Spanish Railway R&D Capacities

I RAIL TECHNOLOGICAL FORUM FOR INTERNATIONALIZATION

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

FUNDACIÓN DE LOS FERROCARRILES ESPAÑOLES

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FOREWORD

This document gathers key data of R&D projects developed with Spanish capacities whose results have had an important impact on the sector. This is understood as R&D projects covered by public or private Spanish funding, projects with Spanish Consortia, or those in which the contribution of Spanish expertise has played a relevant role. This publication has been organized on the basis of scientific and technical challenges in which the Spanish Railway Sector is immersed in, according to the key areas identified by the Spanish Railways Technological Platform and that are developed by its thematic working groups.

The six thematic areas are as follows:

Area 1 – Policies, planning, economy, energy and sustainability
Area 2 – Interoperability and ERTMS
Area 3 – Rolling stock
Area 4 – Platform, superstructure, track and installations
Area 5 – Exploitation, operation and rail system security and safety
Area 6 – Rail freight transport

The information contained in each one of the areas provides an overview of the Spanish R&D know-how and potential to bring further research and innovation improving the sector competitiveness and sustainability. It has been elaborated coinciding with the I Rail Technological Forum for Internationalization, celebrated in Madrid on June 28th, 2011. This event has been supported by the General Directorate for Research and National R&D and Innovation Management Plan, the General Directorate of Technological Transfer and Corporate Development and the CDTI form the Spanish Ministry of Science and Innovation.

Contact:

Spanish Railways Foundation
Ángeles Tauler angelestauler@ffe.es
Aida Herranz aherranz@ffe.es
Eduardo Prieto eprieto@ffe.es

T. +34 91 151 10 99
Web. www.ffe.es
C/ Santa Isabel 44
C.P. 28012 Madrid

Spanish Railways Technological Platform
Mar Sacristán ptferroviaria@ffe.es

T. +34 91 151 10 83
Web. www.ptferroviaria.es

Area 1

Policies, planning, economy, energy and sustainability

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ACRONYM AND TITLE:	**AERO-AVE** **Integration of long-distance air transport with rail transport networks project**		
RESEARCH AREA:	Area 1 – Policies, planning, economy, energy and sustainability		
TYPE OF FUNDING:	Spanish Ministry of Public Works, Call for R&D and innovation projects 2008-2011 Spanish Ministry of Science and Innovation		
STARTING/ENDING DATE:	2009-2011	BUDGET:	€ 1,013,340

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The integration of air transport with long distance railway networks, and in particular, with the new high speed railways, is a policy that is gaining increasing acceptance, among regional authorities and at European and national levels. The intermodality in passenger transport is an issue in which only a few progresses has been achieved due to the existence of various types of barriers that have favored the predominance of unimodal alternatives. It is not the case for freight transport in which intermodality is in a more developed state. One of the research lines is "the promotion of modal change from modes more producers of emissions to less polluting modes, including nonmotorized modes, and the boost of intermodality as most appropriate way to achieve the required optimization of the global transport emissions". Given this context the **objectives** of the AERO-AVE project are:

- To analyze the impact of integration between long distance transport modes (air and high speed railways).
- To evaluate how such integration may facilitate improvements in interconnections between long distance modes and urban transport networks.

Report 1 gathers a literature review and a revision of the international experience. It contains three main parts:

- A review of literature concerning published works on the air-rail intermodality issue.
- A revision of the current intermodality situation at main airports in Europe: Roissy-CDG, Zurich, Copenhague-Kastrup, London-Heathrow, Amsterdam-Schiphol, Bruselas and Lyon-St. Exupéry.
- A deep analysis of the most successful experience of air-rail intermodality in Europe: the air-railway supply as provided in Germany from Frankfurt airport. The AiRail services, that combines services from Deutsche Bahn with the air services from Lufthansa, allows some corridors to complete intermodal trips without any modal breakdown.

Report 2 gathers the theoretical models and the identification of barriers and opportunities for the air-rail intermodality. In relation to theoretical models these are based on the fact that high speed railways and planes have been considered ad substitutive modes that compete between them. However, in spite of competition advantages, it might be possible that integration between planes and high speed railway becomes more beneficial. As a conclusion, we can state that **cooperation is beneficial for operators** that take part in the integration process, though social benefit of intermodality remains uncertain when there are capacity restrictions (due to competition losses in the market). At the same time, the **social welfare** would increase in the case of competition among air carriers (just because of the opposite). Regarding **environmental effects**, these seem to be positive when there is airport congestion at the airports affected by the integration process, whilst the effects appear as ambiguous when there is competition among air carriers.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Within two working groups that were constituted for the identification of barriers and opportunities for intermodality, the elements that customers valued most in the case of air-rail intermodal products were identified. Elements like total travel time, price, baggage management or the integrated management of booking and boarding passes, were considered as very relevant on the users' part in order to accept intermodality. Barriers associated to lack of technological change or to normal practices in the operation of different transport modes were not considered as an insurmountable aspect, being the main problem for the development of intermodality the need to implement cooperation agreements among different agents that would be beneficial for them all. One of the most important elements is the final price that is required to be lower than the sum of prices for each of the trip parts.
Currently the project is close to its completion, having concluded the reports 1 and 2. At the moment the case studies of the project are being finalized. These are the following: Madrid-Barcelona, Madrid-Toledo, Airport and HSR Málaga and routes connecting the Canaries with Mainland Spain.

LEADING ENTITY:	Foundation for Applied Economic Studies (FEDEA)
PARTICIPANTS:	University of Las Palmas de Gran Canaria (ULPGC), University of Castilla-La Mancha (UCLM), Transport and Territory Technical Team (ETT), Research Institute Foundation Innaxis, Renfe-Operadora, Spanish Administrator of railway Infrastructures (ADIF), Spanish Railways Foundation (FFE) and IBERIA
CONTACT DETAILS:	Dissemination: Spanish Railways Foundation. C/ Santa Isabel 44, 28012 Madrid T: +34 91 151 10 97 E-mail: aeroave@ffe.es Web: www.aeroave.es

ACRONYM AND TITLE:	ELECRAIL "Systematical analysis of the energy consumption in railroad metropolitan lines, of commuter and high speed trains, with evaluation of the energy impact and of the economic result, including the development of models and parametrical simulators"		
RESEARCH AREA:	Area 1 – Policies, planning, economy, energy and sustainability		
TYPE OF FUNDING:	Public subsidy. CEDEX, Spanish Ministry of Public Works. National Plan of R&D and innovation 2004-2007. Call 2007		
STARTING/ENDING DATE:	2007-Jaunary to 2011-December	BUDGET:	€ 468,231

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

There is an inventory and systematic analysis of all possible measures to reduce energy consumption on electric railways and exploitation of regenerative braking. These measures are set alongside one another, analysing incompatibilities, differential advantages and the applicability to each specific case.
The area in question is passenger rail transport, but covering segments which produce most traffic and investment: high speed, metropolitan railways and commuter train systems.

Adjustable simulation models are developed to analyse consumption reduction strategies involving the efficient design of both railway timetables and train operation. Particularly focussed on the operation of high speed lines, and specific models for metropolitan lines and commuter trains. The results of these simulation-based studies will be tested in two actual cases.

It is organised into six blocks: General analysis and validation of consumption models; Vehicle specifications; Electrical power supply, cogeneration, network storage and design; Timetable and train operation design; High speed line application; and Underground and Commuter train applications.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The effect of vehicle mass on energy consumption and emissions of rail transport can be made three observations:

- It has a particularly high incidence in the case of urban and suburban, with elasticities of +0.6 to 0.7 . The weight reduction is important in type services near tram and type, and lowest in the case of high-speed services.

- The importance of mass consumption tends to decrease when the trains equipped with regenerative braking and when implementing measures for harnessing the energy generated during braking.

- The mass of passengers does not, in general, influence the energy consumption of the train due to the high ratio of vehicle mass and mass of travelers. In freight services, and in some cases on trams, metros and suburban, it may be relevant, although not as much as in other modes of transport.

LEADING ENTITY:	Study and research group for railway energy and emissions, Spanish Railways Foundation
PARTICIPANTS:	Fundación de los Ferrocarriles Españoles; el Instituto de Investigación Tecnológica (IIT, U.Pontificia Comillas (ICAI); la Facultad de CC. Matemáticas de la UCM; Adif; Renfe-Operadora; Ferrocarrils de la Generalitat de Catalunya; Metro de Madrid, S.A.; Metro de Barcelona; Dtren; Patentes Talgo; CAF; Dimetronic; Team, S.A. y M. Torres.
CONTACT DETAILS:	Main Researcher: Alberto García Álvarez, albertogarcia@ffe.es; Web: www.elecrail.es Spanish Railways Foundation. C/ Santa Isabel 44, 28012 Madrid

ACRONYM AND TITLE:	EnerTRans Model of calculation and prediction of the energetic consumptions and emission of the system of transport that allows to value the sensibility of the consumptions to the decisions of investment for infrastructure and of politics of transport		
RESEARCH AREA:	Area 1. Policies, planning, economy, energy and sustainability		
TYPE OF FUNDING:	Public subsidy of CEDEX, Spanish Ministry of Public Works; National Plan 2004/2007 belonging to PEIT; Code: PT-2006-006-01IASM		
STARTING/ENDING DATE:	2006-December to 2008-December	BUDGET:	€ 1,124,354

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

Enertrans research project develops a model for the estimation and homogeneous comparison of energy consumption (and associated emissions) in different vehicles and modes of transport.

The calculation procedure is multipurpose, versatile and reliable for measuring the sensitivity of consumption and emissions to diverse variables which could be the object of a technical or regulatory decision aimed at reducing the environmental impact of transport. It is also suitable for identifying the reasons for consumption and emission differences between vehicles or modes of transport. It includes a common consumption calculation procedure adapted to physical phenomena which takes into account not only the vehicle's mass, but also its size; and it introduces the concept of "equivalent stop due to speed reduction", which in many modes of transport is fundamental, given that it explains an important part of the energy consumption.

A considerable number of factors have been selected for homogenization and comparison, some of which can be applied independently of the others (e.g. the relationship between vehicle size and seats, between actual distance travelled and straight-line distance, the no-load running coefficient, etc.

RESULTS AND THEIR IMPACT ON THE SECTOR:

From the studies realized in the Enertrans project, and from the synthesized in the Formless final present, the following conclusions can be extracted:

A model who allows to adopt decisions for the reduction of the energy consumptions in the system of transport, must be a model bottom-up that he gathers the physical inductors who in every way of transport explain the consumption, since if there uses a model of distribution (top - down), the average values are not indicative of a few results that could be obtained on having changed the parameters. And the variation of the parameters is the result of many of the possible measures of management.

Every way of transport and every vehicle presents a few certain peculiarities, but it is possible to think common instigadors of consumption (mechanical and aerodynamic resistances to the advance, performance in the systems of propulsion, losses of energy in the brake) that they can explain of form reasonably similar to the energy consumption in all the manners included in a way so differentiated since it is the transport for pipeline.

LEADING ENTITY:	Spanish Railways Foundation (FFE)
PARTICIPANTS:	IIT (UPComillas), Alsa-Enatcar, INSIA (UPM), U. Castilla-La Mancha; Fundación Agustín de Betancourt, Fundación UAM; Universidad de Oviedo
CONTACT DETAILS:	Main Researcher: Alberto García Álvarez; albertogarcia@ffe.es Spanish Railways Foundation. C/ Santa Isabel 44. 28012 Madrid. http://www.enertrans.es

ACRONYM AND TITLE:	**REACTIVA** **Reinforcing Positive Attitudes towards Public Transport**		
RESEARCH AREA:	Area 1 – Policies, planning, economy, energy and sustainability		
TYPE OF FUNDING:	CEDEX, Spanish Ministry of Public Works. National R&D and Innovation Plan 2004-2007. Call 2007		
STARTING/ENDING DATE:	2007-2010	BUDGET:	556.691 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The Project REACTIVA – "Reinforcing positive attitudes of the public transport user" pursues further exploration and quantification of factors of psychological and social influence on the modal choice of individuals and punishing the use of public transportation modes in favour of private vehicles. This is to develop further the understanding of factors related to subjective images, preconceptions or prejudices that individuals, in many cases unrelated to reality have by existing public transport modes. These are REACTIVA's objectives:
- Define alternative actions to improve the perception of public transport and thereby facilitate the development of sustainable transport.
- Study the needs not covered by public transport in different ways.
- Knowing the status of research and actions relating to attitudes towards transport.
- Evaluate the views of the various actors involved in the transport chain.
- Contribute to the knowledge of factors related to subjective images or prejudices that individuals have on the current modes of public transport.
- Analyze the motivations and barriers of the user in choosing the means of transport and type of service.
- Asking for action to meet the real needs of the application, to change prejudices concerning public transport and are feasible to implement by the makers agents.

The Project has been divided into six phases, each of which responds to objectives in particular:
1. State of the Art; 2. Concrete methodological and scientific coordination; 3. Exploration of expectations and need for individuals; 4. Quantitative study of client profiles, assessment of attributes and motivations for travel and market segmentation analysis and positioning of public transport; 5. Design-oriented solutions to improve the positioning of public transport and its final approach to validation of actions to improve and change the image of public transport; 6. Dissemination.

The objective of the validation exercise was to assess the 48 proposals included in the process in terms of their effectiveness and gather ideas, changes and suggestions that can be incorporated into the development process of the final proposals. The methodology used is group dynamics. There have been eleven (11) group dynamics. The first ten (10) were directed to transport users segmented by the following variables: gender, age, family formation, use of car, use public transport and area of residence (urban / rural). Last group dynamics was focused on expert in transport planning and operations.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Qualitative research has yielded a lot of important data because of the quantity and the quality of services. It has allowed the characterization of different modes of transport from the point of view of the perception of demand, and to point out some of the main vectors that would govern the modal choice, bearing in mind the travel situations or travel settings as a basic independent variable. However, it is noted that the selection of segmentation variables of passenger market were not revealed completely effective.
The review of scientific research confirms the importance of attitudes in modal choice. Additionally, it underlines the need to bear attitudes in mind when designing transport policies and measures that act on the elements that actually influence modal choice and when implementing those policies and persuading the public of their benefits.
Furthermore, research shows consistency with important issues outlined in the state of the art, such as the importance of inserting the problem of modal choice within the social organization of transport and, in particular, within the transport system or the importance of habits and emotional elements in the modal choice.
The Reactiva Project's aim is to not stay in these tentative results, but using them for quantitative research and the subsequent construction of strategies of measures and oriented recommendations to the modal transfer towards public transport.

LEADING ENTITY:	UNED
PARTICIPANTS:	ALSA, ETT, Spanish Railways Foundation, INTRAS - Valencia University
CONTACT DETAILS:	Dissemination: Spanish Railways Foundation. C/ Santa Isabel 44, 28012 Madrid T: +34 91 151 10 97. reactiva@ffe.es

ACRONYM AND TITLE:	OPTIRED "*Development of the regulating Framework of the transportation of travelers by railroad in Spain*"		
RESEARCH AREA:	Area 1-Policies, planning, economy, energy and sustainability		
TYPE OF FUNDING:	Public subsidy of Department of Public Works (National Plan 2008-2011)		
STARTING/ENDING DATE:	2008-2011	BUDGET:	€ 1,311,591.80

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The main objective of the Project is the development of a regulatory framework for the opening to competition of the intercity railway passenger services in Spain and the multicriteria evaluation of the side effects on the Intermodal transportation system.

The starting point is an analysis of the state of the art of the aforementioned issue from several approaches. We will firstly review the state of the art of the legal aspects by studying the railway regulation both at the domestic and European levels. The analysis will also include the interrelations with other transportation systems. Secondly we will present a survey of the state of the art of the railways economic regulation as well as a comparative analysis of the most relevant experiences of the opening to competition deregulation within Europe. Finally we will examine the state of the art of the theoretical aspects of the modelization techniques for the analysis of railway competition. The overall review of the state of the art will enable us to identify the most relevant theories and variables. Moreover, it will also help us establish the first hypotheses on the regulatory frameworks. Such hypotheses contain the relevant objectives and tools for our study.

The next step is the scientific research. The first objective is to specify a representative model of the functioning of the Spanish intercity railway passenger services. This model will be based on game theory and industrial economics. The variables for the model include the objectives and tools of the possible regulatory frameworks. The modelization of the competition regime will enable us to obtain a suitable tool to analyze the behavior of potential railway operators.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The separation of exploitation and infrastructure does not seem to jeopardize the development of the high speed network. Moreover, this organizational system encourages the use of new technologies and propels the development of the railway Spanish industry that ranks among the world leaders.

The separation of exploitation and infrastructure does not seem to launch competition in Spain railway freight market. New freight operators have only a 5% market share. Therefore it is necessary to reform the regulatory model. For example, it is necessary to increase the independence of the Rail regulator.

