on whether major repairs conducted on older ships could be considered safe. The reason this new doubt was expressed was that the M/T Prestige had extensive repairs 18 months prior to its accident. Furthermore, these repairs were conducted under the Enhanced Survey Records, appearing to indicate that the procedures of the classification society were followed and that no shortcuts were taken. In the absence of a generally accepted explanation for the cause of the accident, the above events have resulted in questioning the safety of conducting large repairs on older ships. There are a number of obvious and compelling reasons as to why this question needs to be addressed from a rational and technical standpoint. The present proposal aims to address this issue by concentrating on those recommendations contained in the Prestige accident investigation report that are relevant to ship repairs.

Objectives

1. Undertake a thorough examination of current practices in the field of ship repair and propose improvements to the underlying processes in consultation with industry.
2. Review existing and emerging technologies appropriate for ship-repair practices, and propose areas for the development of technologies for future application.
3. Improve the efficiency of tankers by considering inspection, maintenance and repair scheduling.
4. Consider a framework that will be capable of determining, rationally, the extent of repair work that an existing ship could safely undergo with minimum additional risk of structural failure.
5. Promote a safe transportation system for Europe.
6. Reduce human losses, injuries and environmental damage risk associated with transportation of hazardous goods by tankers.
7. Encourage best practice in the tanker shipping and ship repair community.
8. Effectively disseminate the results and facilitate their acceptance by European society and by industry.
9. To coordinate these efforts and to demonstrate the positive effect of this coordination through the participation in integrated projects (IPs), Networks of Excellence (NoEs),

   Strategic Targeted Research Projects (STREPs) and other Coordinated Actions (CAs) for the effective distribution of best practice.

Description of work

Project ALERT will consist of five partly interdependent work packages carrying out all of the coordination activities. Work Package 5 is an integration package where exploitation activities, such as preparing research proposals and the dissemination of ideas generated within the project to a wider community, are carried out in light of the studies performed in Work Packages 1-4.

Work Package 1 will investigate existing ship repair practices; Work Package 2 will provide a study into condition monitoring of ships; Work Package 3 will study the structural strength assessment of tankers; Work Package 4 will study several areas of through-life management of tanker structures. The effects of operational profiles of tanker vessels, such as route planning and weather profiles, partial cargo loading, and heating of cargoes on the wastage (corrosion) rates and ultimately on the structural health of the vessel, will be considered. Work Package 5 aims to integrate and prioritise the research and development needs identified in Work Packages 1-4, and disseminate and exploit the project results and prepare research proposals in prioritised R&D areas. Work Package 5 will be responsible for the organisation of workshops and seminars to be held by the project. It will develop the future roadmaps for research by integrating the future research and development needs identified in each of the work packages.

Results

State-of-the-art and R&D requirement reports will be produced in the following areas:

- standard practices, class society requirements for the repair of ships and alternative repair practices;
- consequences of structural reliability with new to old steel replacement;
- development of common repair, inspection and maintenance;
- non-destructive testing of welds;
- means of detecting fatigue cracks and recording presence of fatigue cracks prior to repairs or renewal;
- corrosion detection and protection, monitoring the environment in void and ballast spaces;
- contact damage on the strength of a ship's side structure and strength of securing arrangements for openings;
- global and local strength;
- influence of residual stresses;
- effect of operational profiles on structural deterioration and failures of tankers;
- legislative responsibilities, and repair and maintenance scheduling.

Keywords: Ship repair and maintenance, tankers, global and local strength, fatigue cracks, corrosion detection

Acronym:	ALERT
Name of proposal:	Assessment of Life-cycle Effect of Repairs on Tankers
Contract number:	TCA5-CT-2006-031459
Instrument:	CA
Total cost:	599,996 €
EU contribution:	599,996 €
Call:	FP6-2005-Transport 4
Starting date:	01.11.2006
Ending date:	31.10.2008
Duration:	24 months
Sector:	Waterborne
Objective:	Advanced Design and Production Techniques
Research domain:	Strategies and processes for clean maintenance, dismantling and recycling of vehicles and vessels (Including post-Prestige package)
Website:	http://www.ncl.ac.uk/marine
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CAS

Cost-effective Inspection and Structural Maintenance for Ship Safety and Environmental Protection throughout its Life Cycle

The project aims at significantly improving the reliability of assessing a ship's condition, by attaching all measurements performed on an operating ship to a numerical 3D model of the ship. This will enable both the electronic exchange of data between maritime actors and a 3D visualisation of the condition of the ship's structure.

Background

An increasing number of structural measurements (especially thickness measurements) is required by regulatory bodies for operating ships in service at sea.

Measurement information consists of thickness measurements, visual assessment of coating and crack detection. In the existing situation, because there is no standardisation of data, the measurements are recorded manually on ship sketches or tables, which are very difficult to handle. Measurement information takes a long time to report and to analyse, leading to some repairs being performed at the next docking of the ship.

Performing the reporting of these structural measurements efficiently requires processing measurement information on a real-time basis. This would result in cost savings because a faster assessment of the ship's condition and quicker decision-making could be done while the ship is still in the dock for maintenance.

Reliability of the analysis of the measurement reports could also be significantly improved by the use of electronic displays, associated with automatic warning devices in case of excessive deterioration of the structure. This is to be compared with today's existing paper measurement reports, which are checked manually, page by page, by surveyors.

Objectives

The system is built around the design of an exchange standard format to describe, in a neutral way, the structural data and associated measurements. All tools used in the ship hull monitoring process are expected to have this exchange standard format incorporated.

The system to be developed in this project includes such innovative features as:

- the development of a simplified and flexible ship electronic model which can be refined to fit the needs of classification inspections
- additional measurement information into the ship model
- automatic updating of the measurement information into the ship model
- the integration of robotics
- easy handling of measurement information using virtual reality
- immediate worldwide access.

Systematic comparison and consistency checks of measurement campaigns will make it easy to trigger electronic alerts. Repair decisions and residual lifetime of the structure will be calculated with modern methods of risk-based maintenance modelling, with the interesting feature that the model will be updated after each measurement campaign.

The system to be developed is applicable to any ship type, but tankers and bulk carriers will be used as the main case studies due to the current focus on these ships.

Description of work

The project's central deliverable is the format of the files exchanged between thickness measurement companies and classification societies, which will take the shape of an XML schema. The first step is to collect the users' requirements, which will be identified by the members of the project and therefore reflect the points of view of all actors involved in the process.

This exchange standard for structural data and measurement information will then be incorporated in all major scenarios anticipated for the use of the exchange standard:

- input and update of ship structure geometry
- input of measurements
- recording of repairs
- input from measurement robots
- 3D visualisation of the ship structure and measurements
- condition assessment by the classification society and checking of the conformity of the condition with applicable classification rules
- probabilistic prediction of future structural condition.

Prototype software tools are being built, which will validate these scenarios of use.

All prototypes tools will be integrated and a full-scale demonstration with a real ship in dry-dock will be run at the end of the project.

Results

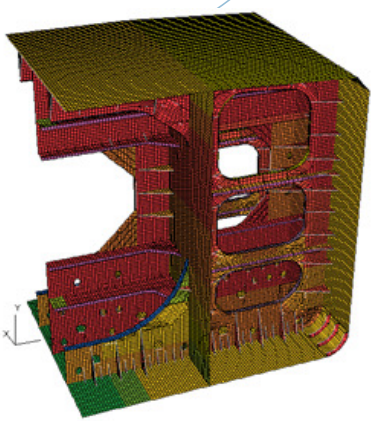
The major deliverable is the exchange standard format for the transfer of structural data and measurements. The exchange standard is expected to enable the transfer of electronic information between all the actors involved in the ship hull monitoring process, especially between the thickness measurement companies and the classification societies.

It will also enable the visualisation of the hull in 3D, for reliably checking the hull condition.

The exchange standard is presented as an XML schema, accompanied by an exhaustive documentation.

It is expected that this exchange standard will first attract attention by its intrinsic qualities. However, this could later be accepted by regulatory authorities as the official reporting format for measurements on board operating ships. Thus, the continuous and reliable follow-up of the ship condition during the whole operating life of the ship would certainly greatly contribute to the safety of ship operation.

Keywords: Safety, ship, hull monitoring, thickness measurements, condition assessment ,3D, electronic model



3D electronic model of a ship

Acronym:	CAS	
Name of proposal:	Cost-effective Inspection and Structural Maintenance for Ship Safety and Environmental Protection throughout its Life Cycle	
Contract number:	TST4-CT-2005-516561	
Instrument:	STP	
Total cost:	3,188,100 €	
EU contribution:	1,650,000 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.02.2005	
Ending date:	31.01.2008	
Duration:	36 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Strategies and processes for clean maintenance, dismantling and recycling of vehicles and vessels (Including post-Prestige package)	
Website:	http://www.shiphullmonitoring.eu	
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	Lisnave Estaleiros Navais SA	PT
	Cybernetix SA	FR
	INTERTANKO	NO
	TOTAL ACTIVITES MARITIMES	FR
	Maritime Russian Register	RU

DIFIS

Double Inverted Funnel for Intervention on Shipwrecks

The scope of the DIFIS project is the study, design (including costing, planning, deployment procedures, etc.) and validation of an EU reference method for the prompt and cost-effective intervention and remediation of tanker wrecks, dealing with eventual leaks and recuperating the fuel trapped in their tanks, even at considerable depths. The proposed method will be of general applicability so long as the trapped pollutant does not dissolve and is of lower density than seawater.

Background

A great number of wrecks exist in the sea or on the ocean bed all over the world, many of them having a quantity of hydrocarbons trapped in their tanks (cargo and/or fuel). Each one of these wrecks constitutes a more or less serious threat for the environment in the shorter or longer term.

Maritime disasters leading to major environmental pollution happen almost regularly every two to three years: Amoco-Cadiz in 1978, Tanio in 1980, Aegean Sea in 1992, etc. In December 1999, the sinking of the tanker Erika caused a major pollution on the coasts of Brittany and triggered several measures aiming at the prevention of similar maritime catastrophes. Several proposals were made on the prompt mitigation of the results of such accidents, by treating the released hydrocarbons with intervention on the wreck to seal the leaks or pumping the trapped hydrocarbons out. However, few of these proposals went further than the conceptual state; none of them was anywhere close to a practical intervention system.

On 19 November 2002, the tanker Prestige, loaded with 77 000 tonnes of heavy fuel oil, broke apart and sunk 133 miles off Cape Finisterre. At the beginning of December 2002, the Prestige wreck was leaking as much as 125 tonnes of oil every day. Although many of the 20 leaks were stopped by the submersible Nautilus of Ifremer, 14 months after the accident the wreck was still leaking about 350 kg daily. An intervention method through special 'shuttle bags' was developed and tested by the Spanish company Repsol YPF to extract the oil from the wreck. At the end of the process, almost two years after the accident, less than 15% of the original fuel load of Prestige had been recuperated; 25% had leaked before its sinking, while 60% of its original load had slowly dispersed in the ocean during the 22 months it took to plan and implement the intervention.

The Prestige case puts in evidence, among other things, the lack of tools, systems and methodologies for the prompt intervention on shipwrecks in order to confine the pollution and thus eliminate the source of the pollution threat.

Objectives

The DIFIS system will consist of a light, quickly deployable, flexible structure that should stay in place until all the tanks of the wreck are emptied and the pollution threat eliminated. The concept, on which the proposed method is based, is shown in the included illustrations.

The envisaged solution relies on gravity forces to channel the flux of spilt fuel towards the surface. However, instead of channelling the flux directly to the surface, where the recovery operation would be greatly affected by adverse weather conditions, the fuel-water mixture will be channelled to a buffer reservoir/separator some 30-50 m below the sea surface.

Description of work

The DIFIS system is very innovative and most of its components, as well as the deployment and procedures, must be validated and optimised with experimentation as well as advanced modelling techniques and tools prior to proceeding to their detailed design.

The leaking fuel is collected by a kind of inverted funnel, consisting of a fabric dome solidly anchored around and completely covering the wreck. The collected fuel is channelled, along with seawater, through a long, flexible riser tube (typical diameter: 1.5-2 meters) into a second inverted funnel, or buffer bell, close to the sea surface (30-50 m). The buffer bell acts like a separator and reservoir. It is made from steel, having a capacity of several hundred tonnes (typically 1 000 tonnes or more). Fuel occupies the upper part of the buffer bell while heavier seawater is forced out from the open bottom. The buffer bell also has the function of a terminal buoy, which keeps the whole riser line in tension. The reservoir, into which the spilt fuel is channelled, is provided with standard equipment through which shuttle vessels can recuperate the fuel rapidly, using standard offshore loading equipment and procedures.

The principal issue regarding DIFIS has to do with the behaviour of such a wide and long tube in various configurations and patterns of sea currents. The prime factor for specifying the number and strength of anchors, tube and cables will be the pattern of the expected sea currents, and the resulting static and dynamically induced pull. This is the major issue on the feasibility and costing of the system. Another not so trivial issue is caused by the possible vibration modes induced by the currents (VIV, vortex-induced vibrations), various instability modes, possible flexing or buckling of the riser tube which in the proposed configuration presents almost no torsion resistance.

All these and other issues that will inevitably rise will be dealt with by the extensive modelling and experimentation activities planned within the project duration.