In regard to domestic railway passenger services, "Competition for the market" allows for the introduction of market discipline in the provision of railway services thereby avoiding some of the problems inherent to the implementation of market competition. The main conclusions are that "Competition for the market" could be the most appropriate model for intercity services railway passenger

LEADING ENTITY:	Spanish Railways Foundation (FFE)
PARTICIPANTS:	ALSA GRUPO S.L.U, Proyectos Unificados S.A., Equipo de Técnicos en Transporte y Territorio S.A. (ETT), BB&J Consultant, S.A., Universidad de Castilla la Mancha, Universidad Jaume I
CONTACT DETAILS:	Main Researcher: Alberto García Álvarez; albertogarcia@ffe.es; Spanish Railways Foundation. C/ Santa Isabel 44. 28012 Madrid Web: http://www.proyecto-optired.es

ACRONYM AND TITLE:	OFE - "*Observatory of the Spanish Railways*" 2007, 2008,2009,2010		
RESEARCH AREA:	Area 1-Policies, planning, economy, energy and sustainability		
TYPE OF FUNDING:	Public Subsidy of the Spanish Ministry of Public Works (Projects of R&D and innovation in the area of transport; *Orden FOM/3929/2005*) 2007-09		
STARTING/ENDING DATE:	Annual (from 2007 up to today)	BUDGET:	87.277 € (2007-2009)

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The Observatory of the Spanish Railways (OFE) is formed as a forum of reference to the knowledge of the sector, which it provides, by means of indicators, the precise and impartial information for the evaluation of the processes of improvement in the Railway Sector. It is integrated for Administrations, researchers, experts, managerial sector and social groups, directly related to the Railways.

The above mentioned Forum generates and spreads periodic objective, significant information and according to dynamics that it characterizes to the Railway Sector, being formed as tool for the possible application to capture of decisions I concern of future political strategies.

Observatory of the Spanish Railways is a project piloted from Foundation of the Spanish Railways, which develops in the frame of the "Helps of research and development in Transport 2005 "of the Sub-secretary of the Spanish Ministry of Public Works.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The main results of the Observatory of the Spanish Railways are:

Summary of the information relative to the transport by train, It disperses in numerous public and not public sources, treatment of the results consolidated to obtain indexes or ratios that allow the best analysis of the reality and of his evolution, database that gathers the key data and the indexes, web page that allows the public access to the information, annual reports that offer the synthesis of the most relevant aspects of the exercise and the technical days of diffusion of the OFE.

Up to the moment, reports of the Observatory have been issued in the following years: 2007, 2008, 2009 and 2010.

LEADING ENTITY:	Spanish Railways Foundation (FFE)
PARTICIPANTS:	Researcher group: Spanish Railways Foundation (FFE) Coordinator of the project: Railway General Direction, Spanish Ministry of Public Works Information / equipment of support: RENFE, ADIF, FEVE, Euskotren, FGC, FGV, SFM, FJA, ETS, Continental Rail, Acciona Rail Services, Minero Siderúrgica de Ponferrada, PTFE
CONTACT DETAILS:	Dissemination: Spanish Railways Foundation. C/ Santa Isabel 44, 28012 Madrid T: +34 91 151 10 99 observatoriodelferrocarril@ffe.es http://www.observatoriodelferrocarril.es

ACRONYM AND TITLE:	RAILBOOK – Integrated handbook for the design and appraisal of railway stations		
RESEARCH AREA:	Area 1 – Policies, planning, economy, energy and sustainability		
TYPE OF FUNDING:	Public		
STARTING/ENDING DATE:	2010/2012	BUDGET:	1.5 Mio Euro

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The aim of the project is to elaborate a unified handbook for the design and appraisal of railway stations, with the aim of elaborating a document of reference for all the railway operators and administrations. This help to tackle the design of railway stations with common criteria and objectives (based on an analytical and quantitative basis), so that coherence is guaranteed in the quality perceived by all users. It will as well ease the standardization of a program of verifications that every design of a future station should satisfy.

The main aim of the project is to define techniques and tools to analyze capacity, level of service and accessibility of railway stations and interchanges. In order to achieve this aim, the following specific objectives have been defined:

* To carry out a taxonomy of railway stations and interchanges based on the infrastructural supply and the demand of users and operations, which should build on an analysis of the requirements of administrators and planners and their influence on the design of the station. This objective should allow identifying the main scenarios that should be verified in the design.

* To carry out a benchmarking of the station of the art at international level and an analysis of good practices done by other railway clusters.

* To develop techniques and tools for quantitative analysis of capacity and level of service, by means of the planning of static models, for the analysis of elements and subsystems, and dynamic models, for the analysis of the interference of processes between those (emergent dynamics).

* To identify a group of quantitative and qualitative indicators to be integrated in the design and appraisal of stations.

* To define design criteria and methodologies for the appraisal for each type of station.

* To elaborate a handbook for the design and appraisal of railway stations that includes the design methodologies, techniques, criteria and recommendations.

* To develop a computer application that gives assistance to the professional staff in the definition of the functional design and appraisal of railway stations and interchanges.

RESULTS AND THEIR IMPACT ON THE SECTOR:

* Handbook for the design and appraisal of railway stations that includes the design methodologies, techniques, criteria and recommendations.

* Computer application that gives assistance to the professional staff in the definition of the functional design and appraisal of railway stations and interchanges.

LEADING ENTITY:	DLM Group
PARTICIPANTS:	DLM Group CENIT (Center for Innovation in Transport) – UPC SENER TYPSA Spora ASCAMM
CONTACT DETAILS:	marta.sanchez-borras@upc.edu

ACRONYM AND TITLE:	"Technologies for optimized energy efficiency in rail transport": Bidirectional power converter for the return of power from the catenary DC to the AC power grid substation". Spotrac (Acronym)		
RESEARCH AREA:	Policies, planning, economy, energy and sustainability		
TYPE OF FUNDING:	Regional, Andalusian Government		
STARTING/ENDING DATE:	July 2009/ December 2010	BUDGET:	428.765,94

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

This project aims to provide a more sustainable transportation system for citizens, contributing to the overall savings and efficient use of energy through the use of specific technology and systems within the transport sector by defining the basic specifications, the design, manufacture, test plan and certification of equipment to allow recovery and return to the AC mains power from the regenerative braking of trains.

Thanks to regenerative brake, kinetic energy can be transformed to electric energy from torque generated by motor. However, when there isn't load spending power, the surplus regenerative energy caused by braking was dissipated in resistor banks. Several studies have revealed in Spain it's possible to regenerate above 450 GWh per year if regenerative inverters in railway substations could be installed.

The goal of Spotrac project is to make the rail a more sustainable transport, developing a new inverter that would allow an electric current to flow in both directions. This regenerative inverter is installed in inverse parallel with the diode rectifier and transfers the surplus power caused by regenerative braking of electric trains into the grid. The new GPtech converter also improves power quality in DC traction substations.

RESULTS AND THEIR IMPACT ON THE SECTOR:

This project proposes the development of DC / AC converters for traction bidirectional applications, allowing a power flow control so as to perform an efficient and controlled power transfer from AC to DC catenary network and vice versa also encouraging compliance with regulations injection power network to be a controlled process.
Main inverter specifications are:

SPECIFICATIONS	
Catenary line voltage	3500 Vcc / 1500 Vcc
Output voltage	1300 Vac
Input current	2000 A
Power	2000 kW
Maximum output power	1000 Arms
THD	<3%
Output frequency	50 Hz
Cooling system	Air
Efficiency	>95%

The innovation of this project is based in the application of high voltage electronic technology and new control strategies for energy recovery. This result will be tracked by the project IP management procedures and individual exploitation routes followed but the prime activity will be focused on exploitation of the energy management.

The developed technology can be adapted to other applications that require bidirectional power systems.
The Railway Infrastructure Management Company of Spain (ADIF) is really interested in the project, joining us and offering facilities for test.
Energy efficiency in transport ranks as one of the national and regional strategy. Companies are working together in order to develop core technologies that may require a more efficient control of the braking energy from their systems. It is really important because the braking energy is a very high percentage of power they consume.

LEADING ENTITY:	Green Power Technologies
PARTICIPANTS:	Green Power Technologies, AICIA
CONTACT DETAILS:	Mª Emilia Hervás Leña Address: Avda. Camas, 28. PIBO. 41110 Bollullos de la Mitación (Sevilla) Tel.: +34 954181521; Mail: mariaemilia.hervas@greenpower.com

ACRONYM AND TITLE:	CRONOS: Integrated Railway Planning Tool		
RESEARCH AREA:	Railways		
TYPE OF FUNDING:	CDTI-INECO Funding		
STARTING/ENDING DATE:	2008-actually	BUDGET:	550.000€

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

CRONOS is intended to be a complete railroad planning suite, allowing integrated running-time calculations, conflict detection, signal optimization, graphic timetables, validation of alignments, etc.

The development methodology is based on the following process:

- Regular INECO Expertise group meetings (selection of experts in the field) -> functionalities document
- Development group implements required functionalities (IT developers working together with civil engineers)
- Test and deploy
- Users' feedback and repeat the cycle (development spiral iteration) from the beginning

CRONOS is fully developed using C# technology.

RESULTS AND THEIR IMPACT ON THE SECTOR:

CRONOS is intended to be a complete solution for the analysis of the development of railroad lines. It is based on the wide existing knowledge in the company and will allow further development on complex algorithms for conflict detection (based on genetic algorithms) and advanced running-time calculation options.

LEADING ENTITY:	INECO
PARTICIPANTS:	
CONTACT DETAILS:	Ignacio Martínez (ignacio.martinez@ineco.es)

ACRONYM AND TITLE:	TARIFO - Determination of pricing methodologies for the use of Railway Infrastructure according to the transport policy objectives		
RESEARCH AREA:	Area 1 – Policies, planning, economy, energy and sustainability		
TYPE OF FUNDING:	Public		
STARTING/ENDING DATE:	2008/2010	BUDGET:	228,210 Euro

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The Strategic Plan for Transport Infrastructures aims at integrating energetic, environmental and economic policies in transport policies. Within this framework, the main objective of this project is to generate the information and analysis tools needed to formulate the most appropriate methodology for the decision making process. This project will also propose some methodologies to determine the charges for the use of rail infrastructure able to include the objectives of the aforementioned policies and to establish charging systems. The project will therefore deal with the relation between costs and charges, the evaluation of the effects of charging policies, the calculation and internalization of the external costs, and the possibilities of applying theoretical methodologies and experience in the Spanish framework.

RESULTS AND THEIR IMPACT ON THE SECTOR:

- Proposal of a rail infrastructure pricing structure for the Spanish railway network
- Definition of a road map to implement the proposal of rail infrastructure pricing structure for the Spanish railway network

LEADING ENTITY:	CENIT – Center for Innovation in Transport
PARTICIPANTS:	CENIT Universidad de Granada
CONTACT DETAILS:	marta.sanchez-borras@upc.edu

ACRONYM AND TITLE:	High Speed, energy consumption and emissions		
RESEARCH AREA:	Area 1 – Policies, planning, economy, energy and sustainability		
TYPE OF FUNDING:	Fees in return for provision of the services (contract for provision of services)		
STARTING/ENDING DATE:	2010-January to 2010 May	BUDGET:	10.000 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The purpose of the study is to identify and quantify energy and environmental characteristics of high speed trains.

The study only covers three variables: final energy consumption, consumption of primary energy or fossil fuels and CO2 emissions.

Energy differences and advantages of conventional trains in relation to other modes of transport will be observed first, therefore identifying factors inducing train consumption and differences according to train and lines.

The characteristics of the high speed system with respect to conventional trains will be analysed next, checking to see whether these accumulate or become diluted with increasing speed, and whether their source is the infrastructure, the vehicle or the operation.

Thirdly, it is shown the effect of the shift of traffic from other modes of transport to high speed trains for varying speeds, checking in each case the effect of consumption on the whole corridor.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Thoughts on the widespread opinions regarding the energy consumption and emissions of high speed trains, have been published in various previous articles written by members of the “Study and Research Group for Railway Energy and Emissions of the Spanish Railway Foundation”.

Besides expanding on the aspects dealt with in previous publications, this report also adds a number of considerations and data relating to the effect of speed on the amount of energy needed (and on the emissions produced) to manufacture and recycle the train (including the materials incorporated into the train).

The design and operation measures outlined above are applicable to all kinds of trains. However, some of them are especially applicable to high speed systems, three of which can be highlighted due to their particularly powerful effects at high speeds:

Increase of feasible downgrade speeds, optimization of the train’s exterior dimensions (length, width and height) to reduce coefficient C per unit of capacity and reduction of air intake according to actual train occupancy.

LEADING ENTITY:	Study and Research Group for Railway Energy and Emissions, Spanish Railways Foundation (FFE)
PARTICIPANTS:	High Speed Committee of International Union of Railways (UIC) and Study and Research Group for Railway Energy and Emissions, Spanish Railways Foundation (FFE)
CONTACT DETAILS:	Main Researcher: Alberto García Álvarez; albertogarcia@ffe.es Spanish Railways Foundation. C/ Santa Isabel 44, 28012 Madrid

ACRONYM AND TITLE:	Methodology of Evaluation of the Energy Efficiency in the Rolling Stock		
RESEARCH AREA:	Area 1 – Policies, planning, economy, energy and sustainability		
TYPE OF FUNDING:	Public subsidy of the Institute for the Diversification and Saving of the Energy (in Spanish, (IDAE), Department of industry, Tourism and Trade.		
STARTING/ENDING DATE:	2008-September to 2009-May	BUDGET:	€ 32.000 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The object of the study is to develop a system and a methodology that allows the operators of railroad transport or the public authorities that contests of public services bid, to select the trains more efficient in relation with energy, in accordance with a few indexes targets, or at least, to fix a few consumptions maximum and minimum.

As soon as this work was realized, one will proceed to the diffusion of the obtained results and a pursuit will be realized on the evaluation and application of the methodology developed in the section of mobile railroad material between the public and private operators of market.

Equally, it is a part of the performances to develop, the achievement of a day of presentation of the reached developments

RESULTS AND THEIR IMPACT ON THE SECTOR:

The results or products that tried to be obtained by the work derived from the Agreement FFE-IDAE were basically two:

1. Quantification previous to the consumption of a train, expressed in quantity of energy for unit of offer for a combination of service and infrastructure. It must be useful so that an operator could specify a maximum consumption for a type of service.

2. Establishment of a value of exchange between the consumption of energy and the economic associate cost, in order to which the operator could value different progress for the material that might suppose an increase of the initial investment, but which they reduce the consumption of energy in the phase of development. Also this value can be useful for a possible penalization in case of nonperformance of the parameters targets that were applied for the estimation of the consumption.

Also procedural topics talk each other in the project: how is the process of calculation regulated; who will calculate the consumption of every train; or how is the regulation updated.

LEADING ENTITY:	Study and Research Group for Railway Energy and Emissions, Spanish Railways Foundation (FFE)
PARTICIPANTS:	Institute for the Diversification and Saving of the Energy (in Spanish, (IDAE), Spanish Railways Foundation (FFE)
CONTACT DETAILS:	Main Researcher: Alberto García Álvarez; albertogarcia@ffe.es Spanish Railways Foundation. C/ Santa Isabel 44, 28012 Madrid

ACRONYM AND TITLE:	EURNEX, European Railway Network of Excellence.		
RESEARCH AREA:	POLICIES, PLANNING, ECONOMY, ENERGY AND SUSTAINABILITY		
TYPE OF FUNDING:	Public. European Framework Program 6th.		
STARTING/ENDING DATE:	01/2004 - 12/2007	BUDGET:	6 M€ aprox

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

Background & policy context

The rail system in Europe is faced with a challenging situation. The Railway Business Scenario 2020 drawn up by the European Rail Research Advisory Council (ERRAC) has set a goal of almost tripling passenger traffic volume and more than a threefold increase in rail freight transport throughout Europe in twenty years. To achieve this ambitious goal, the competitiveness of the rail systems over other transport modes must be considerably improved, with the support of innovative products and services, because the European railway system is very fragmented, being a patchwork of disparate systems and networks, with their own technical and operating standards evolved independently over the last 180 years. This wide range of different rail systems in Europe presents a huge challenge for achieving a pan-European rail interoperability. The new European Rail Research Network of Excellence EURNEX aims to provide essential contributions to meet this challenge. The "new culture of co-operation" between all stakeholders of the European rail system established in projects like - for high speed and conventional rail - European Driver's Desk, SAFETRAIN, MODTRAIN, etc., and - for urban rail - UGTMS, SAFETRAM, LibeRTiN etc., has prepared the ground to develop a long-lasting EURNEX network.

Objectives

The strategic objectives of EURNEX are:

•to integrate the fragmented European rail research landscape by combining research activities in a network of mutually shared facilities, tools and platforms;

•to promote the railway contribution to a sustainable transport policy;

•to improve the competitiveness and economic stability of the railway sector and industry, e.g. with flexibility, regarding the new challenges for rail research in a shared process;

•to achieve a self-standing and long-lasting business package for the network beyond the granting period, thus creating a durable, integrated network of excellence in rail research, technology innovation and knowledge management from the research capacities of universities and institutions, implementing knowledge from rail operators and the rail industry including SMEs.