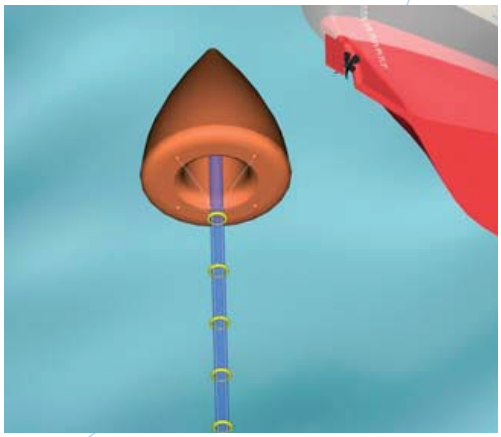
Results

The DIFIS solution is innovative both as a technical solution and as a method to tackle both the containment (short term) and the elimination of the pollution threat (long term) at the same time. There have been concepts and solution proposed before which had one or more characteristics and/or functionalities common with DIFIS. However, none of these solutions has progressed, to our knowledge, further than an abstract concept. The few methods that have actually been applied differ drastically from DIFIS.

Keywords: Wreck, intervention, pollution, oil slicks, environment, civil protection, sub-sea operations

Fivos Andritsos (JRC)

DIFIS system dome covering a wreck at the sea bottom



Fivos Andritsos (JRC)

DIFIS system buffer bell for collecting the oil from the wreck

Acronym:	DIFIS
Name of proposal:	Double Inverted Funnel for Intervention on Shipwrecks
Contract number:	TST4-CT-2005-516360
Instrument:	STP
Total cost:	3,182,900 €
EU contribution:	1,800,000 €
Call:	FP6-2003-Transport 3
Starting date:	01.09.2005
Ending date:	31.08.2008
Duration:	36 months
Sector:	Waterborne
Objective:	Advanced Design and Production Techniques
Research domain:	Strategies and processes for clean maintenance, dismantling and recycling of vehicles and vessels (Including post-Prestige package)
Website:	http://www.difis.eu
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ECODISM

Ecological and Economical Development of Innovative Strategy and Process for Clean Maintenance, Dismantling and Further Recycling of Vehicle Parts

This project is about the eco-conception of automobiles by using adhesive joining technologies, which include active systems providing for further easy dismantling of bonded parts, at the end of a vehicle's life or at a maintenance stage, and finding the technologies for activating these systems.

Background

To achieve the objectives of the End of Life Vehicle directive (ELV), the automotive industry and its suppliers need to come together at the design stage of the next generation of vehicles, and develop innovative processes and methodologies that will be used for maintenance, dismantling and recycling of car elements.

Today, the automotive industry suffers from a lack of solutions that could combine cost-effectiveness, speed, low energy consumption and selectivity for maintenance with the dismantling and recycling of materials, such as plastic, composite, glazing, metals and aluminium parts, which are being used more and more.

Objectives

The objective of the ECODISM project is to provide ecologic and economic processes to the automotive industry to overcome these difficulties and improve its competitiveness. This will be done through the integration of active systems within adhesives that are expandable when exposing them to an external energy source. To develop processes for debonding operations, the partners will focus their efforts on:

- specifications of a wide range of active systems, type, temperature sensitivity range and coating preventing degradation
- a range and type of suitable energy sources, infrared, UV and electrical
- the technological results of the experiments and the best options for each interface
- a computer mathematical model identifying the most suitable microspheres with the trigger options to match the adhesive and materials to be bonded and debonded
- a computer mathematical model identifying the most suitable active systems with the trigger options for the application of curing to match the adhesive and the materials to be bonded
- processes and methods to use these materials for debonding operations during maintenance and dismantling operations.
- The consortium gathers 12 partners from six EU countries and Switzerland, and includes three high-tech SMEs. The consortium is representative of the European automotive industry (carmakers, suppliers for glazing, plastic composites, etc.).

Description of work

There are nine work packages merged into four main themes:

Specifications:

- Materials to bond (for example: glazing to painted metal sheet, composites to composites, glazing to plastics, aluminium to aluminium)
- Geometry
- Application methods of adhesives
- Dismantling specifications, dismantling protocols and life cycle assessment (LCA)

Adhesives and active systems:

- Integration of active systems within adhesive (thermo-expandable microspheres, blowing agents, etc.)
- Formulation of adhesives

Assembly line compatibility:

- Application of adhesives on concrete examples
- Tests on application methods
- Ensuring bonding durability
- Ensuring the durability of the debonding capability
- Full-scale tests

Energy sources – optimisation and modelling:

- Selection of adapted activation sources (IR, UV, microwave, etc.)
- Computer modelling of delivering method energy
- Computer modelling of the debonding process

Results

The main achievements and deliverables are:

- Specifications
- First generation of adhesive active systems
- Assembly methods
- Computer model of the debonding process
- Second generation of adhesive active systems
- Final reports on bonding and debonding durability
- Final Report on LCA
- Dismantling protocol

Keywords: Recycling, ELV, maintenance, adhesives, adhesion, IR

Acronym:	ECODISM
Name of proposal:	Ecological and Economical Development of Innovative Strategy and Process for Clean Maintenance, Dismantling and Further Recycling of Vehicle Parts
Contract number:	TST4-CT-2005-516333
Instrument:	STP
Total cost:	2,296,484 €
EU contribution:	1,189,367 €
Call:	FP6-2003-Transport 3
Starting date:	01.01.2005
Ending date:	31.12.2007
Duration:	36 months
Sector:	Road
Objective:	Advanced Design and Production Techniques
Research domain:	Strategies and processes for clean maintenance, dismantling and recycling of vehicles and vessels (Including post-Prestige package)
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ECODOCK (ex GREENDOCK)

Enviromentally friendly coatings for ship building and ships in operation

EcoDock focuses on the optimisation of marine coating activities during the entire ship's lifecycle and considers economy, technical performance, environmental impact and health and safety issues.

Background

The EcoDock starting point is the fact that maintaining costs for ships are increasing as a result of increasing legislation and regulation. The average cost for applying paint to a new ship can be less than $1.50/sq.m. but up to $50/sq.m. to repair it during the vessel's life. During the past five years, marine coating processes have changed due to advanced material developments, changed production systems and international regulations. The application of concurrent engineering and production approaches reduces the timeframes for marine coating processes. Marine coating is not just a complex technology area due to the large variety of production parameters but also because different industrial parties are involved with competing objectives. Ship-owner, shipyard, marine paint supplier, classification society and public authorities have different intentions during the lifecycle of a ship. Apart the different objectives, the technical background of the parties involved in many cases is diverse and therefore the introduction and acceptance of new technologies and concepts can be slow. EcoDock intends to stimulate the communication and provide common baseline information to introduce new coating technologies.

Objectives

The overall objectives of EcoDock are in this context:

- to improve the performance of marine coatings during the lifetime of a ship
- to reduce environmental impact of marine coatings during the ship's lifecycle
- to provide independent assessment of marine coating systems
- to establish a European communication platform in order to stimulate the information exchange of the parties involved
- to speed up the application of advanced environmentally friendly materials and production processes in the building of new ships, repair and operation.

The technological developments in the work programme will focus on paint systems that are most relevant according to the economy, technical performance, environmental impact, and health and safety issues. Although the relevance depends on the vessel type, the main areas of interest will be:

- corrosion protection in ballast tanks and cargo holds
- antifouling at underwater areas
- visual impressions of the superstructure.

Description of work

The project work plan contains seven interrelated work packages.

WP1: Development of advanced paint systems

In this work package various characteristics of advanced marine paint systems are investigated. It includes research on new polymer binders, anticorrosion effects of paint pigments, film formation and solvent entrapment, and properties of paints based on nano-composites.

WP2: Application technologies for advanced paint systems

The introduction of new paint systems, like high volume solid or waterborne systems, requires modifications of the production processes. The objectives of this work package are benchmarking coating systems and the specification and evaluation of surface preparation and paint application technologies for advanced paint systems in order to achieve best product performance in different production environments. New building state, onboard maintenance and repair work will be considered.

WP3: Performance assessment of advanced paint systems

This work package develops and establishes standardised test methods and criteria for quality assessment of marine paints. The work focuses on anticorrosion testing in ballast tanks and cargo holds, and antifouling properties of the ship's hull.

WP 4: Assessment of health and safety conditions for marine paints

Almost all coating materials in the shipyards contain hazardous components. WP4 analyses the effects and improvements of advanced coating materials and application technologies on the working conditions. The WP defines and develops a respective measurement methodology, performs measurements during the production process and then defines requirements to improve operational safety.

WP 5: Assessment of environmental influence of advanced paint systems

This work package provides information on the short-term environmental impact of shipyard processes regarding distribution of antifouling biocides in the environment. These examinations will be complemented by the development of a method for the determination of biocide leach rates from antifouling paints.

WP 6: Specification of computer-supported coating management systems for a ship's lifecycle

Coating activities and the coating products have come under increasing scrutiny over recent years for ship-owners and shipyards. However, most of the related activities are paper-based and only partly supported by computer systems. The objective of this work package is the development of a modular software tool supporting coating activities during the ship's lifecycle.

WP 7 European Coating Management Platform

This work package disseminates the research result and stimulates the information exchange between parties involved in the marine coating process.

Results

The main results of the project will be:

- Comprehensive background information on paint characteristics
- Concept for robotic spraying
- Concept for automatic paint removal in ship repair
- Benchmark of surface preparation and application technologies
- New test methods for antifouling and anticorrosion performance measurements including internal stress
- Health and safety assessment in ship repair and initial ventilation measurements
- Baseline data for the environmental impact at new building and repair yards from sediment sampling and analysis
- Optimised method for release rate measurements
- Mock-up of coating management software
- Establishment of a European research and development communication platform.

Keywords: Marine coating, surface preparation, marine paint application, marine coating manager

DNV

Performance test of marine antifouling paint systems

Acronym:	ECODOCK (ex GREENDOCK)
Name of proposal:	Enviromentally friendly coatings for ship building and ships in operation
Contract number:	TST3-CT-2003-506491
Instrument:	STP
Total cost:	2,955,000 €
EU contribution:	1,874,000 €
Call:	FP6-2002-Transport 1
Starting date:	01.02.2004
Ending date:	31.01.2007
Duration:	36 months
Sector:	Waterborne
Objective:	Advanced Design and Production Techniques
Research domain:	Strategies and processes for clean maintenance, dismantling and recycling of vehicles and vessels (Including post-Prestige package)
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EU-MOP

Elimination Units of Marine Oil Pollution

The project addresses the concept of autonomous units (EU-MOPs) that are capable of fighting oil pollution at sea. Hence its end result will be the design of low-cost units that can be released at the spill area and confront oil mechanically. The entire spill can be covered using a number of these units.

Background

Oil pollution, arising either from marine accidents or from ship operations, is one of the major problems that threaten the equilibrium of the marine environment. The severity of the situation, for open and confined seas alike, has never been evaluated to its fullest extent, due to the lack of comprehensive data. Only estimates can be given on the quantity of oil that finally ends up in the sea from all possible sources (ships, fixed-shore installations, etc.). These estimates, although not particularly accurate and very dependent on the database employed, reveal the criticality of the problem at hand: 1.7 to 8.8 million tons per year, with an average of about 2.5 million tons per year being the most commonly accepted rate. This is the amount of oil that eventually reaches the sea. The issues of oil pollution and spill confrontation have attracted increasing research efforts over the past 25-30 years. The preservation of the marine environment is of extreme importance and therefore all possible dangers/problems that threaten it must be dealt with determination and efficiency. In the post-Prestige era, it is now time for a completely new and multidisciplinary concept for handling oil spillage in European waters to be developed. This will yield environmental benefits, an impulse to the respective industry and it will result in an exportable product for marine oil spill confrontation.

Objectives

There is an existing and direct need for a continuous renovation of the relative anti-pollution methodologies and equipment, always striving to minimise or eliminate the adverse effects an oil spill has on the environment. Such a goal must be incorporated in all hierarchical levels, at the same time taking all necessary legislative and surveillance measures to prevent the emergence of oil spills in the first place. However, it is an undisputed fact that as long as oil-carrying vessels sail the seas, tons of oil will eventually end up in the seawater. In effect, and taking into account the increase of oil-related traffic of recent years, efficient operational techniques that allow for the control and the elimination of observed oil spills are imperative. In this context, the research objectives of the EU-MOP project are to establish:

1. innovative technologies in oil spill management
2. pioneering devices/units for oil spill response
3. an integrated framework for oil spill management
4. an advanced structure for the dissemination of oil pollution response policies. Moreover, validation, proof of concept and virtual (simulation) experiments are included in the project.

Description of work

The work focuses on the design of the unit, the artificial intelligence platform, the oil-processing scheme, on cost-benefit analysis and on response logistics at both strategic and tactical levels. Thus the project is formulating an advanced approach for spill management issues, including mobilisation, application tactics, strategic management, logistics, etc. Emphasis will also be given on the logistics and support chain of the EU-MOP concept and operation: the implemented logistics and the corresponding techniques will be properly assessed in terms of efficiency, functional facilitation and continuous service enhancement. Some of the technological challenges involved in the project's work plan and selected points from its technical annex are:

1. energy source and propulsion
2. sensors, electronics and artificial intelligence
3. vessel design
4. robotics
5. oil processing.