RESULTS AND THEIR IMPACT ON THE SECTOR:

After the funding of the EU, EURNEX, the EUropean rail Research Network of EXcellence, has successfully turned into a self standing legal entity by November 2007. It comprises 47 scientific institutes in the area of transport and mobility all over Europe. The Advisory Board to direct research consists of high level decision makers from rail sector. EURNEX is the first research cluster of excellence to underpin the European Research Area in the rail sector. Driven by operators and industries and supported by the European Commission EURNEX provides multidisciplinary R&D organised in scientific poles of excellence, pursuing

•Integration and knowledge sharing throughout EU27

•Providing local based services in the EU member states representing the summarized knowledge of the European rail research community

•Fostering innovative, practical solutions to increase competitiveness of rail transport stakeholders and system.

LEADING ENTITY:	FAV Berlin/TSB
PARTICIPANTS:	More the 60 entities took part on the Project, amongst others: University of Leeds, DUT, DTR, INRETS, DLR, VTI, ... In Spain: Universidad Politécnica de Madrid; Tecnología e Investigación Ferroviaria S.A.; Centro Estudios Investigaciones Técnicas de Gipuzkoa; Politechnical University of Catalonia; Universidad del País Vasco
CONTACT DETAILS:	CITEF, CENTRO DE INVESTIGACIÓN EN TECNOLOGÍAS FERROVIARIAS RAILWAY TECHNOLOGY RESEARCH CENTRE ESCUELA TÉCNICA SUPERIOR DE INGENIEROS INDUSTRIALES UNIVERSIDAD POLITÉCNICA DE MADRID C/. José Gutiérrez Abascal, 2 | 28006 Madrid. TEL + 34 91 336 3212 | FAX + 34 91 561 8618. E-MAIL: jesus.felez@upm.es; citef.jmmera@etsii.upm.es; juandedios.sanz@upm.es ;joseantonio.lozano@upm.es WEB: www.citef.industriales.upm.es

Area 2

Interoperability and ERTMS

I RAIL TECHNOLOGICAL FORUM FOR INTERNATIONALIZATION

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

FUNDACIÓN DE LOS FERROCARRILES ESPAÑOLES

PTFE
Plataforma Tecnológica Ferroviaria Española

FONDO EUROPEO DE DESARROLLO REGIONAL

Unidad de Innovación Internacional · Ferrocarriles

ACRONYM AND TITLE:	Advanced Systems for Rail Interoperability based on IT technologies by the development of the ERTMS component, EUROLOOP.		
RESEARCH AREA:	Area 2		
TYPE OF FUNDING:	Public-Private Partnership, held by the Spanish Ministry of Science and Innovation		
STARTING/ENDING DATE:	01.01.09/31.08.11	BUDGET:	2.141.292,97 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

Current installations of ERTMS/ETCS level 1 infrastructures where in-fill data is provided only by Eurobalises can present a low performance in some scenarios, especially in high-density traffic lines, as train information is only refreshed at discrete locations.

The Euroloop Subsystem provides semicontinuous in-fill information in advance as regard to the next main signal in the train running direction, as soon as it becomes available. To achieve this functionality, a leaky cable is installed along the track and in the vicinity of the signals that want to be advanced to the on-board equipment. The leaky cable is connected to the track interlocking system through a Loop Modem and a Lineside Electronic Unit, providing continuous signaling data transmission from track to train in the area where the cable is present.

Several advantages can be obtained from the implementation of this Subsystem. On the one hand, it improves the availability of ETCS Level 1 train systems, as it allows train operation without release speed. On the other hand, as the train operation become more agile and expedite, with less train stops and stationary moments, there is a saving in the energy consumption of the whole system.

The scope of the present work involves a research and development effort in several areas. From the trackside point of view: The adaptation of current Lineside Electronic Units for Euroloop operation, the study and characterization of the Euroloop leaky cable behavior in real field environments and the Loop Modem that is able to feed the leaky cable, guaranteeing a robust modulation and amplification scheme of the track signals that should be read by the on-board equipment. From the on-board point of view: The research is centered in the radiant system that physically captures the in-fill signal, and in the electronic equipments that decode and process the signal data for further train control decisions.

To guarantee the interoperability of the Euroloop Subsystem in the context of ERTMS/ETCS infrastructures, several norms are guiding all the research, being the 'SUBSET 044 - FFFIS for Euroloop v2.3.0' the most relevant. This norm is part of the overall set of normative background that constitutes the basis for the European Union Directive 96/48/EC on the interoperability of the Trans-European High-Speed Railway system, and for the Control Command and Signalling Technical Specification for Interoperability (CCS TSI). Consequently, the electronic equipments developed for this Subsystem are being tested and evaluated by the Spanish Railway Interoperability Laboratory (CEDEX) with the collaboration of INECO.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The expected results from this project pretend to show the feasibility of a Euroloop Subsystem in a real environment. The first Euroloop Subsystem installed in a Spanish rail track will be tested jointly with the Spanish Infrastructure manager, ADIF, and the Spanish Main Train Operator, RENFE, in order to prove the enhancement of train operations, thanks to the reinforcement of the present in-fill data coverage that the Euroloop Subsystem application provides.

The massive application of this system in high-density lines (for example, installing it in stations of commuter train lines) would greatly improve the service quality that is offered to users, as a faster and more available train service could be achieved.

LEADING ENTITY:	InfoGlobal
PARTICIPANTS:	ADIF, RENFE, INECO, Dimetronic, Fundación InfoGlobal, InfoGlobal
CONTACT DETAILS:	Daniel Navascues Benito [DNavascues@infoglobal.es] Beatriz Sierra [Beatriz.sierra@ineco.es]

ACRONYM AND TITLE:	GRAIL: GNSS introduction in the RAIL sector GRAIL-2: GNSS-based enhanced odometry for RAIL		
RESEARCH AREA:	Area 5 – Exploitation, operation and rail system security and safety Area 2 – Interoperability and ERTMS		
TYPE OF FUNDING:	European Union Frame Programs 6th and 7th		
STARTING/ENDING DATE:	GRAIL: 2005/2008 GRAIL-2: Feb 2011 / Dec 2012	BUDGET:	GRAIL: 6.783.000 € GRAIL-2: 2.063.642 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The GRAIL project proposed a strategy, consistent with the deployment process of ERTMS/ETCS in Europe, for a smooth integration of GNSS (Global Navigation Satellite Systems as Galileo EGNOS and GPS) into control and command applications and particularly in ERTMS/ETCS.
The project was based on three main objectives:
1. To specify, develop and test a GNSS prototype system for enhanced odometry, ready to be integrated in an ETCS on-board, meeting the requirements for this application.
2. To pave the way for the future introduction of more ambitious approaches at different levels of ERTMS/ETCS architecture. This action was tackled by defining system and test specifications (including tools and test environments), drafting the Safety Analysis of the applications and setting up the main drivers for the migration strategy. Finally a real functional prototype was developed and tested in lab and track environments. The enhanced GNSS-based ETCS functionalities selected in GRAIL were
- Cold Movement Detector.
- Enhanced Train Awakening
- Absolute positioning
- Train Integrity (at specification level)

3. To complete the perspective of the safety-related applications with the study and demonstration of non-safety applications and the study of economical and legal issues, aiming at achieving a whole understanding of the correct path to introduce GNSS in the rail domain and proposing solutions to overcome the problems encountered.

The GRAIL-2 project goes further in the implementation and testing of one of the application defined in GRAIL: the Enhanced Odometry based on satellite positioning to be used in a context of High Speed Lines and compatible with ETCS/ERTMS requirements. The project is mainly focused in the following features:
- Validation of the system in a real environment, bringing the prototype closer to a product
- Going further in the safety demonstration compatible with a future certification process, following rail practices

RESULTS AND THEIR IMPACT ON THE SECTOR:

The first main achievement of the GRAIL project was to produce set of specifications for the use of GNSS in Enhanced Odometry, Absolute Positioning, Train Awakening & Cold Movement Detector, and Train Integrity. These specifications were agreed by a working group including the main signaling companies in Europe. These documents establish a milestone from where future projects can build into more detailed analyses and demonstrations.
Second achievement was the development of a functional prototype integrating GRAIL functionalities in a real commercial ETCS onboard equipment. The prototype was tested both in lab and site environments. A laboratory test provided by ADIF was equipped with GRAIL prototype and used for the track demonstration. Test track was the high speed line Madrid-Lleida, fully equipped with an ERTMS level 2 trackside system. For the first time in Europe a train has been running in Full supervision mode in an ERTMS/ETCS commercial line using GNSS as the base for its location.

As a main result from GRAIL-2 it is expected the development a GNSS odometry prototype close to a final and certificate product. This result will provide a technological solution to the real problems encountered in traditional odometry systems, especially in High speed applications

LEADING ENTITY:	INECO
PARTICIPANTS:	GRAIL: INECO, Ansaldo STS, Alstom, Siemens, Dimetronic, Bombardier, Thales, Thales Alenioa Space, Indra, ESSP, Deimos, NSL, ESYS, IIASL, RSSB, CEDEX, ADIF, DLR GRAIL-2: INECO, Ansaldo STS, Thales Alenioa Space, ADIF, NSL, Alstom, AZD, iQST, REFER, Aena Internacional
CONTACT DETAILS:	María José García Prieto mjgarciap@ineco.es, Celso Prados celso.prados@ineco.es

ACRONYM AND TITLE:	ACOUTRAIN - Virtual certification of acoustic performance for freight and passenger trains		
RESEARCH AREA:	Rail system interoperability (regulatory and non-legislative interoperability based on technological innovations)		
TYPE OF FUNDING:	European Commission. 7th Framework Programme. Cooperation, Theme 7: Transport. FP7- SST.2011.2.5-1 Collaborative Projects - small or medium-scale focused research projects		
STARTING/ENDING DATE:	2011 - 2014	BUDGET:	3,208,335 Euros

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

ACOUTRAIN will simplify and improve the acoustic conformity assessment process of new rolling stock, in particular relating to the TSI Noise [6]. Today the need of conformity assessment for a new vehicle according to the TSI Noise represents a significant element of both cost and time to market due to the need to carry out expensive and time consuming tests. The goal of the proposed project is to speed up the product authorisation by introducing some elements of virtual testing while retaining the same degree of reliability and accuracy. A successful simplification of the TSI conformity assessment process would result in a strengthening of the competitiveness of the European railway sector. The risk of not developing such a simplification would be that the expense of excessive certification of new products could hamper the introduction of new innovations.

The overall goal of the ACOUTRAIN project is to promote interoperable rail traffic in Europe by reducing costs and time of certification for acoustic performance. This will be achieved by the following high level objectives:
1) Dramatically reduce time and cost of the TSI noise conformity assessment procedure ;
2) Harmonise the process for noise conformity assessment across Europe by providing standard procedures;
3) Clarify the application of the simplified evaluation method introduced by the partial revision of the TSI Noise by providing specific examples;
4) Investigate a widening of the scope for the certification procedure and explore synergies with the END noise mapping.

RESULTS AND THEIR IMPACT ON THE SECTOR:

To contribute to the global European policy for railway noise control and reduction, the certification process could be used as an input for the implementation of the European Noise Directive (END) [7]. Today, the noise maps required by the END present a high level of uncertainty due to a poor degree of accuracy for the rolling stock definition. The output from the new certification process can provide a better definition of the rolling stock noise sources that will greatly improve the noise mapping accuracy.

Therefore, ACOUTRAIN will provide recommendations:

- on high level functional requirements for virtual certification for the next TSI Noise revision;

- on detailed procedures for simplified evaluation and virtual certification methods to be included in the Application Guide of the TSI Noise

LEADING ENTITY:	Union des Industries Ferroviaires Européennes-UNIFE
PARTICIPANTS:	Société Nationale des Chemins de Fer Français SNCF France, Bombardier Transportation Sweden AB BT Sweden, University of Southampton ISVR United, Kingdom, Alstom Transport S.A. ATSA France, Deutsche Bahn AG DB Germany, Fundacion CIDAUT CIDAUT Spain, Ecole Centrale de Lyon ECL France, Dynamics, Structures and Systems International D2S Belgium Kungliga Tekniska Högskolan KTH Sweden Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek TNO The Netherlands VIBRATEC VTC France ABB Sécheron Sa ABB Switzerland Patentes TALGO, S.L. TALGO Spain ALMA Consulting Group SAS ALMA France
CONTACT DETAILS:	Fundación CIDAUT, CORDERO Roberto, +34 983548035, robcor@cidaut.es

ACRONYM AND TITLE:	SMART WAY, Galileo Based navigation in transport public system with passenger involvement.		
RESEARCH AREA:	INTEROPERABILITY AND ERTMS		
TYPE OF FUNDING:	Public. European Framework Program 7th.		
STARTING/ENDING DATE:	Feb 2010 / Jan 2012	BUDGET:	2.380.873 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

Navigation systems in public transport (PT) could establish an innovation in everyday life, as it is already known from private car navigation. Beside already known and used mobile information services based on timetable or schedule information, the navigation allows passenger to use PT in a unknown city or in a rarely used PT network.
Imagine you could just jump into the first tram or bus you see and you would be guided to your destination by your own mobile phone through the public transport network! During spontaneous deviations from the planned route you won't be lost in the network. In case of delays or disruptions you do not lose the orientation. However, even today passenger can find detailed information about PT in a city 2.000 km away on the web, often better than what could be found directly on site! SMART-WAY is a mobile passenger navigation system that will fulfill this vision with a series of innovative and new approaches. SMART-WAY is performed by partners from all over Europe including scientific institutes, universities, a SME, which is experienced in commercial mobile applications, and two transport operators as practice partners. The resulting navigation system will be practically tested within real transport networks.
Furthermore seamless integration into the production work flow and the commercial transfer will be done for the whole research process. The adaption of the initial business plan on each step of development to the needs of transport companies and of their customers will SMART-WAY allow to be implemented on different European transport networks.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Direct applications and market prospects:The outcome of the project will be an easy to use mobile navigation system for public transport networks comparable to those which have been in use in cars since years. Most people already know the advantage of navigation systems instead of street maps. The same situation will be with the public transport navigation system instead of printed or electronic time tables. In both cases a traveller wouldn't get lost in the transport network anymore when he/she leaves his/her planned trip for whatever reason.
Potentially patentable ideas. The functionalities of navigation in public network, that are:
- matching and correlation of passenger location based on GNSS technology with the vehicle position based on the localisation of the transport company,
- the knowledge of the transport network and
- the knowledge of the (real time data based timetable) to detect if passengers are within a certain vehicle, leaving it, entering it or staying outside on a station

have got the potential value of patents too. The concrete knowledge about that will be created within SMART-WAY, so that an according patent may be a potential outcome of the project
Benefits and competitive advantages
Concerning the benefits a differentiation between passengers and PT operators has to be made. Of course, for passengers the proposed navigation system will bring more comfort using PT means of transport. But this must be seen as strategy of the PT operators to heighten the contentment of PT passengers. The comfort is one issue that influences the demand in public transport. The more passengers PT use the more efficient the operation of an urban PT system is. So, to increase the passengers comfort means to enhance the efficiency for public transport operators.

LEADING ENTITY:	FRAUNHOFER
PARTICIPANTS:	CERTH –HIT, VTI, POLITO, DVB, GTT, UPM, TAF
CONTACT DETAILS:	CITEF, CENTRO DE INVESTIGACIÓN EN TECNOLOGÍAS FERROVIARIAS RAILWAY TECHNOLOGY RESEARCH CENTRE ESCUELA TÉCNICA SUPERIOR DE INGENIEROS INDUSTRIALES UNIVERSIDAD POLITÉCNICA DE MADRID.C/. José Gutiérrez Abascal, 2 | 28006 Madrid. TEL + 34 91 336 3212 | FAX + 34 91 561 8618. E-MAIL: jesus.felez@upm.es; citef.jmmera@etsii.upm.es; juandedios.sanz@upm.es ;joseantonio.lozano@upm.es. WEB: www.citef.industriales.upm.es

ACRONYM AND TITLE:	INESS, Integrated European Signalling System.		
RESEARCH AREA:	INTEROPERABILITY AND ERTMS		
TYPE OF FUNDING:	Public. European Framework Program 7th.		
STARTING/ENDING DATE:	Oct-2008 / Mar-2012	BUDGET:	16.598.366 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

Due to the seamless guidance by rails, the railway system requires a dedicated signalling sub-system, whereby a major part of the functionality must be ensured and controlled on the infrastructure side. From a European perspective, the traditional signalling is one of the most conservative parts of the railway system strongly bound to the national traditions by all involved parties. Since 1990 the EU is promoting the reformation of parts of the signalling subsystem under the ERTMS programme. However this covers not the whole signalling system. The implementation of ETCS could be hampered, in areas of the conventional European rail network, where interlocking will need to be replaced, if this cannot be carried out in an economically and technically efficient manner. Also the implementation of systems utilizing centralized and automated route-setting of trains will be economically constrained. Railways are aiming for significantly reduce life-cycle costs of future interlocking and associated outdoor equipment. Standardisation, increased competitive tendering and significant reduction of implementation time are considered to be the key requirements for the future. Without an approach, similar to that underway for ERTMS-ETCS, many suppliers will run into resource constrains, making it difficult for them to keep up with the many new current developments. Therefore, railways and the signalling supply industry agree that the scope of INESS should be the interlocking up to the point of interfaces with the surrounding other signalling and train control systems like centralized traffic control, neighbouring interlocking, ETCS Radio-block centres and possibly object controllers for out-door devices. INESS will adopt the CENELEC norm with the underlying system engineering principles. It will build on the available results of both the Euro-Interlocking project and the ERTMS developments and it will especially not modify the current ETCS functionalities and solutions.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Since this is an ongoing project, the expected impact and results will be listed below:
INESS will contribute to the harmonisation of European rail signalling systems, and the interlockings included within them, up to the point of interfaces with the surrounding other signalling and train control systems, according to the current European policies.The consequent standardisation of the definitions for the different sub-systems within a signalling system, and the explicit statements of the operating requirements for signalling systems by INESS will contribute to the opening-up of national markets and the removal of the remaining national barriers arising from protectionism or highly individualised practices. The main strategic impact of INESS will be to facilitate cost-effective solutions to securing a more cost-effective migration from the present heritage non-interoperable signalling systems to ERTMS due to a more harmonized, standardised signalling systems (including their associated Interlockings), and providing efficient integration with adjacent systems for Centralized Traffic Control, ERTMS, and other relevant systems.
This target is in compliance with the European norms addressing railway operation and safety system.
Standardising the different multiple signalling systems currently used will:- Increase the competitiveness of the railway industry, - Improve inter-working of freight and passenger rail services, - Stimulate the European rail equipment market, - Reduce costs and improve the overall quality of rail transport.- Be in line with the aims of ERTMS, that fall within the overall scope of the Lisbon strategy (the interoperability will increase the competition between road and rail transport).