According to the above description of work, the introduced research activities will be multidisciplinary and encompass areas of particular technological innovation. Furthermore, the study of the EU-MOP system level (the emergency response management component) will acquire a realistic structure and consequently provide for the best possible protection of the marine and coastal environment.

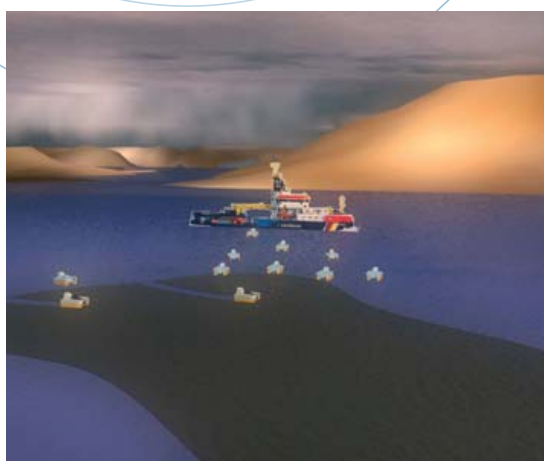
Results

There are a number of elements/outputs concerning the EU-MOP project that makes it particularly appealing to the maritime industry in terms of efficiency, quality and environmental friendliness concerning the marine and littoral environment. Hence the EU-MOP units will be designed so as to provide an efficient, cost-effective and manageable technique to combat oil spillage at sea. There will be no side effects, no dangerous materials onboard and no possibility of any harmful action. The EU-MOP project will come up with an advanced approach for spill management issues for both the strategic and tactical levels (e.g. confrontation, strategic survey, logistics, etc.). Thus it will present an integrated solution-chain concerning the overall framework for the mobilisation and application of anti-pollution means. In effect, the complete integrated system, including communication, logistical support, and response management will also be developed. The envisioned units will be designed and assessed (proof of concept) and assembled from inexpensive materials, and a range of such units will be selected so as to allow their use in various oil spill scenarios (a 'one size fits all' concept is inappropriate). This will make them, in the end, an appealing challenge for the industry, since they will be efficient, patentable and will allow for an adequate profit margin.

Keywords: Marine pollution, oil confrontation, artificial intelligence, swarm tactics, emergency response

NTUA

EU-MOP catamaran unit - large model



NTUA

EU-MOP swarm operation

Acronym:	EU-MOP	
Name of proposal:	Elimination Units of Marine Oil Pollution	
Contract number:	TST4-CT-2004-516221	
Instrument:	STP	
Total cost:	2 900 689 €	
EU contribution:	1 899 629 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.02.2005	
Ending date:	31.01.2008	
Duration:	36 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Strategies and processes for clean maintenance, dismantling and recycling of vehicles and vessels (Including post-Prestige package)	
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	Environmental Protection Engineering S.A.	GR
	AURENSIS, S.L.	ES
	The Chancellor, Masters and Scholars of the University of Oxford	UK
	Consultrans s.a.	ES
	BUREAU MAURIC	FR
	Institute of Shipping Economics and Logistics	DE
	Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.	DE

HISMAR

Hull Identification System for Marine Autonomous Robotics

This project will develop a multi-purpose inspection and maintenance platform with an advanced navigation system for marine applications. The device developed will offer a means to undertake hull inspections and maintenance, thereby improving the potential safety and environmental impact of vessels.

Background

Both the global and EU shipping fleet continue to grow. Over 3 billion tonnes of goods are handled in the EU, as well as the movement of over 300 million people, and the sector employs more than 2.5 million people in the EU. Whilst shipping is one of the cleanest forms of transportation, the fouling of ships reduces efficiency and increases the consumption of fuel burnt. Vessel safety has improved in recent years; however structural failures continue to occur. Therefore any system which is capable of continuously monitoring the integrity of the vessel's hull will provide a valuable operational tool.

HISMAR is intended to be a multifunctional robotic platform, which will offer the option to perform specific inspection or maintenance tasks, such as structural integrity monitoring of the ship's hull or carrying out cleaning. This project offers a means to undertake hull inspection and maintenance effectively and efficiently, thereby extending the safe working life of the vessel.

The project is highly relevant to the EU Maritime Policy and thereby EU business and society. The improved environmental performance and safety will support shipping operators through reduced fuel, insurance and other operating costs. The project will provide improved safety, reduced shipping costs, reduced emissions and employment opportunities, all of benefit to society.

Objectives

The proposed dead reckoning method will use optical technology so that surface feature changes are tracked. As platform slip and drift can occur, known hull features will be used to updated the current position. With a combination of Hall Effect and optical sensors, a map of the structure of the vessel will be intelligently learnt, stored and recalled. By saturating the hull with a localised magnetic field, Hall Effect sensors can detect subsurface strengthening struts and other hull structural features, which will be used as unique landmarks.

The device will be able to partially complete its tasks whilst in one port then be re-launched at successive points to complete the task elsewhere. The platform can be launched whenever the vessel is in port or at anchor. It will also be deployable in a dry-dock situation.

Description of work

The initial stage of the project consists of a full investigation of end-user requirements including a cost-benefit analysis. Following the initial investigation, the design, manufacture, testing and analysis of the navigational sensory system and its test cell will commence, resulting in the construction of a prototype sensory system for platform navigation. The next stages of the project will include design and construction of a hull structure mapping system, and the design and construction of the drive and electromagnetic attachment system. Finally the buoyancy outer shell will be designed and constructed. At every stage, each element will be fully tested and analysed before the complete system is tested in dry and underwater conditions. Full field trials will be undertaken.

Technical innovations are a key element of the project, particularly relating to the optical dead reckoning system underwater. Intellectual property, areas of novelty and patentability are managed as part of the exploitation and dissemination work package.

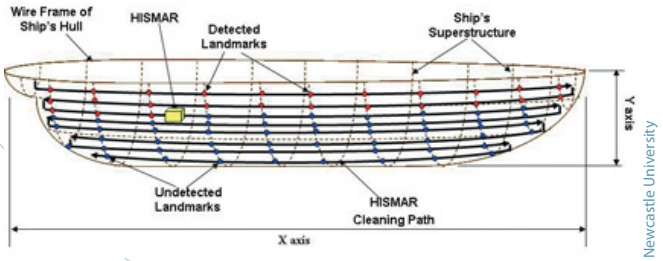
The project is managed through eight work packages, six which deal with research and innovation, one which covers exploitation and dissemination and, lastly, a project management work package. Each work package has a work package leader and is broken down into tasks with clearly defined objectives, task leaders and deliverables.