LEADING ENTITY:	UIC – Union International des Chemins de Fer
PARTICIPANTS:	ADIF, ALMA, ALSTOM, ANSALDO, AZD, BV, BBR, BT, DB, TUE, NUCLEO, FUNKWERK, INVENSYS, MERMEC, NR, PR, RAILSAFE, RFI, FIR, SB, SIEMENS, SOUTHAPMTON U., TIFSA, THALES, TUBS, UPM, YORK, UNIFE, DLR
CONTACT DETAILS:	CITEF, CENTRO DE INVESTIGACIÓN EN TECNOLOGÍAS FERROVIARIAS RAILWAY TECHNOLOGY RESEARCH CENTRE,ESCUELA TÉCNICA SUPERIOR DE INGENIEROS INDUSTRIALES.UNIVERSIDAD POLITÉCNICA DE MADRID C/. José Gutiérrez Abascal, 2 | 28006 Madrid TEL + 34 91 336 3212 | FAX + 34 91 561 8618E-MAIL: jesus.felez@upm.es; citef.jmmera@etsii.upm.es; juandedios.sanz@upm.es ;joseantonio.lozano@upm.esWEB: www.citef.industriales.upm.es

Area 3

Rolling stock

I RAIL TECHNOLOGICAL FORUM FOR INTERNATIONALIZATION

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

FUNDACIÓN DE LOS FERROCARRILES ESPAÑOLES

PTFE
Plataforma Tecnológica Ferroviaria Española

FONDO EUROPEO DE DESARROLLO REGIONAL

Unidad de Innovación Internacional · Ferrocarriles

ACRONYM AND TITLE:	AVRIL, Light Independent Wheel High Speed		
RESEARCH AREA:	Rolling Stock		
TYPE OF FUNDING:	PATENTES TALGO SL and CDTI		
STARTING/ENDING DATE:	01/01/09-31/12/12	BUDGET:	20,4 M€

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

AVRIL is the outcome of a work philosophy which combines experience, a careful assessment of the market, direct collaboration with customers and users, social needs, and a permanent commitment to improvement and innovation. In this project, major technological institutions as well as experts in innovative sectors have actively collaborated.

AVRIL is based upon the Talgo technical principles allowing:
- Optimal Accesibility
- Lower energy consumption
- Lower emission of CO_2
- Lower acoustic emissions to the outside
- Lower Lyfe Cycle Cost (LCC)
- High standards of comfort for the passengers

AVRIL introduces a new concept which benefits from the advantages of the concentrated and distributed tractions:
- High acceleration and brake performance
- High capacity
- Very high speed: maximum speed: 380 km/h

AVRIL: Focused on future market demands:
- Economy
- Operation
- Service

OBJECTIVES:

- High speed train
- New wide bodyframe .- 5 seats per row
- Decreasing inner and outer noise levels
- System of usage of cinetic energy during brake
- Integrated train control and monitoring system
- Power head integrated multi-voltage traction system installed by Talgo

RESULTS AND THEIR IMPACT ON THE SECTOR:

AVRIL is a very high speed, high capacity train developed with a platform concept which responds to present and future market demands for high speed services worldwide. Based on the experienced Talgo Technology, known for its accessibility and light weight construction, AVRIL expects to become a new reference for the market in terms of sustainability and environmental responsibility in the high speed passenger transportation. With no constructive barriers such as entry steps, an extraordinary energy efficiency performance, and the application of new technologies in the fields of traction and rolling stock, AVRIL is able to host more than 600 passengers on a single-deck 200m train at a maximum operating speed incorporating the most advanced developments in the areas of passive and active safety, noise reduction, climate control and information technologies for their security and comfort.

LEADING ENTITY:	PATENTES TALGO S.L.
PARTICIPANTS:	INDRA, AEROPOXY, FAINSA, KELOX, CIDAUT, ID ERGO, UPV, UPZ.
CONTACT DETAILS:	Emilio García.- R&D Director.- egarcia@talgo.com Marcos Lozano.- Project Manager .- mlcanalejo@talgo.com

ACRONYM AND TITLE:	TALGO 250 HYBRID		
RESEARCH AREA:	Rolling Stock		
TYPE OF FUNDING:	PATENTES TALGO SL and IMADE		
STARTING/ENDING DATE:	31/05/10-31/12/10	BUDGET:	960.800 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

Train fitted with automatic variable gauge system and dual voltage traction system, designed for travelling on conventional (non-electrified) and High Speed tracks (electrified).

Main activities of the project:

- Design, development and manufacture of a Technical End Coach, fitted with a powerful generator unit, able to travel on tracks of different gauges (European, and Iberian), as well as on electrified (electric traction of 25 kv ac, and 3 kv dc) and non electrified tracks (diesel).

- Design and development of a new bodyframe and bogie.

Main characteristics:

- The energy needed for travelling on non-electrified tracks comes from two diesel generator units fitted on the Technical End Coaches.

- Power supply from electrical to diesel sources and vice versa can be done without actually stopping the train.

- It can travel at top speeds of 250 km/h (UIC gauge) and 220 km/h (Iberian gauge).

- It offers the possibility to develop High Speed networks without incurring on any costly investments in infrastructure.

- Energy savings.

RESULTS AND THEIR IMPACT ON THE SECTOR:

This train will be able to run on different infrastructures, different gauges and non-electrified and electrified tracks in order to cover long distances, reducing travel time.

With this type of train we can take advantage of the high speed network to reduce the total duration of the trip, without problems among different gauges, tracks or infrastructures.

LEADING ENTITY:	PATENTES TALGO S.L.
PARTICIPANTS:	ALTRAN, MTU, BEHR, BOMBARDIER
CONTACT DETAILS:	Emilio García.- R&D Director.- egarcia@talgo.com Julio Lorente.- Project Manager.- jlcasado@talgo.com

ACRONYM AND TITLE:	Variable-Gauge Freight Axle		
RESEARCH AREA:	Rolling Stock		
TYPE OF FUNDING:	PATENTES TALGO SL and CDTI		
STARTING/ENDING DATE:	01/05/08-01/06/12	BUDGET:	1,45 M€

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

It is similar to a conventional freight axle, equipped with a variable-gauge Talgo system, ready to be fitted in bogies type UIC Y-25 with minimum adaptation operations.

Its main features are:

- 22,5 metric tons maximum axleload.
- Maximum speed 120 km/h.
- Talgo classic wheel locking system.
- Low maintenance, mainly focused on parts subject to wear in the gauge-change operation.
- Minimum mass increase with respect to a fixed-gauge axle, with the aim of not reducing wagons load capacity.

In a first stage, a 1520-1435 mm variable-gauge axle is being developed (between former USSR countries and the standard track gauge).

In further stages, new variable-gauge axles will be developed for the following infrastructures:

- 1668-1435 mm (Spain-Portugal and the standard track gauge)
- 1600-1067 mm (Brazil)

The wagons fitted with these axles will be able to use the standard Talgo gauge changer without any restriction.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The competitive advantages of this design are:

- Reduction of journey times.

- Elimination of the bogie/axle change operations or load transfers between trains.

- Drastic reduction of the labor force associated to the system change operations (only the gauge changer device operator).

- Recovery of the surface associated to the traditional load transfer operations and also the change of the wheelset elements.

- Additionally, the time saved in load transfer operations allows infrastructure managers more flexibility in programming other train routes.

LEADING ENTITY:	PATENTES TALGO S.L.
PARTICIPANTS:	
CONTACT DETAILS:	Emilio García.- R&D Director.- egarcia@talgo.com Juan Manuel Ramírez.- Project Manager .- jmramirez@talgo.com

ACRONYM AND TITLE:	DEVELOPMENT OF A HYDRID POWERTRAIN FOR A RAILWAY VEHICLE BASED ON A PEM FUEL CELL SYSTEM AND BATERIES		
RESEARCH AREA:	Rolling Stock		
TYPE OF FUNDING:	FEVE and regional funding of Principality of Asturias		
STARTING/ENDING DATE:	01/03/09-31/12/10	BUDGET:	1,5 million of €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

This project dealt to prove hydrogen technologies as a clean and sustainable alternative to electric traction power or diesel traction power for railway services of passengers. In this context a tram vehicle moved by hydrogen fuel cells supported by batteries was designed, developed and tested. This experience pioneer in Europe was structured in three subprojects executed by each participating entity so the stages from the production of hydrogen gas until purification of this gas for consumptions in hydrogen fuel cells are also covered. These subprojects were:

Subproyect 1 (FEVE): design, development and test of hydrogen tram
Subproyecto2 (BIOGAS FUEL CELL, S.A): researching on obtaining hydrogen from biogas
Subproyecto 3 (INCAR): Purification of hydrogen from biogas to obtaining hydrogen suitable for its use in hydrogen fuel cells

The development of the hydrogen was carried out through the following activities:

-Design and development of the new hydrogen power plant which involved the development of a energy model to size the different powertrain subsystems
-Design and development of the tram
-Integration of systems and subsystems of hydrogen power plant in tram structure
-Testing and validation of the hydrogen tram prototype including testing of several control strategies which are devoted to properly manage both the power distribution, the system behaviour and the DC bus control, taking special care to the behaviour during transitory states.
-Study of legislation relative to hydrogen, security and railways

The most relevance part of the hydrogen tram, hydrogen power plant is composed by two hydogren fuel cells, sixteen sets of batteries, supercaps, converters, hydrogen bottles suppliers, etc.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Hydrogen would be the renewable fuel of the future but it is necessary investigate how hydrogen technologies can be applied to real applications and system. This project has studied in deep the ways and strategies to do this and has demonstrated hydrogen technologies are suitable to apply to railway vehicles. The result is a railway vehicle which is the first one in integrating a hybrid system based on Fuel Cell in Europe. This experience is a first step for the change from conventional energy powertrain sources as electricity and diesel to hydrogen and the methodology developed and employed in this project could be use for railway operator and railway manufacturers.

LEADING ENTITY:	FEVE
PARTICIPANTS:	FEVE, BIOGAS FUEL CELL, S.A AND INCAR
CONTACT DETAILS:	Patricia Morala-Research & Innovation Manager of FEVE patricia.morala@feve.es

ACRONYM AND TITLE:	**TrioTRAIN** : **T**otal **R**egulatory **A**cceptance in the **I**nteroperable **N**etwork Aerodynamics - **AeroTRAIN** Railway Vehicle Dynamics and track interactions - **DynoTRAIN** Pantograph and catenary interacion - **PantoTRAIN**		
RESEARCH AREA:	7th Framework Programme. Theme 7: transport (including aerodynamics). SST.2008.2.5.1: Interoperable rolling stock		
TYPE OF FUNDING:	Partial (European Comission Contribution)		
STARTING/ENDING DATE:	june 2009 / june 2012 (Aero & Panto) - june 2013 (Dyno)	BUDGET:	13,23 million € (8 million € funded)

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

TrioTRAIN is a cluster of integrated research projects partially funded under the European Commission's 7th Framework programme. It's central theme is to promote interoperability by increasing the use of virtual certification. This means replacing the physical testing processes by virtual simulation and simplifying complicated authorisation processes through an optimised mix of field testing, mock-up testing and simulation. The TrioTRAIN concept comprises 3 related projects: AeroTRAIN, DynoTRAIN and PantoTRAIN. Aerodynamics (AeroTRAIN), Railway Dynamics and Track Interaction (DynoTRAIN) and Pantograph and Catenary interaction (PantoTRAIN) are the technical areas that have been identified as most beneficial for improved processes. Additionally, all these technical areas bear great synergetic potentials when it comes to network approval processes, i.e. they can learn from common experience.

The **high level objectives** are:

- To foster cross-acceptance of rail vehicle authorisation through standardised processes for conformity proof, becoming less dependant on 'local' testing customs thus allowing for faster evaluation of minor technical changes of the vehicle
- To close "open points" in the Technical Specifications for Interoperability (TSIs)
- To reduce cost and time effort allowing for general ease into the network approval process in Europe introducing and/or exploring the use of "virtual homologation" (replacing assessment by testing through assessment by simulation), cross-border certification transfer of testing results in Europe, and "virtual extension of homologation" (for minor changes to existing homologated solutions).

The Work Program of the **AeroTRAIN** project is organised around five technical aspects: Open Air Pressure Pulse, Aerodynamic Loads on Tracks, Crosswind, Train – Tunnel Interaction and Slip Stream Effects.

Regarding the **DynoTRAIN** project, the the Work Program is organised around 6 technical aspects: Measurements of track geometry quality and virtual homologation, Track geometry quality, Contact geometry, Track loading limits related to network access, Model building and validation and Virtual certification of modified vehicles and vehicles running in other conditions.

Finally, **PantoTRAIN** project covers the following 5 aspects: Criteria to build and validate pantograph / catenary numerical simulation tools, Hardware-in-the-Loop testing of pantographs, Virtual homologation for interoperability, Virtual extension of homologation for a pantograph that presents minor changes from an already homologated one and New innovative pantograph designs with control functionalities.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The certification of a rail vehicle according to European regulations, Technical Specifications for Interoperability, European Standards and national safety rules represent a significant element for both vehicle cost and time to market. TrioTRAIN will contribute to the practical implementation of interoperability of railway systems across Europe by checking for inconsistencies and "open points" in the existing acceptance criteria and by proposing revisions of acceptance criteria in European standards and resolutions to close relevant "open points" in the TSI. So, the project aims at **decreasing the cost and time to market** associated with certification **without reducing the safety level** to enhance the competitiveness of rail traffic. The success of TRIOTRAIN cluster will lead to a time reduction for relevant parts of the certification process from 24 to 6 months, an 80% saving in effort for the acceptance of a new vehicle already accepted in another country and an estimated financial saving of €20-50 million/year.

LEADING ENTITY:	UNIFE
PARTICIPANTS:	ADIF, ALMA CONSULTING GROUP, ALSTOM TRANSPORT, ANSALDOBREDA, APNCF, BOMBARDIER TRANSPORTATION, CAF, CEIT, CONTACT, DEUTSCHE BAHN, INECO, INRETS, KUNLIGA TEKNUSKA HÖGSKOLAN, MANCHESTER METROPOLITAN UNIVERSITY, NETWORK RAIL, POLITECNICO DI MILANO, RAIL SAFETY STANDARDS BOARD, RENFE, RFF, ROME UNIVERSITY (DITS), SIEMENS, SNCF, STEMMANN-TECHNIK, TECHNISCHE UNIVERSITÄT BERLIN, TRENITALIA, UIC, UNIVERSITÉ DE VALENCIENNES ET DU HAINAUT CAMBRÉSIS, UNIVERSITY OF BIRMINGHAN.
CONTACT DETAILS:	Ross Hanley (UNIFE); Ross.HANLEY@unife.org Eduardo del Río (INECO); erioa@ineco.es

Area 4

Platform, superstructure, track and installations

I RAIL TECHNOLOGICAL FORUM FOR INTERNATIONALIZATION

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN
FUNDACIÓN DE LOS FERROCARRILES ESPAÑOLES
PTFE
FONDO EUROPEO DE DESARROLLO REGIONAL
Unidad de Innovación Internacional · Ferrocarriles

ACRONYM AND TITLE:	AURIGIDAS “Experimental study on ballast flying phenomenon”		
RESEARCH AREA:	Area 4 – Platform, superstructure, track and installations		
TYPE OF FUNDING:	National Plan of R&D and innovation, approved on the call of the Ministry of Development 2008, sub-program of infrastructure and transport		
STARTING/ENDING DATE:	2008-December to 2011-August	BUDGET:	€ 1.958.515

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The movement of trains at speeds of 300 km/h and above raises the need to respond to various problems. One of the most important is the ballast flying phenomenon, for which it is considered necessary planning and coordinating a project like Aurigidas. The project develops a model of the train-track set which allows identify, establish and reduce or eliminate the problems caused as well as define the actual limits of the operation of trains on ballasted tracks characterizing the train-track aerodynamic behavior. In practical terms the conclusions to be derived are of great importance for a possible increased of maximum speed in our high-speed lines.
One of the keys to decrease the projection of the ballast is to improve the aerodynamic conditions of both the train and the track. This project will study the aerodynamic constraints of trains and maintenance criteria and geometry of the ballast border, integrating both knowledge and defining the criteria and limitations on operation of high-speed lines with ballast.
Currently, the maximum operating speed is at 300 km/h; however it is desirable to know in advance the possible problems generated by the increase of this speed in those lines allowing speeds of 350 km/h. The project envisages the development of a model of the train-track set which allows knowing and minimizing the ballast flying phenomenon at speeds exceeding 300 km/h.
One of the keys to decrease the projection of the ballast is to improve the aerodynamic conditions of both the train and the track. Aurigidas will study the aerodynamic constraints of trains and maintenance criteria and geometry of the ballast border, integrating both knowledge and allowing defining the criteria and limitations on operation of high speed lines with ballast.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Already have been conducted the first essays with testing trains, being the first ones performed in Spain. Moreover, have been obtained for the first time the recordings of the ballast flying phenomenon, very important information for developing future models. These tests also serve to provide a field database, sufficiently large and contrasted to help solving the problems, besides trying to implement solutions that minimize the ballast flying phenomenon. This project has been a source of information for the AEROTRAIN Project.