Results

There are key deliverables throughout the project, which relate to each task and include the design of equipment and the development of resultant prototypes. There are also deliverables associated with the project management and the exploitation and dissemination strategy. The final deliverable of the project is a fully integrated HISMAR system which has been tested and analysed, including full field trials.

The project influences economic benefits to ship operators due to the reduced operating costs. The project has a positive impact on the environment through reduced fuel consumption, reduced emissions and a reduction in the likelihood of structural failure. Employment opportunities in the areas of electronics, robotics and marine servicing industries will be developed through the manufacture and use of the system. The underwater hull maintenance industry can use the product, retraining its staff in the use of the robot, thereby reducing the safety problems associated with diving operations, which is a hazardous activity. These positive impacts will help to develop the commercial market for this product.

The product will also support the changing legislation associated with hull cleaning which is becoming more onerous. It will also allow ports to comply with their obligations to the EU white paper on port pollution.



Cleaning concept

Acronym:	HISMAR
Name of proposal:	Hull Identification System for Marine Autonomous Robotics
Contract number:	TST4-CT-2005-012585
Instrument:	STP
Total cost:	1,670,899 €
EU contribution:	1,200,942 €
Call:	FP6-2003-Transport 3
Starting date:	01.11.2005
Ending date:	31.10.2008
Duration:	36 months
Sector:	Waterborne
Objective:	Advanced Design and Production Techniques
Research domain:	Strategies and processes for clean maintenance, dismantling and recycling of vehicles and vessels (Including post-Prestige package)
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OSH

Oil Sea Harvester

By raising the issue of marine oil spills to the highest priority for the EU community, OSH is addressing these needs to develop a fast ship in transit to be quickly on the scene and to recover oil in rather high sea states. The outcome is the technico-economical definition of the integrated OSH system.

Background

The increase of traffic, together with the presence of many old and not always well-maintained vessels, on the seas quite close to European coasts will increase the risk of having human, ecological but also economical disasters. The consequences of tanker accidents are often catastrophic, raising the issue of oil spills to the highest priority for the EU community. Analysing accidents like the recent ones of the Erika and the Prestige, there is a clear need for vessels specifically designed to recover oil pollution at sea (with efficient recovery tools, decantation and storage capacities), which have onboard tools to help them detect and track the pollutants. There is also a clear need to have a fast ship in transit in order to be quickly at the scene of the accident to operate oil recovery when the spill is still well concentrated. It is also necessary to have a stable ship for rough weather conditions, which has oil recovery tools as well protected as possible from the sea in order to be able to operate in rather high sea states.

Objectives

The objectives are:

- to define the requirements of the OSH concept to respond to oil spill scenarios
- to develop a trimaran vessel adapted for the OSH requirements
- to develop and/or validate hydrodynamic simulations and optimisations of the performance of the OSH platform
- to develop a recovery tool and a carriage that are adapted to the ship
- to develop or further develop and integrate tools dedicated to oil recovery for different viscosity of pollutants
- to evaluate/validate experimentally the ability of the tools to recover the pollutants
- to develop and/or validate scenarios of oil recovery with the OSH system
- to assess the final integration of the OSH concept
- to study the possibilities of having a decision-support and mission-planning tool for OSH
- to evaluate the price of the OSH system and its maintenance costs
- to establish a technical and commercial documentation dedicated to promoting the system on the market and presenting the system to the European Safety Agency

The main deliverable is the definition of the integrated OSH concept (vessel, tools and systems), including its economical perspective.

Description of work

The following work is being carried out:

- an adjustment of the OSH capacities and features to the identified situations of pollution and taking into account operational lessons from past accidents

- the definition of a preliminary ship design regarding hull line definition and general arrangements, including the main design options (platform, hull form, propulsion and manoeuvring, functional area arrangement, stability in rough weather and speed for the recovery operations)
- the design of oil recovery tools (brush type skimmer, oil separator), tool carriage and their integration on an OSH vessel
- hydrodynamic calculations and tank tests aimed at optimising ship design in sea keeping (recovery operation) and powering (transit)
- experimental tests in oil recovery performance for the skimmer (with different viscosities of oil)
- the definition of an oil-spill mission and other complementary missions as the OSH is a multipurpose vessel
- the development of a prototype of a mission-planning tool
- the assessment of the economical potentials of the OSH
- final project integration, including a parametric study, final technical definition, overall performance of the OSH system, virtual 3D prototype for demonstrations of the concept
- the development of the OSH project documentation for promotional and exploitation purposes.

Results

The following results will be achieved:

- specifications of the OSH concept
- preliminary design of the trimaran OSH vessel
- oil recovery tools adapted for the OSH
- optimised hydrodynamic performances in sea keeping and powering, through numerical simulations and tank tests
- validated oil recovery performances through experimental tests
- definition of the OSH mission in oil spill response
- definition of other complementary missions for OSH
- demonstration of the prototype of the mission-planning tool in oil-spill scenarios
- final integration of the OSH concept, including demonstrations with virtual 3D prototype
- economical perspective of OSH
- full documentation of OSH for promotion and exploitation.

Keywords: Oil spill, scenario, ship, trimaran, design, hydrodynamics, sea-keeping, oil recovery, other missions, cost-benefit, Prestige, Erika, virtual prototype

OSH trimaran vessel

Acronym:	OSH	
Name of proposal:	Oil Sea Harvester	
Contract number:	TST4-CT-2004-516230	
Instrument:	STP	
Total cost:	3,547,500 €	
EU contribution:	2,000,000 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.12.2004	
Ending date:	30.11.2007	
Duration:	36 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Strategies and processes for clean maintenance, dismantling and recycling of vehicles and vessels (Including post-Prestige package)	
Website:	http://www.osh-project.org	
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	NAVALIMPIANTI S.p.A.	IT
	Canal de Experiencias Hidrodinámicas de El Pardo	ES
	Environmental Protection Engineering S.A.	GR

ROTISII

Remotely Operated Tanker Inspection System II

Ship integrity and pollution prevention call for periodic ship inspections with high costs and risks to those involved. The Remotely Operated Tanker Inspection System (ROTIS) has been developed to enter the flooded ballast tanks (even during ship navigation) to perform close-up visual inspection and wall thickness measurements, using tele-operation from remote sites. The advantages are lower costs (e.g. avoiding ship stand-by), lower risks and reliable results.

Background

On 4 June 2003, the European Parliament adopted a legislative resolution on double hulls or equivalent design requirements for oil tankers so that old, unsafe and dangerous oil tankers like the Prestige will no longer be allowed to transport oil in EU waters.

In future, heavy grades of oil will be transported by double-hull tankers only.