LEADING ENTITY:	SENER
PARTICIPANTS:	SENER, UPM, LANCESS, CIDAUT
CONTACT DETAILS:	Main Researcher: Miguel Rodríguez Plaza, ADIF, mrodriguez@adif.es

ACRONYM AND TITLE:	IFZONE “Investigation of advanced techniques to railway operations in neutral zones of the catenary of high-speed lines”		
RESEARCH AREA:	Area 4 – Platform, superstructure, track and installations		
TYPE OF FUNDING:	National Plan of R&D and innovation, approved on the call of the Ministry of Development 2008, sub-program of infrastructure and transport		
STARTING/ENDING DATE:	2008-December to 2012-June	BUDGET:	€ 2.262.141,89

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

To achieve the above objective, the project carries out different lines of work that begin with a electrical study of the neutral zone focusing, inter alia, on the analysis of different distributions of electrical phases in the feeding of the catenary, and in reducing the number of neutral zones or minimizing the impact of its conditions. The possible electromagnetic disturbances on the ERTMS signalling system and on the GSM-R communication system are also being determinated.
The second line of work undertakes the development and implementation of a switching system that allows energize the neutral zone at train passage, so that from train point of view the neutral zone disappears (SCZN). This switch must be robust, reliable and low maintenance so it is proposed to develop a solid state switch, using IGBT or IGCT technology. This phase also includes development of the sensors that are considered necessary like the train passage sensor or the detection sensor for the reception pantograph.
In the third line is developed and implemented a protection relay to prevent a train causes a short circuit in a neutral zone (SPZN). For this, will be built the necessary sensors that will incorporate innovative communications systems and power supply, and will be established the integration of this new protection system into existing control systems in the electrical substations of traction.
Finally, in the fourth line of work, will be defined the requirements for provide to the signalling system information concerning the state of the neutral zone, being able to provide it to the trains too.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Overall, the need to install neutral zones in high-speed lines brings associated different technical and operational problems:
1/ Breakdowns in the catenary when a train enters tractioning -with the traction switch closed - and causes a short circuit between phases that can cut the conductors that make up the catenary. If the trains run with ATP -and automatic opening of switch- these incidents usually do not occur.
2/ Electrical noise that can affect different equipment of train or infrastructure.
3/ Fatigue generation in train traction equipment by continuous openings and closings of the circuit.
4/ Trains stopped in the neutral zone and unable to resume their march by themselves. In this case the remote control must perform a neutral zone configuration process to leave it energized so the trains can tractioning. The halting in neutral zone tends to affect the regularity of the trains running behind.
5/ Existence of problematic neutral zones which, being situated in places close to staging areas can cause conflicts for those trains running at low speed. In the worst case, these trains will be stopped in the neutral zone.
6/ In some cases, there is an increase in traction energy because the train lost speed and must retrieve it again after the passage through the neutral zone.
7/ In some cases, increased travel time due to undergone speed loss.

LEADING ENTITY:	Spanish Administrator of Railway Infrastructure (ADIF)
PARTICIPANTS:	TRAINELEC, TRAINTIC, ZIV, ELECTRANS, SENER, IMA, CSIC, UAH
CONTACT DETAILS:	Main Researcher: José Conrado Martinez Acevedo, ADIF, jcmartinez@adif.es

ACRONYM AND TITLE:	"Advanced Energy Storage System SA^{2}VE"		
RESEARCH AREA:	Area 4 – Platform, superstructure, track and installations		
TYPE OF FUNDING:	National Plan of R&D and innovation		
STARTING/ENDING DATE:	2006-December to 2011-December	BUDGET:	€ 10 M€

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

Improving energy efficiency in transportation is an issue of great strategic importance. One of the results is the development of the Advanced Energy Storage System (SA2VE). The objectives of SA2VE are the use of energy coming from braking trains by recovery, as well as the improvement of the load curve of the substation. The system continues developing and analyzing improvements in kinetic energy storage (ACE in Spanish) systems.
Given high energy costs, the SA2VE project aims at using the braking energy of trains, which is not used by other trains on the network and therefore is dissipated in braking resistances. This energy could reach values of up to 20% of energy consumed. The consumption profile of a substation is characterized by its irregularity with continuous peaks and valleys that correspond to the presence or absence of traffic. This is a not desirable situation because peaks are forcing to oversize transformers and other substations equipment for a reduced utilization, in a moment.
In addition, power companies penalize the presence of these peaks because it also requires them to oversize their facilities. In this situation, the energy storage system delivers power during peaks demand from the energy stored in the valleys. This makes a more uniform consumption profile, reducing substation elements and supply penalties.
While this system can be applied in high-speed network to eliminate the consumption peaks, the system that ADIF is developing will be applied to the conventional network, in which energy cannot be returned to the network because current substations consist of diode-based rectifiers and therefore are not reversible.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The advantages to be derived from this project can be summarized as follow:

1/ Reduction of losses in energy conversion and transport to trains

2/ Use of the braking energy of trains

3/ Energy efficiency of railway facilities

4/ Improved stability of the electrical network

LEADING ENTITY:	ADIF
PARTICIPANTS:	ACCIONA, TEKNIKER, IBERDROLA, US, ELYTT, GREEN POWER, INABENSA, ZIGOR
CONTACT DETAILS:	Main Researcher: José Conrado Martinez Acevedo, ADIF, jcmartinez@adif.es

ACRONYM AND TITLE:	MIFFO “Real-time monitoring of railway infrastructure using technologies based on fiber optics”		
RESEARCH AREA:	Area 4 – Platform, superstructure, track and installations		
TYPE OF FUNDING:	National Plan of R&D and innovation		
STARTING/ENDING DATE:	2008-December to 2010-December	BUDGET:	€ 363.100

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

One of the great engineering challenges is the maintenance, updating and safety in the operation of major infrastructure, including railways. This infrastructure requires the use of sophisticated monitoring systems to control the impact of new constructions on existing ones and monitoring the state of constructions in operation. According to the above, the monitoring of railway infrastructure is essential to ensure the security, reliability and availability, allowing early diagnosis of problems in the infrastructure, significantly improving safety and reducing maintenance costs.
The project MIFFO has as priority objective to research and develop two types of complementary sensing systems based on fiber optic for real-time monitoring of railway infrastructure. This monitoring project arises from the need to monitor certain railway infrastructure (tunnels, embankments, viaducts, etc.) allowing early action, which increases the security of the infrastructure and promotes a significant savings in maintenance costs.
Moreover, the results provided by traditional methods of visual, mechanical or electronic monitoring are not the most suitable for railway environments, so that in MIFFO project were chosen fiber optic sensors, more accurate and reliable.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Once developed these analysis systems, the MIFFO project has planned to carry these systems for a field trial, which must be simultaneous with the normal use of the track. This will also allow knowing limitations and problems that would have these technologies in this environment. It has been presented a clear improvement in the range of fiber optic sensing which allows monitoring fiber in lengths exceeding 150 kilometres. The testing have begun with a measuring system based on Bragg gratings on track, at kilometre 69.5 of the high-speed line Madrid-Barcelona, with support from the technical building for tests and field trials for Technological Innovation projects. Moreover, it has completed the design and schedule of monitoring test through dynamic sensors based on fiber optics and located in a viaduct and accelerated trials at real scale in the installation of CEDEX.

LEADING ENTITY:	SENER
PARTICIPANTS:	CSIC, ICYFSA, UAH
CONTACT DETAILS:	Main Researcher: Miguel Rodríguez Plaza, ADIF, mrodriguez@adif.es

ACRONYM AND TITLE:	**BALASTO ARTIFICIAL** **Artificial ballast project**		
RESEARCH AREA:	Area 4 – Platform, superstructure, track and installation		
TYPE OF FUNDING:	Spanish Ministry of Public works. R&D and innovation Plan 2008-2011. National programme of Public-Private Cooperation. 2008 Call		
STARTING/ENDING DATE:	2008-2011	BUDGET:	2.209.757 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

Innovation in railway infrastructure has been developed along mutually exclusive paths either with ballasted track or slab track. Until now, no intermediate solution has been investigated where the science of materials and advanced simulation tools would allow the research, development and manufacturing of an "artificial ballast", as a new approach which should eventually **combine the advantages of crushed-rock** or natural ballast **with the controlled design, manufacturing and construction features that characterize slab track**.

The key point in this project lies in the definition of an artificial material from the "natural ballast" made of crushed rock, of which many properties and features are not yet fully understood.

The project has been involving different perspectives and fields of expertise. On one hand, the research is focusing on finding suitable base materials for artificial ballast manufacturing, with focus on developing micro-concrete or high resistance mortars, with cement base and different additives. On the other hand, mass-production techniques are being investigated (casting, controlled crushing of base material,...), with alternatives for texture, roughness or indentations. At the same time, computer models are being developed to further define the geometric properties of grains that should lead to an improvement in the behavior of the ballast layer.

The test program of the project intends to establish a rigorous comparison between natural (from three selected quarries) and artificial materials, considering the behavior parameters Rc, Rt, G, H and also the LA value, which despite its empirical nature, is a value of general reference.

The project assesses the feasibility of different industrial production techniques of artificial ballast grains, mainly along the following options:

- Grain moulding, with particle geometry allowing an easy mould release
- Crushing of blocks of artificial material with preferred fracture planes
- Controlled "dilatation" breakage of blocks of artificial material

The curing techniques of ballast particles shall also be analyzed.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The Artificial Ballast project is the first step towards research into an artificial material that **may be used in the medium term for construction of new railway lines or renovation of existing lines**. Besides the expected results, this project could be a starting point for further research on specific and more focused goals. The application of the science of materials (along with proper testing procedures) may represent a significant improvement as regards the characterization of rocks used for ballast production and should be the basis for the design of appropriate artificial materials such as very high performance micro-concrete or mortars.

The project allows to establish design criteria for the generation of granular matter with grains of controlled geometry within the limits set by production techniques but with a wide range of options as regards the grading envelope and the geometry of particles.

The current production of railway ballast in Spain is around 2 million cubic meters per annum of which about 60% are used for the construction of new lines and 40 % for renovation of existing lines. Ballast volume for renovation could even increase in the next few years as the life cycle of the ballast first installed on new high speed lines comes to an end. Therefore the **environmental and economic impact** of the production of an artificial ballast is huge. On the environmental side several benefits can be pointed out, such as a diminished impact from existing quarries or new ones, transportation savings, improved track maintenance, increasing the ballast life cycle and the eventual utilization of recycled materials in the productive process of the new material.

LEADING ENTITY:	Fundación Caminos de Hierro
PARTICIPANTS:	Polytechnic University of Madrid; INGECIBER; Oficemen; IECA; Spanish Railways Foundation
CONTACT DETAILS:	Main Researcher: Pedro Gonzalez Requejo. pgonzalez@fundacioncdh.com Dissemination: Spanish Railways Foundation. C/ Santa Isabel 44, C.P. 28012 Madrid T: +34 91 151 10 99 E-mail: balastoartificial@ffe.es Web: www.balastoartificial.es

ACRONYM AND TITLE:	**VIADINTEL - VIADINTEGRA** Intelligent Railway Viaducts		
RESEARCH AREA:	Area 4 – Platform, superstructure, track and installations		
TYPE OF FUNDING:	Spanish Ministry of Science and Innovation through the European Fund for Regional Development		
STARTING/ENDING DATE:	2009-2010 2011-2013	BUDGET:	VIADINTEGRA: 5.900.000 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The objective of the project is to provide a series of viaducts of two sections of high-speed railway lines of an "intelligence system" based on the monitoring of structural behaviour in service through a continuous analysis over time of the structural behaviour of these viaducts. The project also seeks:
a) Increased reliability of the rail system, focusing on the overpasses as critical elements of the system.
b) Improvement of maintenance of structures, going from inspection and corrective maintenance to predictive maintenance based on ongoing assessment.
c) Integration of the system in the proceedings of a railway infrastructure manager and the companies carrying out maintenance to optimize and schedule the maintenance, cost and service conditions of the minimum line.
d) Better understanding of the phenomena of degradation of the infrastructure and the evolution of service levels or any pathology (the study of functional degradation phenomena) and the actual or expected life of this infrastructure.
e) Application of knowledge to improve standards and current design tools, with particular focus on improving the design of the increasing number of unique viaducts (in light of growing size, cell height, and length) to its dynamic behaviour, increasing the speed of railway and finally, improvement of legislation in this regard.

RESULTS AND THEIR IMPACT ON THE SECTOR:

VIADINTEL/VIADINTEGRA is a unique and strategic national project, as it is a Pioneer Experience in the integration of different technologies (instrumentation, data processing and transmission, structural behavior models and systems management infrastructure).
It improves the knowledge of the dynamic behavior of railway viaducts, strategic objective for the Spanish Network at the increasing service requirements of large structures meet the increasing traffic speeds.
It provides environmental benefits derived from increased efficiency of a sustainable transport system such as the railroad.
The participation of two railway infrastructure manager companies such as ADIF and TP FERRO makes possible a straight forward integration of new systems and processes developed within the project into the general management systems of Spanish railway networks.
Possible improvements in the treatment of the specifications for the design of large railway viaducts in the current legislation, especially the IAPF-07.

LEADING ENTITY:	VIADINTEL: Fundación Caminos de Hierro-Spain / VIADINTEGRA: PROINTEC
PARTICIPANTS:	VIDINTEL: Fundación Caminos de Hierro, Madrid Polytechnical University, CEDEX, ADIF, TP Ferro, Spanish Railways Foundation, GEOCISA, INGECIBER, INSERAIL, Granada University. VIADINTEGRA: PROINTEC, Fundación Caminos de Hierro, Madrid Polytechnical University, ADIF, Spanish Railways Foundation, GEOCISA, INGECIBER, INSERAIL, Granada University.
CONTACT DETAILS:	Main Researcher: Jorge Nasarre, Fundación Caminos de Hierro Mail: jnasarreg@fundacioncdh.com Phone : +34 91. 564. 39. 75 Dissemination: Spanish Railways Foundation. C/ Santa Isabel 44, C.P. 28012 Madrid T: +34 91 151 10 99. www.viadintel.com

ACRONYM AND TITLE:	UNIVERSAL AXLE CHANGE SYSTEM TCRS4 UNICHANGER "Development of universal changer and strategies of compatibilización and migration in the network Spanish railroad"		
RESEARCH AREA:	Area 4 – Platform, superstructure, track and installations		
TYPE OF FUNDING:	National Plan of R&D and innovation, approved on the call of the Ministry of Development 2008, sub-program of infrastructure and transport		
STARTING/ENDING DATE:	2008-December to 2011-Jun	BUDGET:	€ 2,567,367

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The universal axle gauge changer system TCRS4 Unichanger is the result of a project named Development of universal converter and compatibility and migration strategies in the Spanish railway network, that aims to solve a major problem for railway operations: the "borders" derived from the difference of gauges, which increases travel times and overall costs while reducing railway competitiveness. The universal system reduces transit time, encouraging the modal transfer by increasing the railway competitiveness. In 2008 it was patented the TCRS4 universal system, suitable for both Talgo and Caf Spanish technologies and for Polish and German systems. This changeover facility, in addition to enable the passage of vehicles with all systems, could allow wagons with different technologies in the same train.

The Unichanger project for the development of a universal gauge changeover facility is a national development project in progress, under the National Plan of R&D&I, and approved on the call of the Ministry of Development, 2008, sub-program of infrastructure and transport The project is led by Adif which acquired the patent to the company Ingeniería y Tecnica del Transporte (TRIA S.A.). It is developed in collaboration with the Center for the Study of Technical Research (CEIT in Spanish and the companies TRIA, Talgo, CAF and the Spanish Railway Foundation From Adif side are involved the Executive Directorate of High Speed and the Technological Innovation Management.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Infrastructure authority ADIF have been testing the TCSR03 gauge-changer which has been built at Roda de Bará near Tarragona, using facilities made redundant by completion of the Madrid - Barcelona high speed line.

Developed as part of the Unichanger research programme, the TCSR03 is designed to accept both the Talgo and CAF variable-gauge technologies in a single module. During the validation phase, the equipment has been tested with a CAF Series 120 train set and the ADIF high speed test train which uses the Talgo system. The trials are intended to confirm the safety and reliability of the equipment, and to ascertain the savings in cost and time compared to earlier designs of gauge-changer now in use.

The next step in the programme will be to develop a second variant also able to accept the German and Polish technologies used at the borders with the 1520 mm gauge network in Eastern Europe. This will be installed in the adjacent building at Roda de Bará.

LEADING ENTITY:	Spanish Administrator of Railway Infrastructure (ADIF)
PARTICIPANTS:	Center for the Study of Technical Research (CEIT in Spanish), TRIA, Talgo, CAF and Spanish Railways Foundation
CONTACT DETAILS:	Main Researcher: Ignacio Jorge Iglesias, ADIF, jorge.iglesias@adif.es www.unichanger.es

ACRONYM AND TITLE:	**"RECYTRACK" - ELASTOMERIC "ECO-FRIENDLY" MATERIAL BASED ON END-OF-LIFE TYRES BLENDED WITH ORGANIC BIND RESIN FOR RAILWAY APPLICATIONS.**		
RESEARCH AREA:	Area 4 – Platform, superstructure, track and installations		
TYPE OF FUNDING:	Grant 50% of elegible costs		
STARTING/ENDING DATE:	**01/10/2011 - 30/03/2015**	BUDGET:	**1.583.981,00** €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The overall objective of the project is to demonstrate the environmental benefits and technical and economic feasibility of the implementation of an **elastomeric "eco-friendly" material** made of end-of-life tyres blended with resin for railway applications.

As previous research and development activities two products have been developed with the elastomeric material: a "***New Isolated Block System for slab track" and an "Elastomeric mat for ballast conventional system and slab track".*** To reach the objective, the implementation of two demonstrators with these two new products in real-scale railway worksites is proposed.

The project addresses the "***waste and natural resources***" priority of the LIFE+ Environment Policy & Governance such by contributing to recycle a waste like end-of-life tyres. In addition, it also contributes to the following priorities: "***noise***" since the project is straight driven to give a solution to undesirable vibrations and noise caused by trains passing and "***innovation***" since ***RECYTRACK*** will recycle waste (end of life tires), turning it into two innovative eco-products and demonstrate them in railway infrastructures.

The *European Tyre & Rubber manufacturers' Association (ETRMA)* stated in its annual activity report 2007 that: More than 3.4 million tons of used (end-of-life) tyres are generated each year in Europe. These amounts are approximately 300 million units1. On the other hand, the new waste framework directive (2008/98/EC) states that End of Life Tyres (ELT)-derived products may no longer be considered as a waste in the future but as a secondary material for new applications. This fact leads to look for new technical solutions for recycling this waste.

RECYTRACK will significantly contribute to this directive by developing a new civil engineering technical application for a waste that is growing day by day in Spain and Europe. Both products can be easily adopted by other European countries once they have been technically demonstrated on a real railway worksite in Spain. The establishment of networks at local and European level, and the study of technical and economical barriers in different local and EU potential scenarios will make it easier the transferability of the solutions to other EU countries.

To accomplish the overall objective, these specific targets and objectives must be achieved:

- Identification of the technical, environmental and economic requirements of the whole value chain.
- Up-scaling the technology. Specific design adapted to the real case scenario and manufacturing of the products for demonstration, which have been already demonstrated with satisfactory results in laboratory prototypes.
- Implementation of these innovative products in two real work sites in Spain to demonstrate their technical and economical feasibility.
- To elaborate a continuous monitoring plan to assess and validate the innovative products implemented in real work sites.
- Awareness and dissemination of the projects results.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The main outcome of the project will be the demonstration and assessment of the environmental benefits and the technical and economic feasibility of the elastomeric recycled material based on end-of-life tyres: "***isolated block and mat***" in two real railway worksites.

In addition, thanks to the development and demonstrators of the solutions proposed and as a planning for the future, a minimum revalorisation of 365.000 tyres (see section: EU added value of the Project and its actions) is foreseen for the next 10 years. In terms of economical indicators savings of 5.824.000€ can be estimated considering the previous planning.

Both elastomeric products are a feasible technical alternative to the existing ones in the market, but with more advantages like revalorisation of waste into applications in the railway sector, where the solutions would be implementation for the first time.

Finally, with all the results of demonstrator's implementation in railway worksites and knowing the flexibility of the mechanical and vibro-acoustic properties of the elastomeric material, other application's fields for the product can be explored.

LEADING ENTITY:	ACCIONA Infraestructuras
PARTICIPANTS:	ADIF, LADICIM, AV Ingenieros
CONTACT DETAILS:	Name: Ms. Eleanor Sillerico Mayta E-mail address: eleanorjuana.sillerico.mayta@acciona.es Address: Valportillo II, 8. Alcobendas 28108. Madrid – Spain Telephone: +34917912112 Fax: +34917912101

ACRONYM AND TITLE:	MAT (Architectural Module to Transport)		
RESEARCH AREA:	Area 4 – Platform, superstructure, track and installations		
TYPE OF FUNDING:	Internal		
STARTING/ENDING DATE:	02/02/2010 – 30/11/2011	BUDGET:	214.900 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The aim of the innovation project is to develop a versatile architectural module in order to respond to the current demand of different markets in the transport sector – public transport as train, bus, subway, airplane - by applying the skills and knowledge of Ineco in the railway field.

Based on Ineco's experience, the Architecture Department drafts a report to lay down the bases of the architectural module:
-It might be extendable and modular according to the transportation system.
-It might be flexible in order to adapt to different weathers.
-It might be implemented in those places where a direct relationship between passengers and transportation exists.
-Materials will be chosen according to its location.

The line of work followed is summarized in the points below:
- Study and analysis of the requirements of different transports by identifying weaknesses in order to find new market fields.
- Construction definition of an architectural prototype based on versatility.
- Implementation of the prototype in trade fairs to launch the project.

The innovation project will make possible to solve quickly and effectively a wide variety of projects getting an unified image. It will let improve the ability to react at international competitions by providing good quality solutions. According to the global situation, it will make possible to minimize the impact during the work execution what will reduce costs and time. The design ensures its aesthetic integration and its structural suitability, and also an effective maintenance service management by centralizing the systems. In addition, it is planned to be a sustainable and self-sufficient construction what will reduce maintenance costs.

RESULTS AND THEIR IMPACT ON THE SECTOR:

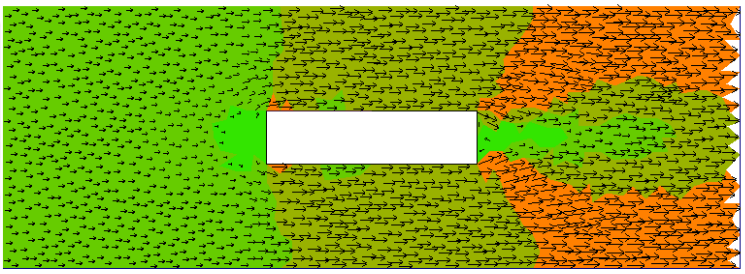
As a result of the research made up to now, a prototype has been geometrically defined with such characteristics that might respond to a wide range of requirements, clients and markets. This has been due to:
- Planning a dimensional module that adapts to different transportations.
- Developing a construction method based on industrialization and modulation.
- Defining an open materials catalog to adapt the product to the corporate image of each client.

LEADING ENTITY:	INECO
PARTICIPANTS:	Aixa Márquez Muñoz, María del Mar Armenteros García, Pablo Fernández-Victorio, Francisco Javier González de Riancho, Paloma Nuche Burgos and Martín Moreno Soriano, all from Ineco.
CONTACT DETAILS:	María del Mar Armenteros: mar.armenteros@ineco.es Pablo Fernández-Victorio: pablo.fernandez@ineco.es

ACRONYM AND TITLE:	The study of the scour capacity around bridge piers using fluvial modeling with two-dimensional flow.		
RESEARCH AREA:	Area 4		
TYPE OF FUNDING:	Internal		
STARTING/ENDING DATE:	11/05/2010 – 31/12/2011	BUDGET:	174.996,95 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The history of the Spanish railway lines go back to the year 1848, when the first railway line was finished between the cities Barcelona and Mataró. From that moment the Spanish railway network expanded through the entire country, and most of its bridges date from the second half of the XIX century and the beginning of the XX century.
Due to the limited construction methods available most of the foundations of the bridges are spreaded footings and thereby at risk of scour failure. A study realized in 1976 about the causes of the collapsing of 143 bridges all over the world showed that 70 of them were caused by flood hazards, and 66 of these due to scour, a 46% of the total.
In 2005 Ineco started with an inspection program of railway bridges, specially focused on the detection of scour at bridges for the Spanish Railway Company. Part of the contract was to develop a method to evaluate in a numerical way the risk for scour at bridges. The developed method is unique in his kind, and takes into account the overall erosion of the river, erosion due to the contraction of the river caused by the bridge and local scour around piers and abutments. The input data is based on hydrologic calculation of the rainfall and its surface runoff.
The weak part of the method is the use of average water speeds, overseeing possible concentrated peeks around piers.
The aim of this innovation project is to develop correction factors for different types of bridge piers, applicable to the existing method. Using a commercial computer program (InfoWorks RS of the company Innovyze) we are going to do hydraulic modeling on a wide range of bridge pier types. Variants of the modeling of each case will be the angle of the pier respect to the river.
The idea behind the innovation project is to do something similar as in a hydraulic laboratory, but with a substantial reduction of costs and time.



RESULTS AND THEIR IMPACT ON THE SECTOR:

The aim of the innovation project is to improve an existing method for the detection of the risk of scour at bridge piers, being scour the main reason of collapsing of bridges all over the world. Due to the use of average water speeds in the existing method, it is possible to oversee the real risk in some kind of bridges.

LEADING ENTITY:	Ineco
PARTICIPANTS:	Leendert de Haan, Mª Gloria Rosa Díez, Mª José Pantoja Fernández, Ignacio Velázquez Calleja and Miguel Jerez Delgado, all of Ineco. Technical support by the company's TECMA and SICA.
CONTACT DETAILS:	Leendert de Haan. lhaan@ineco.es

ACRONYM AND TITLE:	STUDY OF RAIL BEARERS - CROSS GIRDERS JOINTS THROUGH THREE-DIMENSIONAL FINITE ELEMENT METHOD AND INFLUENCE OF THE FATIGUE EFFECT ON EXISTING STEEL RAILWAY BRIDGES		
RESEARCH AREA:	Area 4 – Platform, superstructure, track and installations		
TYPE OF FUNDING:	Private		
STARTING/ENDING DATE:	June 2011/ October 2012	BUDGET:	142.397,30 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The calculus on existing metal truss bridges are usually solved using three dimensional models of nodes and bars. These models are fairly approximate to the actual structure and their results have been tested using load tests. However, these models are not enough to further study local effects that occur at joints between elements and how they are affected by construction details such as section changes, category of the joint, stress concentration in screws, rivets or welds or the influence of the existence of angular or joint-cover-plates.

This project aims to achieve the following objectives:

– Develop a three-dimensional analysis method to study joints, according to geometry details of the joint. This study will enable to:

-Detect points of stress concentration thanks to finite element analysis. These critical points are likely to cause cracks in the short or medium term due to fatigue effect in old steel bridges.

-Determine the residual bearing capacity of a cracked element and detect the need to establish restrictions on rail traffic.

-Test and compare the theoretical results obtained in the calculation by performing load tests on several real bridges and obtaining records by implementing intensive study areas.

-Study the effect of fatigue on these elements, estimating their lifespan and proposing procedures once exceeded the maximum number of cycles expected.

-Optimizing the design of the beam to beam joints in new bridges or necessary replacement of rail bearers.

-Propose the best solutions for repairing and strengthening damaged joints.

– Establish prioritization criteria to carry out specific studies on these bridges.

– Write a guide about Design Recommendations for new bridge beams and for repairing existing bridge beams.

RESULTS AND THEIR IMPACT ON THE SECTOR:

There is currently no specific study of the singularities existing in unions on steel railway old bridges to serve as a preventive measure of control. At present, the control of structures in service is carried out by visual inspection and global calculation models. Innovation is to perform local analysis, instrumentation and test the theory by load tests. INECO has an extensive experience in the railway and a close relationship with the agencies managing the railway infrastructure of our country. Therefore it is crucial to stay ahead in research and innovation in this area.

The Department of Steel Structures of INECO has been carrying out annual inspection campaigns since 1985, with a high level of expertise, so it has a large knowledge of pathology on steel bridges and on the types and geometric features associated with these.

The results and their impact on the sector are significant for several reasons:

It means to investigate in a field that has not been specifically studied so far, and that, however, is of vital importance, as it is a critical point in the structural safety of bridges service.

The result will help to project efficient repairs, reinforcements or designs of new rail bearers unions. This is important both nationally and internationally, because there are many steel railway bridges in service that would benefit from this study.

At a broader level, this proposal benefits society as a whole, reducing risks in railway bridges currently in service, and improving safety in steel structures, as it enables early detection of weak points or possibility of failure in a given period of time and helps to take the most appropriate decision in each case.

LEADING ENTITY:	Ineco
PARTICIPANTS:	Adif
CONTACT DETAILS:	elena.jerez@ineco.es

ACRONYM AND TITLE:	MRT : Absolute track positioning trolley, based on external references.		
RESEARCH AREA:	Area 4 – Platform, superstructure, track and installation		
TYPE OF FUNDING:	Internal financing and CDTI		
STARTING/ENDING DATE:	1/01/2009 to 1/12/2009	BUDGET:	225.000 euros

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

For assembly and correction of the track geometry it is necessary to have reference points in order to help correct placing. How is it done until now? External referencing of track is done by means of flags placed on pickets, posts, walls, gable ends of tunnels and/or elements nearby:
Using a metallic ruler or measuring tape, being an inaccurate method and very dangerous due to the high risk of electrocution.
By topographical methods that are very precise but slow and expensive.
Because of the hazard involved in these methods, ADIF issued a statement on th 18th of April 2006, prohibiting the rail companies to use metallic or non-isolated elements to perform this kind of measurements.
MRT is an alternative solution to these two methods of track referencing.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Positioning of both rails and axis from external references.
Export of track geometrical corrections to ballast tamper.
Electrification works:
- Distance between catenary and track.
- Electric wires height, decentering.
- Electrical clearance, etc...

Clearance verification for passing machinery.
Profiling,...

Electrocution hazard is eliminated.
Precise measurements can be performed at greater distances.
(maximum deviation ±5mm in 10m and ±0.3 mm in cant measurments).
Results are directly referred to both rails and axis.
Data is collected electronically and saved in an ASCII file, so transcription errors are eliminated and digital processing is allowed.
A single person can perform the measurements.
Major productivity.
Product approved by ADIF (Spanish Operator).

LEADING ENTITY:	COMSA S.A.
PARTICIPANTS:	CARTTOP PROYECTOS S.A.
CONTACT DETAILS:	Jesús Pérez Herrero www.carttop.com , carttop@carttop.com

ACRONYM AND TITLE:	R500T : railway track absolute positioning trolley by means of topographical total stations		
RESEARCH AREA:	Area 4 – Platform, superstructure, track and installation		
TYPE OF FUNDING:	Internal financing and CDTI		
STARTING/ENDING DATE:	1/07/2006 to 1/5/2008	BUDGET:	235.000 euros

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

CARTTOP R500 adapts to the needs of businesses.

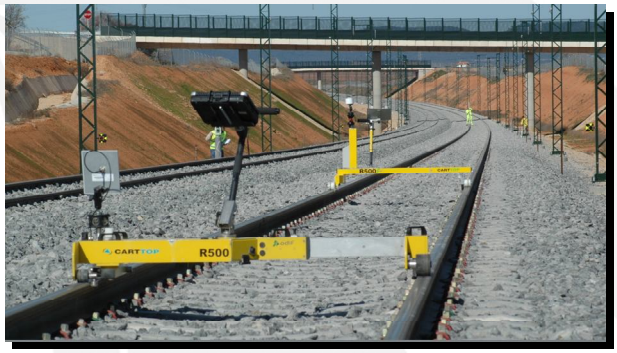
CARTTOP R500 is a portable trolley allowing real-time topographical control of any railway track on the market, from nominal gauges of 1000mm to 1676mm, on both ballast and concrete.

“The ultimate tool for surveying, redesign and geometric probing of railway tracks”.

CARTTOP R500 offers high productivity, making work easier, more accurate and effective. Allowing exhaustive railway surveying.

R500T: INNOVATIVE TELESCOPIC SYSTEM
Has an innovative telescopic system, rapidly adapting to different gauges of railway tracks.