The introduction of double-hull vessels is widely seen as the response to the need to prevent maritime catastrophes. However, to be effective, it must be coupled with measures towards more efficient and cost effective inspection procedures. Adequate tools must be provided to the surveyors and ship-owners, as well as to state and port authorities providing them with the capacity to perform rapid but safe and reliable inspections.

To date, maritime vessel inspections are based on close-up visual inspections and steel plate thickness measurements. Prior to inspection, a ship must be made fully available at the harbour area, all access spaces must be made safe and prepared accordingly, often in dry dock, thus resulting in a considerable ship idle time and, consequently, a significant cost. In the case of big double-hull tankers it can easily amount to multiples of $100 000.

Objectives

The ROTIS II project will develop a remotely operated underwater vehicle, which is dedicated to ship inspection and certification with a minimum of human intervention and without the need to empty the ballast tanks.

ROTIS II will thus reduce the human intervention in this difficult and dangerous environment and reduce the time for the measurements and reporting in the certification phase as demanded by the classification societies.

The system will address the following operations as requested by the classification societies:

- close-up visual inspection
- steel plate thickness measurements.

The ROTIS reference application scenario is relevant to operations inside the ballast area, between the inner and outer hulls of double-hull vessels, with the aim of performing remotely all the inspections required during vessel surveys, taking into account safety and other operational constraints, such as operations in potentially explosive atmospheres.

Description of work

The ROTIS II system will be made up of the following elements:

- small, versatile remotely operated vehicle (ROV) equipped with ultrasonic sensor equipment for thickness measurements and a camera system for visual inspection
- an intermediate unit, providing energy for the ROV based on a proven air generator and high bandwidth wireless communication links to the central unit
- a rugged and transportable control station for the system providing an easy-to-use human machine interface, the inspection recording equipment and reporting software.

The ROTIS II project includes a significant research effort to correct/meet the technical issues identified by the first ROTIS prototype, which will significantly enhance all the ROTIS functionalities.

Each component and subsystem of ROTIS II is being designed considering the subsequent industrialisation. All subsystems will be finally integrated in an operationally ready, class-approved ROTIS II prototype; particular emphasis will be given to safety and usability issues.

Main research activities:

a. choice of the correct NDT probe: extensive early testing activities involving various manufacturers and technologies in order to perform plate thickness measurement and coating condition assessment
b. communication system: new technological developments to get a very thin and neutrally buoyant tether for power and communication, and to design a new tether for the management system
c. the human machine interface: re-engineering activity to enable the ROTIS II operator to efficiently and quickly perform the high quality inspections in the flooded ballast spaces, with logging of data for future reporting or use in CAD interfaces of the classification societies
d. vision system: enhancement of the vision system to support the operator in the most critical tasks, such as the centring and passage through the manholes.

Results

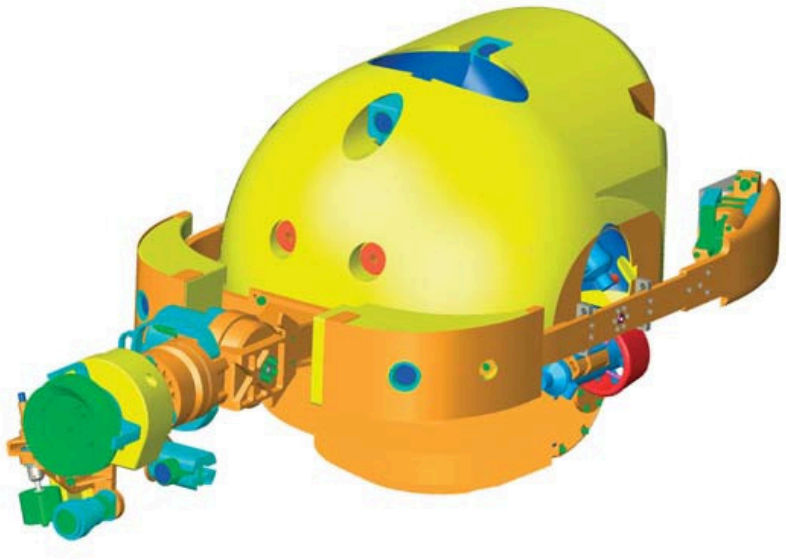
The final deliverable of the ROTIS II project will be a complete prototype system, ready for deployment and operation on double-hull vessels by properly qualified operators. The functionality of the system will be tested in conditions as close to reality as possible.

Such a system is expected to contribute significantly in a safe and environmentally benign navigation. It is expected that the availability of adequate tools and methods that will greatly reduce, if not eliminate, the main cost factors (ship idle time and space access preparation) will also make the inspection safer and more reliable.

The possibility of performing tele-operated inspections, i.e. avoiding the direct access of human beings near the structural members to be inspected, is particularly appealing for the following reasons:

- reliability: reduced logging errors, objective measurements
- safety of personnel: greatly reduced need to access potentially unsafe spaces
- economy: elimination of the needs for dry docking and preparing the access spaces can reduce significantly (even eliminate) ship idle time; inspections while navigating can be envisaged.

Keywords: Ship inspection, safety, robotics, teleoperation



Tecnomare S.p.A.

ROTIS II Remotely Operated Vehicle (ROV) performing inspection of ballast tanks

Acronym:	ROTISII	
Name of proposal:	Remotely Operated Tanker Inspection System II	
Contract number:	TST3-CT-2003-505936	
Instrument:	STP	
Total cost:	3,281,000 €	
EU contribution:	1,700,000 €	
Call:	FP6-2003-Transport 3	
Starting date:	01.03.2004	
Ending date:	28.02.2007	
Duration:	36 months	
Sector:	Waterborne	
Objective:	Advanced Design and Production Techniques	
Research domain:	Strategies and processes for clean maintenance, dismantling and recycling of vehicles and vessels (Including post-Prestige package)	
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	Avin Oil Trader Company	GR
	Alexandra Shipping Company	GR

SEES

Sustainable Electrical and Electronic System for the Automotive Sector

The SEES project aims to develop sustainable, clean, cost- and eco-effective electrical and electronic system (EES) prototypes and end-of-life processes. SEES follows a life-cycle approach considering all life-cycle steps, including design, pre-production at suppliers, production, assembly, use and end-of-life of automotive EES.

Background

The share of electrical and electronic systems (EES) in vehicles is steadily growing, in terms of both material utilisation and value. These systems offer benefits for safety, comfort and environmental performance. The European Directive on end-of-life vehicles (2000/53/EC) sets requirements for the end-of-life treatment and the design of vehicles, which thereby also includes automotive EES.