FULLY WIRELESS COMMUNICATIONS SYSTEM.
Wifi + Bluetooth.
Simultaneous measurement with 2 topographical instruments (that can be of different brands)
Control of track overlaps from two topographical stations without affecting productiivity.



RESULTS AND THEIR IMPACT ON THE SECTOR:

For infrastructure managers, the R500 enhances the quality of they railway network.

For engineering and consultancy companies, the R500 is a user friendly and safe, tool that streamlines the surveying process and guarantees high quality at low costs as it performs many operations in at once.

For construction companies the R500 represents a great leap in terms of productivity and ease of use.

Product approved by ADIF (Spanish Operator).

LEADING ENTITY:	CARTTOP PROYECTOS S.A.
PARTICIPANTS:	VIAS Y CONSTRUCCIONES S.A.
CONTACT DETAILS:	Jesús Pérez Herrero www.carttop.com , carttop@carttop.com

ACRONYM AND TITLE:	RLM : Digital ruler for railway track measurements and switches		
RESEARCH AREA:	Area 4 – Platform, superstructure, track and installation		
TYPE OF FUNDING:	Internal financing		
STARTING/ENDING DATE:	01/04/2010 to 01/11/2010	BUDGET:	155.000 euros

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

ADIF rules for track measurement instruments requires these tools to be digital in 2010 and with a better precision than the current analog rulers. In general terms, digital rules are more precise than mechanical ones mainly due to:

- Electrical sensors precision is better than analogue ones.

- Errors of human appreciation and transcription of data are eliminated. Digital rulers can reach a precision of ±0.2mm in width and ±0.3mm in cant.

RESULTS AND THEIR IMPACT ON THE SECTOR:

RLM . Measurement of gauge and cant in General Track.

PACK 01. Data record + RLM Office.Data record in intern memory and exportation to PC by bluetooth. Includes PC software, RLM Office.

PACK 02. Switches. Switches measurement : safety headroom, check rail, rail clearance.

PACK 03. Range extension. Widening of the distance measurement : points coupling.

PACK 04. Software RLM PDA. Software RLM PDA for data record in PDA. Includes pack 01 and 02

Simultaneous visualization of gauge and cant.

Back-illuminated display.

It's light and rigid at the same time.

Each model is available in gauges from 762mm to 1676 mm.

Product approved by ADIF (Spanish Operator).

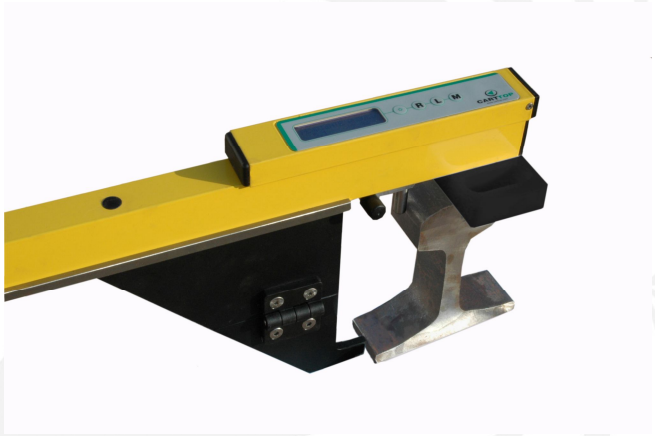
LEADING ENTITY:	CARTTOP PROYECTOS S.A.
PARTICIPANTS:	COMSA S.A.
CONTACT DETAILS:	Jesús Pérez Herrero www.carttop.com , carttop@carttop.com

ACRONYM AND TITLE:	RLMi : digital rule to measure the rail cross inclination		
RESEARCH AREA:	Area 4 – Platform, superstructure, track and installation		
TYPE OF FUNDING:	Internal financing		
STARTING/ENDING DATE:	1/6/2010 to 1/9/2010	BUDGET:	45.000 euros

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

Nowadays, the measurement of the inclination of the rails, it is realized by an angle meter (goniometer), the useful one of support to the meter and one rules length.

We wanted to measure the rail cross inclination without using any auxiliary material or previous calibrations.



RESULTS AND THEIR IMPACT ON THE SECTOR:

RLMi : is a digital rule with which we can measure in a fast and accurate, the rail cross inclination straight and curved, without using any auxiliary material or previous calibrations.

Simultaneous visualization of cross inclination in %cant and in degrees.

Back-illuminated display.

It's light and rigid at the same time.

Is valid for gauges from 1000 to 1668 mm.

Is valid for rails UIC 54.E1 and UIC 60.E1.

Product approved by ADIF (Spanish Operator).

LEADING ENTITY:	CARTTOP PROYECTOS S.A.
PARTICIPANTS:	
CONTACT DETAILS:	Jesús Pérez Herrero www.carttop.com , carttop@carttop.com

Area 5

Exploitation, operation and rail system security and safety

I RAIL TECHNOLOGICAL FORUM FOR INTERNATIONALIZATION

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN
FUNDACIÓN DE LOS FERROCARRILES ESPAÑOLES
PTFE
FONDO EUROPEO DE DESARROLLO REGIONAL
Unidad de Innovación Internacional · Ferrocarriles

ACRONYM AND TITLE:	**MULTIPLATFORM project: Wireless communication multi-platform and specification and implementation of a standard communication protocol**		
RESEARCH AREA:	Area 5 – Exploitation, operation and rail system security and safety		
TYPE OF FUNDING:	PEIT 2008 (Ministry of Public Works -> Ministry of Science and Innovation)		
STARTING/ENDING DATE:	Nov 2008 – Dec 2011	BUDGET:	1.693.271,73 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The main purpose of this Project addresses the need to increment the types and coverages of both on board and track detection systems, as well as to ease the on board visual supervision through the implementation of an intelligent video surveillance system. The design and validation of a new wireless communication multi-platform is instrumental to that goal. The multi-platform high level requirements are the following:

In order to provide an efficient control and management of the multi-platform functionalities, the specification and implementation of a new communication high level protocol is proposed.

The project includes a task designed to examine the electromagnetic compatibility of the multi-platform implementation and the railway environment emissions. Also, it comprises the analysis of the protocol and multi-platform RAMS parameters, in order advance towards the certification of the multi-platform.

The multi-platform and protocol implementations are tested through the implementation, divided in two phases, of a prototype:

Phase 1: Lab prototype. The phase activities focuses on the measurement and analysis of the network parameters, aiming at validating the correct functioning of the wireless communication equipments. A preliminary validation of the high level application protocol is also included in the phase.

Phase 2: Railway environment prototype. The main objective of this second phase is to model and analyze the functional, in-situ behavior of the railway wireless communication multi-platform for the transport from the rolling stock to the Infrastructure Manager Control Center of video and sensor data information.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The main goal of this project is to increase the security of the railway infrastructure, through a widespread, flexible and low cost deployment of railway detection and video surveillance systems (train-track communications), allowing a real time and more accurate supervision along the railway infrastructure, guarantying the highest levels of security to the railway transport.

Compared to conventional sensor networks systems, where their cost is high (often not by the sensor technology but by the civil work associated with their installation, because it is necessary to wire communications and energy), this system will allow sensor networks deployed in areas where the budget is more limited.

LEADING ENTITY:	SENER
PARTICIPANTS:	ADIF, IMA, UPC, Planytec
CONTACT DETAILS:	raquel.martinez@adif.es / isabel.navarro@sener.es

ACRONYM AND TITLE:	DETRA: Determining the accepted risk level of the railway in Spain for the different existing subsystems.		
RESEARCH AREA:	Area 5 – Exploitation, operation and rail system security and safety		
TYPE OF FUNDING:	R&D Project funding by Ministerio de Fomento – CEDEX (Government of Spain).		
STARTING/ENDING DATE:	December 2007-October 2011	BUDGET:	-

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The standard EN 50126 gives to the National Safety Authority (NSA) and the railway industry a vision of the managing of reliability, availability, maintainability and safety (RAMS), with the objective to promote a common understanding of management and enable interoperability of European railways.

When the rule came into effect, in Spain was not available the values that determine the historical risk of the facilities in service, which made difficult the implementation of the "RAMS" to new systems/subsystems. Also, the new regulation appeared recently as the upgrade of the Directive Safety Railway (149/2009/CE) and the regulation 460/2009/CE need disaggregated statistical data to obtain de safety indicators and the national reference value.

The research project "DETRA" has the objective of providing to the Spanish Safety Authority, the infrastructure manager and the railway undertaking, data of assumed risk level in the railway system based on its type of failure.
In this way, it has developed, as a result of the research project "DETRA", this manual in order to obtain a tool for railway safety management that can explain:
- How to classify, decompose and represent in subsystems each of the systems that are part of the Spanish railway.
- How to determine the causes and consequences of accidents and incidents.
- How to assess quantitatively the different parts involved in the system, according to its type of failure.
- How to get the safety indicators from data available of accidents and incidents (safety indicators 49/2004/CE, 149/2009/CE and 460/2009/CE, among others)
- How to assess quantitatively the different security duties of the railway systems.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The main benefits of research project "DETRA" are addressed primarily to the following targets: National Safety Authority (estimation of assumed risk values on the railway and assignment of risk level for systems/subsystems of failure causes and actors involved in the railway); Infrastructure Manager and railway companies (identification of the railway system failures and hazards associated with it); and Railway Industry (proposal of recommendations for systems and subsystems rail of failure causes).

The conclusions of the project are:

The fault system "Third parties" (behaviors of people outside the railway) is the system which more risk brings to the Spanish railway system, especially the subsystems of invasion of vehicles and the imprudence of people in railways.

The harmfulness of the groups of passengers, level crossing users, other people and unauthorized persons on railway installations, relates mainly to the system of "Third parties"; and in case of invasion-of-railway, a very important part is given at the level crossings.

Definitely, the risk analysis for systems and subsystems of Spanish railway failures concluded that to reduce the risk of the Spanish railway system, necessarily we must act on the fault system "Third parties", highlighting the difficulty of reducing the risk if we act on failures systems "Rolling Stock Failure" and "Infrastructure Failure" because they have very low rates of harmfulness.

LEADING ENTITY:	Research Group INFORSE (University of Valencia)
PARTICIPANTS:	Renfe Operadora, Adif, Airtren, S.L.
CONTACT DETAILS:	Francisco.toledo@uv.es

ACRONYM AND TITLE:	**Determine the skill profile of subway and streetcar drivers**		
RESEARCH AREA:	Area 5 – Exploitation, operation and rail system security and safety		
TYPE OF FUNDING:	Ferrocarrils de la Generalitat Valenciana (FGV)		
STARTING/ENDING DATE:	2007 - 2009	BUDGET:	-

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The Spanish railway operator, RENFE, determined in 1950 the factors to evaluate and the test to administer in the selection of train drivers: intelligence, driver attitudes, motor skills, coordination, among others. Since that year many progress haven't been made in the determination of the profile of a train driver, as well as in the design of new test for the selection of train drivers.

The driving of trains and subways require common skills in the drivers and given the different characteristics of the task and, therefore, the skills required to do it, it's necessary determine the specific skill profile of the train and subway drivers.

The aim of this project is to determine the skill profile of the subway and streetcar drivers, identifying the psychophysics aptitudes, skills, abilities and characteristics of personality, as well as to determine the test to assess them.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The research is being carried out in three steps: In the first place, a review of the all national and international literature about the topic; in the second place, an analysis of the task by means of observation, video records, interviews and questionnaires; and finally, in the third place, analyze all information to determine the skill profile of a subway and streetcar driver with the aim toward increase the safety in the driving of subway and streetcar.

The analysis results report that driving on the surface the driver must keep attention during the most part of the route and pay attention to the numerous crossings between platforms. This requires that the driver must have a capacity of divided and sustained attention, and also resistance to monotony.

In the tunnel, the driver must have sustained attention to a greater extent.

The streetcar driver must have a great capacity of selective and divided attention, due to the quantity of contextual stimuli to which the driver must pay attention, being necessary to be constantly on the alert, activated and watchful in order to react in a safe and efficient way faced with any contingency.

LEADING ENTITY:	Research Group INFORSE (University of Valencia)
PARTICIPANTS:	FGV
CONTACT DETAILS:	Francisco.toledo@uv.es

ACRONYM AND TITLE:	STAC RAIL: TECHNOLOGICAL SYSTEM FOR HELP TO RAILWAY CIRCULATION		
RESEARCH AREA:	Exploitation, operation and rail system security and safety		
TYPE OF FUNDING:	FEVE		
STARTING/ENDING DATE:		BUDGET:	

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

STAC Rail was born as an answer of the detected necessities in particular railways environments and track stretches where there is NO Central Traffic Control. Then FEVE and PROINTEC decided to undertake the development of a product that allow railway traffic management and control with a high level quality. The result was STAC Rail (Technological System for Help to Railway Circulation) based on the last mature technologies and in the deep knowledge provided by FEVE, becoming a specialized product for railway.
The system dates capture of service planning and situation, state and traffic characteristics, providing information about traffic in real time.
For it, STAC Rail connects itself with rolling stock, personnel, Exploitation Plan and Security Plan. Train location is done through GPS equipment. Position, velocity and direction are sent to Control Centers permanently in real time through GSM/GPRS and satellites.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The development of STAC Rail has become a helping system for exploitation in pieces of lines or areas where there is no Traffic Control Installations, nevertheless its functionalities are applicable also to areas where there is that type of installations.

STAC Rail is today an operative reality that replies to the initial goals and it has got exceed, becoming a global system which is an essential support for Traffic Control Centers with independence of the conventional technologies which are implemented in them. It provides a level more of security, accuracy and quality to conventional systems and efficient tool for companies in related to railway exploitation. In other words STAC Rail is a multifunction tool of global management and control for railway transport. It supplies with dates of tracking, planning, analysis and information to different users in the railway environments: travellers, engine driver, train station agent and Central Traffic Control

LEADING ENTITY:	FEVE
PARTICIPANTS:	FEVE, PROINTEC
CONTACT DETAILS:	Patricia Morala-Research & Innovation Manager of FEVE patricia.morala@feve.es

ACRONYM AND TITLE:	DEVELOPMENT OF A NEW ON BOARD SYSTEM IN TRAIN UNITS FOR AUTOMATIC COUNTING OF PASSENGERS		
RESEARCH AREA:	Exploitation, operation and rail system security and safety		
TYPE OF FUNDING:	FEVE		
STARTING/ENDING DATE:	01/01/11-31/10/11	BUDGET:	36.000 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

This initiative emerged from the necessity of knowing passenger occupations of different trains in circulation, the existing demand in all railway lines of FEVE with the innovative goal of measurement them on board moreover in stations along the time.
During this project the development of a system which allow to test, compare and simulate in the same conditions of train operation different technologies and sensors for passengers counting, so it provide to take decisions of which is the best and most suitable device or system between all of them considering the relation between reliability of the counting and devices costs.
Also an own system will be design and develop using commercial sensors which will realize its signals analysis and later information analysis in a unit control design specifically.
Finally the optimal system will be validated for all different series of passenger units.
For the purpose of this project different technologies as thermal sensors, infrared vision and artificial vision will be used.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The results of this project will be a complete and reliable study of technologies for automatic on board counting of passengers, advantages and drawbacks, capacities and above all a comparison of its effectiveness and error rates based in real tests made in the same conditions and correlated with its implementation (supplying +installation) costs.

LEADING ENTITY:	FEVE
PARTICIPANTS:	FEVE, UNIVERSITY OF VIGO
CONTACT DETAILS:	Patricia Morala-Research & Innovation Manager of FEVE patricia.morala@feve.es

ACRONYM AND TITLE:	3DyFAT: Train Derailment Detector and Automatic Braking Device		
RESEARCH AREA:	Exploitation, operation and rail system security and safety		
TYPE OF FUNDING:	FEVE		
STARTING/ENDING DATE:		BUDGET:	

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The 3DyFAT® System is applicable to any wagon equipped with bogies, both for freight and passengers and metro. The role 3DyFAT® System is to reduce the effects of the derailment, because it acts automatically stopping the train at the instant it detects the derailment of the first axle. The 3DyFAT® System works for the security of rail transit, with evidently ability to improve company profits in this business.

3DyFAT® is adaptable to any wagon equipped with bogies, being able to instantly detect the moment at which derailment occurs, causing automatic and immediate braking of the complete train. The 3DyFAT® system reduces the sometimes devastating consequences of train derailments, thereby representing a major contribution to railway transport safety, with obvious capacity to improve the profits of companies in the industry.

In general terms, the 3DyFAT® system is a mechanical and pneumatic device installed on each bogie. The mechanical part is made up of a specially designed pulsator, whose task is to examine the position of the bogie in relation to the wagon chassis or body, with respect to both its vertical axle (relative movement due to curves and the normal curving caused on straight sections) and the horizontal axle crossing the wagon (relative movements of the two bogie axles due to irregularities and bumps on the track). The mechanism is specifically sized for every type of bogie and track, certain tolerances being fixed in accordance with the minimum curve radius on the track, the maximum bumps and according to the type of suspension the wagon has. If these tolerances are exceeded, circumstance that only occurs when bogie derailment takes place, the longitudinal movement is transferred to the pulsator.