In this context, the SEES project aims to improve the present design of automotive EES and to analyse innovative end-of-life processes, contributing towards the overarching goal of sustainability. EES materials include electronics containing copper and precious metals as well as regulated substances (e.g. lead in solder) and different kinds of plastics which have a potential value for recycling/recovery. In the present situation the EES remains in the car when it enters the shredding process and then is separated afterwards by hand. Alternative end-of-life options to be studied include disassembly of EES components for reuse/recycling and advanced post-shredder recycling of the shredding residues. Optimum end-of-life scenarios for automotive EES (as well as for the whole car) have to take into account the whole life cycle of the product without shifting problems from the end-of-life phase to other life-cycle phases.

Objectives

The main objective of the SEES project is to develop sustainable, clean, cost- and eco-effective electrical and electronic system (EES) prototypes and dismantling/recycling processes to increase the vehicle recovery/reuse rate. SEES studies focus on the EES materials to identify sustainable end-of-life scenarios and to develop new EES design concepts to contribute towards sustainability. Innovative EES and plastic recycling schemes are to be developed considering economic and environmental aspects over the whole life cycle. The new EES design concept will include prototyping specific functions or parts. The new design concept is not limited to improve end-of-life aspects because use phase and production proved to be much more relevant from a life-cycle perspective.

During the project, results from environmental and dismantling studies demonstrated the limited improvement potential by focusing on dismantling and end-of-life aspects of EES. Therefore, the focus of the objectives has switched slightly from a focus on end-of-life related actions to a more holistic approach covering the whole life cycle as described above.

Description of work

The project activities include the following technical work packages:

1. Integrated assessment of EES in cars: characterisation and classification of types of EES components considering legal, environmental and economic aspects
2. Assembly study: study of EES assembly and future trends
3. Disassembly study: studying EES disassembly from new and end-of-life vehicles to identifying influences on disassembly time, cost and improvement potential
4. EES recycling: development of mechanical and chemical recycling EES processes
5. Plastic recycling: development of plastic recycling processes for disassembled EES as well as for shredding residues

6. Shredding study: study the contribution of the EES in the shredder output fractions and their recycling/recovery potential
7. Environmental and economic studies: life-cycle assessment and costing case studies to define optimum design options and end-of-life scenarios, development of methods to evaluate recyclability/recoverability potential of EES and to simulate end-of-life scenarios
8. Eco-design guidelines: development of guidelines to improve the environmental profile of EES considering the whole life cycle
9. Development of a new EES concept: application of the eco-design guidelines and prototyping of specific parts and functions for a new EES concept, and study of intelligent materials to facilitate disassembly
10. Product test: testing and validation of the new EES concept
11. Software development: development of software tools to support EES designers and recyclers in evaluating different designs and end-of-life scenarios.

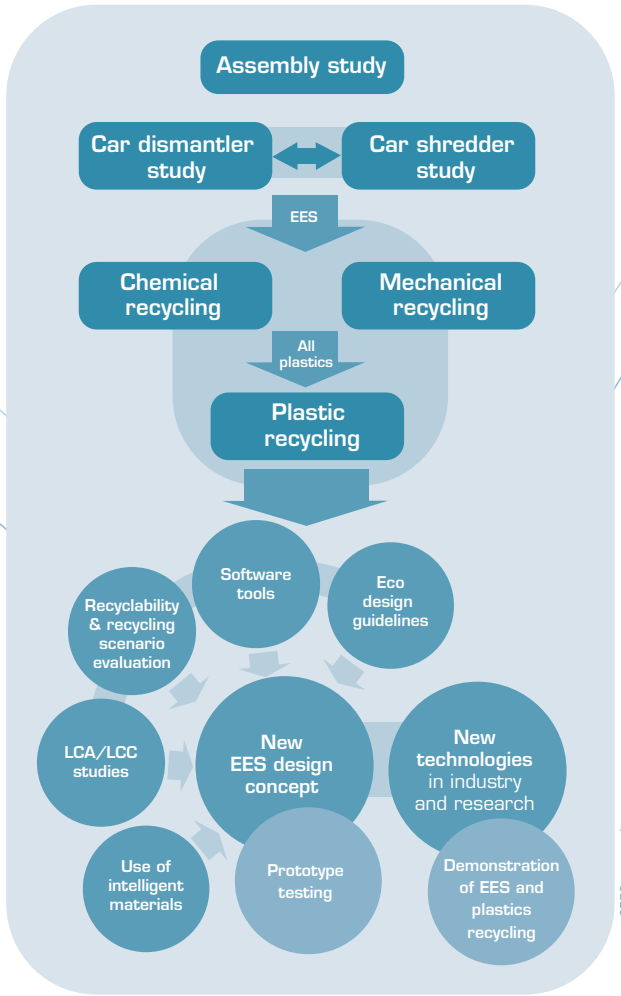
Results

The main SEES deliverables will be:

- Integrated end-of-life assessment of automotive EES
- Economic and environmental assessment including different design options and end-of-life scenarios
- Software prototype to support decisions on EES designs and recycling scenarios
- Eco-design guidelines to improve future designs of automotive EES
- Dismantling and shredding manuals for automotive EES
- Demonstration and application of new end-of-life technologies for EES
- New EES design concept and prototypes to be developed, tested and validated
- Dissemination and exploitation of all SEES results.

The project supports the objectives of the Sustainable Surface Transport Priority providing strategies and processes to clean dismantling and recycling of vehicles. SEES improves the competitiveness of the recycling value chain (from collectors, shredders, dismantlers to EES/plastics/metal recyclers), most of them SMEs. It also increases the competitiveness of EES manufacturers due to the benefit of the 'recyclable' product and reduces the costs associated with end-of-life car treatment. SEES helps to minimise life cycle impacts, raw material consumption and waste disposal (landfill/incineration). Findings will be communicated inside and outside the project consortium to improve the skills of the involved stakeholders. SEES also contributes to standardisation activities on dismantling, eco-design and life-cycle costing on international, European and company level.

Keywords: Automotive electrical and electronic system, life-cycle approach, disassembly, recycling, design



SEES project approach with main activities and products

Schematic illustration of the automotive electrical and electronic system (EES)

Acronym:	SEES	
Name of proposal:	Sustainable Electrical and Electronic System for the Automotive Sector	
Contract number:	TST3-CT-2003-506075	
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Call:	FP6-2002-Transport 1	
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Duration:	36 months	
Sector:	Road	
Objective:	Advanced Design and Production Techniques	
Research domain:	Strategies and processes for clean maintenance, dismantling and recycling of vehicles and vessels (Including post-Prestige package)	
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	nv Salyp (participation finished 31.12.2004)	BE
	Müller-Guttenbrunn GmbH	AT
	Fundación GAIKER	ES
	CIMA Kft - Center for Impact Assessment	HU
	Universitat Rovira i Virgili	ES
	Müller-Guttenbrunn Kft	HU