On noting this movement, the pneumatic part instantly transmits a pneumatic signal to an automatic valve, whose task is to discharge pressure from the general compressed air collector, and by which the entire train receives the emergency brake order and is stopped. The necessary air pressure for the system to work is taken form the auxiliary air receiver on the wagon itself

RESULTS AND THEIR IMPACT ON THE SECTOR:

The 3DyFAT® System is the automatic derailment detector most used and secure in the world. It is a reality that is operating. Since was developed it has been installed in about 1,400 wagons, in freight trains and passengers, resulting equipments highly reliable, covering most of the causes behind freight wagon derailments. The system has functioned well in 100% of cases and has never acted inopportunely up to now without the prior existence of a derailment. Train derailments are inevitable, but the advantage of 3DyFAT® resides in reducing drastically its economic impact.

LEADING ENTITY:	FEVE
PARTICIPANTS:	FEVE
CONTACT DETAILS:	Patricia Morala-Research & Innovation Manager of FEVE patricia.morala@feve.es

ACRONYM AND TITLE:	Study of Harmonic interferences generated by rolling stock on railways infrastructure		
RESEARCH AREA:	Area 5 – Exploitation, operation and rail system security and safety Area 3 – Rolling stock		
TYPE OF FUNDING:	National Plan for Scientific Research Development and innovation 2008-2011		
STARTING/ENDING DATE:	01-01-09 / 31-12-11	BUDGET:	1.286.674,59 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The inclusion of power electronics in traction circuits of modern rolling stock vehicles is bringing the use of non-linear elements in the electric supply networks. These non linear elements, together with the disruptions in the electric power current induced by the pantograph-catenary interaction, are contributing to a waveform distortion in network voltage and current. Due to its harmonic components, these distortions can be amplified by resonant effects and provoke interferences in track circuits giving rise dysfunctions on exploitation and/or even on safe train operation.
The activities which are been carried out are summarized as follows::

- Compilation of information on rolling stock
- Compilation of information on infrastructure
- Compilation of information on incidences
- Theoretical analysis of the problem. Identification of critical points
- Overall track test campaign
- Identification of interference levels on track circuits
- Development of a normative framework at this respect for rolling stock

RESULTS AND THEIR IMPACT ON THE SECTOR:

The main objective of the project is to search and to identify problems induced by the rolling stock – infrastructure interaction, related to the interferences generated by harmonic currents, as well as its impact on railways exploitation safety. The final goal would be to produce a set of relevant results leading to:

- From rolling stock perspective:
  - Development of clear acceptation criteria for circulation authorization of rolling stock.
  - Definition of maximum limits for acceptable harmonic interferences in trains in order to assure an uncoupled behavior of track circuits.
  - Elaboration of a normative to define measurement methods and validation criteria to be applied to rolling stock.
- From infrastructure perspective:
  - Detection of critical conditions in ADIF rail network
  - Actions and solutions to mitigate conflictive situations.
  - Identification and characterization of existing track circuits in ADIF rail network.
  - Development of normative. Definition of criteria to be applied to track circuits for its installation in ADIF rail network.

LEADING ENTITY:	INECO
PARTICIPANTS:	INECO, ADIF, RENFE, IMA, TRAINELEC, ELYTT ENERGY
CONTACT DETAILS:	Manuel Bueso Delgado. manuel.bueso@ineco.es. 913436209 - 661249967

ACRONYM AND TITLE:	Automated Decision Support System for Emergencies in High Speed Passenger Trains Ref. P65/08		
RESEARCH AREA:	Exploitation, operation and rail system security and safety		
TYPE OF FUNDING:	Grant of the national program on public-private cooperation. Transports and Infrastructures R&D Projects.		
STARTING/ENDING DATE:	01-01-2009 / 31-12-2011	BUDGET:	1.848.707,42 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

Emergency Situations inside passenger trains can constitute a significant risk to life safety. Consequently, it is necessary to ensure that crew procedures are adequate in order to guarantee the safety of passengers during different emergency conditions. However, the train crew procedures under a variety of conditions in passenger trains have not yet been studied in depth. Prevention is a key factor but it is not enough when an emergency occurs. This Project aims to develop an Automated Decision Support System (DSS) for emergency management in High – Speed Trains.

This project includes seven work packages (1) Analysis and Classification of Emergency Situations. The statistical analysis of data collected from rail accidents permitted to obtain the probability of occurrence of different emergencies. (2) Analysis of Detection Systems. The available detection systems and its impact into the emergency management were analysed, (3) Convenience and Appropriate Moment of Train Stop. The analysis of emergency situations permitted to establish the appropriate moment and place to stop, (4) Evacuation in Basic Conditions. The analysis of the movement and human behaviour in high-speed trains permitted to obtain the evacuation times in basic conditions, (5) Evacuation in Emergency Situations. This work package permitted to analyse the evacuation processes in different emergency situations, (6) Characteristics of the Train Crew. The actual crew procedures and strategies were analysed and classified and (7) Decision Support System or the integration of the previous models.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Emergencies in high-speed trains (fire, collision, terrorism, derailment, etc.) lead to high-risk situations that can endanger passengers live. However, many rail accident reports are critical of the crew actions showing that, despite advances in facilities and safety systems, the decision making during the emergency have not sufficient scientific and technical basis.

The aim of this project is to develop an Automated Decision Support System for emergency management in high speed passenger trains enabling to propose actions and decisions in real time, mainly addressed to early detect and automatically prevent events in its early phase that may create an Emergency Situation. It will also be able to establish the activities in case of emergency, considering the initial features, the available resources and the dynamic result of the procedures in an emergency situation.

LEADING ENTITY:	GIDAI Group Fire Safety – Research and Technology. University of Cantabria
PARTICIPANTS:	RENFE INTEGRIA CITEF – Technical University of Madrid INFORSE – University of Valencia GIST – University of Cantabria MSC, S.L.
CONTACT DETAILS:	Prof. Jorge A. Capote Abreu GIDAI Fire Safety – Research and Technology E.T.S.I.I.T. UNIVERSIDAD DE CANTABRIA Avda. Los Castros s/n 39005 Santander Ph: +34 942 20 18 26 Mail: jorge.capote@unican.es

ACRONYM AND TITLE:	**SECUREMETRO** **Inherently secure blast resistant and fire safe metro vehicles**		
RESEARCH AREA:	Area 5 – Exploitation, operation and rail system security and safety		
TYPE OF FUNDING:	Seventh Framework Programme 2nd call, Transport (Including Aeronautics), sub programme Safety and security by design, Human components. Small or medium-scale focused research project. FP7-SST-2008-4.1.1-RTD-1		
STARTING/ENDING DATE:	Jan 2010/ Dec 2012	BUDGET:	3.624.902 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The aim of the project is to achieve increased safety and security of metro vehicles from terrorist attacks by explosives and firebombs through materials choices and design, thereby increasing resilience and reducing the impact of attacks on passengers, staff, infrastructure and property.
The SecureMetro project will consider threats from conventional explosives and firebombs. The objectives are:

To increase metro vehicle resilience to terrorist bomb blast through selection of vehicle materials and structural design. This will reduce injuries from fragments of vehicle materials and improve structural integrity in blast situations, offering greater security to passengers and staff. This includes enhancing the ability of a vehicle to remain on the track and keep moving so that underground rescue is not required.
To increase security against a firebomb attack through design of fire barriers and fire suppression technology while also contributing to passenger safety from accidental or vandalism fires. Design of features to prevent the spread of fire and fumes will contribute to standards compliance (prEN 45545 and TS 45545) for fire protection of railway vehicles.
Acquire increasing resilience of vehicles to blast and fire attacks and reduced damage to adjacent vehicles and infrastructure, speed up recovery following attack, allowing the rail system to "bounce-back" to normal operation quickly
Reduce the attractiveness of metro systems as a target for attack by reducing deaths and injuries, increased resilience, reducing economic impact and making recovery faster. This will be achieved through wide dissemination of the findings of SecureMetro, and promotion of transfer to high speed rail of the vehicle design and technology developed for metro systems.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Casualties in terror attacks result from both the initial blast, but also from falling and flying debris, and shrapnel from disintegrating structural and interior vehicle components. The SecureMetro project will build on research due to be completed in mid-2009 in EU project **RailProtect,** UK project **ReDesign "Resilient design for counter-terrorism: Decision support for designing effective and acceptable resilient places"** and the European Commission project **FIRESTARR** (1995 to 2000), this work being the key input to the current CEN TS 45545 standard.
There is currently no EU wide study focused on materials and design of rail vehicles to mitigate blast, firebombs and smoke bombs through design of intrinsically more secure vehicles. There is currently no design guidance for how vehicles should respond to best protect people in the event of a terrorist attack. The SecureMetro project will address this need in four major ways through the following innovative topics:
The rail vehicle industry currently **needs input on the range of materials and technologies available** which could contribute to security of vehicles through design. In particular, materials and techniques applied outside the rail industry will be surveyed, modelled and tested to provide guidance on their use to design in security by mitigating the effects of a blast, fire or smoke attack.
Analysis of previous attacks together with metro system operator input will be used to draw up design criteria for how a vehicle should behave to protect passengers and staff during a terrorist attack. This will include factors such as assistance in evacuation, containment of damage to speed recovery, understanding vehicle stability during a blast, and structural integrity improvement to prevent collapse, or a vehicle becoming stuck in a tunnel.
The output of the project will contribute to EU standardisation and interoperability of vehicles through contribution of new aspects to standards on the structural integrity of rail vehicles (EN12663 "Railway applications. Structural requirements of railway vehicle bodies") and through guidelines for interior performance able to meet CEN TS 45545 (European standard for fire protection of rail vehicles), while also defending against a firebomb.

LEADING ENTITY:	University of Newcastle upon Tyne (UK)
PARTICIPANTS:	Institut français des sciences et technologies des transports, de l'aménagement et des réseaux (IFSTTAR), TECNALIA,Bombardier, MAXAM-EXPAL, STAM, Istituto Affari Internazionali, RATP, Spanish Railways Foundation , Suncove S.A., Metro de Madrid
CONTACT DETAILS:	University of Newcastle upon Tyne (UK), Conor O´Neil. Mail: conor.oneill@newcastle.ac.uk Phone: +44 (0) 191 222 3973

ACRONYM AND TITLE:	SAFEINTERIORS - Train Interior Passive Safety for Europe		
RESEARCH AREA:	Rail Safety - Developing integrated safety systems which are reliable and fault tolerant (preventive, active and passive) taking into account human-machine interface concepts focusing on the system implementation		
TYPE OF FUNDING:	European Commission. 6th Framework Programme. Priority 6. Sustainable Surface Transport, FP6-2005-Transport-4		
STARTING/ENDING DATE:	Jul.2006 – Jul. 2010	BUDGET:	3,685,231 Euros

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

SAFEINTERIORS will present the European railway industry with a key step towards achieving full interoperability by providing the structure to implement a full methodology to design, test and validate improved interior solutions, thus reducing the levels of fatalities and injuries in rail accidents.

The purpose of the SAFEINTERIORS project is to provide the different railway stakeholders with a currently missing platform capable of assessing interoperability of all present and future interior rail vehicle layouts. The proposed framework will address design requirements and assess new interior solutions following advanced state-of-art interior designs, representative layouts, a range of suitable crash pulses and new test and validation procedures suitable to the rail industry. The use of new materials will be fully exploited to improve the occupant/furniture contact characteristics and contribute to lower overall vehicle mass levels.

SAFEINTERIORS will appraise requirements and validation procedures and propose best practices for future standards, recommendations and regulations to improve the chances of "survival" in future catastrophic events. At the same time it will explore the suitability of the proposed interior passive safety methodologies as applied in retrofitting of existing rail vehicles, thus contributing to speed up the introduction of improved passive safety levels in the railway sector.

RESULTS AND THEIR IMPACT ON THE SECTOR:

This new interior passive safety platform will provide tangible and commercially viable solutions and a systems approach to methodically reduce injuries and fatalities by combining and exploiting in a cost efficient and optimised manner the already well matured railway structural crashworthiness (closely linked with primary collisions events), with injury biomechanics, directly associated with secondary collisions.

LEADING ENTITY:	Newrail
PARTICIPANTS:	Alstom Transport, Association of Train Operating Companies, University of Bolton, Fundación CIDAUT, Deutsche Bahn AG, Institut National de Recherche sur les Transports et leur Sécurité-INRETS, Instituto Superior Técnico, MIRA Ltd., Rail Safety and Standards Board, Siemens AG Transportation Systems, Société nationale des chemins de fer français – SNCF, Association of the European Railway Industries, VÚKV a.s., Bombardier.
CONTACT DETAILS:	Fundación CIDAUT, Mr. Roberto Martín-Macías, +34 983548035, robmar@cidaut.es

ACRONYM AND TITLE:	ARRIVAL: Algorithms for Robust and online Railway optimization: Improving the Validity and reliAbility of Large scale systems http://arrival.cti.gr/		
RESEARCH AREA:	Area 5 – Exploitation, operation and rail system security and safety		
TYPE OF FUNDING:	ARRIVAL is a Specific Targeted Research Project funded by the FET (Future and Emerging Technologies) Unit of the European Commission (EC) — priority IST (Information Society Technologies) — within the 6th Framework Programme of EC, under contract no. FP6–021235–2.		
STARTING/ENDING DATE:	March'2006 – May'2009	BUDGET:	

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

This project were interested in establishing such a new paradigm and considerably advance the current state of algorithmic research by attacking optimization questions in perhaps the most complex and largest in scale (transportation) setting: that of railway systems. Railway optimization deals with planning and scheduling problems over several time horizons. We focus on two important and actually unexplored facets of planning that pose even harder optimization questions: robust planning and online (real-time) planning. These two, tightly coupled, facets constitute a proactive and a reactive approach, respectively, to deal with disruptions to the normal operation.
The main goal was to develop the necessary foundational algorithmic research in order to provide ingenious and sound answers to the fundamental efficiency and quality issues encapsulated in robust and online planning of complex, large-scale systems as those in railways. ARRIVAL focused on two important and actually unexplored facets of planning that pose even harder optimization questions: robust planning and online (real-time) planning. These two, tightly coupled, facets constitute a proactive and a reactive approach, respectively, to deal with disruptions to the normal operation over a short or medium time horizon.It also aimed at developing a thorough understanding of the fundamental issues that make robust and online railway optimization problems hard and to subsequently develop new algorithmic and complexity principles to deal with hardness: *(i) Robust planning* is concerned with the development of an a priori plan that allows the absorption of disruptions to the best possible extend. A robust plan is one that maintains feasibility andasmuchaspossibleofthequalityofanoptimalsolutioninthecaseofdisruptions. Conse¬quently, a quantitative characteristic that we thoroughly investigated was the trade-of between an optimal and a robust plan, called the price of robustness. *(ii) Online planning* is concerned with real-time decision making when, typically unpredictable, disruptions in daily operations occur, and before the entire sequence of disruptions is known. The goal is to react fast, while retaining as much as possible of the quality of an optimal solution, that is, a solution that would have been achieved if the entire sequence of disruptions was known in advance. This set up a quantitative characteristic that we thoroughly investigated, namely the trade-off between the quality of an online and an optimal (in the above sense) plan, which we refer to as the price of recoverability.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Several of the research results produced within ARRIVAL have started to find their way to practice. For instance: (i) fast answering of timetable information queries has been bought by a mobile company, (ii) optimization tools developed for robust timetabling, rolling stock re-scheduling, and crew re-scheduling have been adopted and used in the Netherlands railways, software prototype for computing optimal classification schedules in hump yards in Swiss railways, timetable optimization of Berlin Underground and to optimize the public transport system of other German cities, etc. Moreover, several software tools have been developed. For example, a simulation tool has been built for testing delay resistant timetables and delay management policies in a multi-level stochastic optimization setting, etc. ARRIVAL has been selected by the European Commission as one of the most successful research projects and its results have been presented in a press conference in Brussels Moreover, several news have been published in different media: BBC News, Daily Mail, Zebulon.fr ACM Tech News, TO BHMA To Vima (in pdf), etc.
An volume "Robust and Online Large-Scale Optimization" of the Models and Techniques for Transportation Systems Series in Lecture Notes in Computer Science, Vol. 5868 reflects several research results of the project. The volume is organized in four parts: Robustness and Recoverability, Robust Timetabling and Route Planning, Robust Planning Under Scarce Resources, and Online Planning: Delay and Disruption Management.

LEADING ENTITY:	Research Academic Computer Tecnology Institute (CTI), Grece
PARTICIPANTS:	University of Karlsruhe (UniKarl),Erasmus University Rotterdam (EUR),Eidgenössische Technische Hochschule Zürich (ETHZ),University of L'Aquila (ULA),Department of Mathematics and Computer Science, Technische Universiteit Eindhoven (TUE), Technical University Berlin (TUB),University of Bologna (UniBo),University of Padua (DEI),University of Sevilla (USE),Polytechnic University of Valencia (UPVLC), SNCF
CONTACT DETAILS:	Prof. Dr. Christos Zaroliagis (Project Coordinator): http://www.ceid.upatras.gr/faculty/zaro/, Federico Barber (fbarber@dsic.upv.es) Polytechnic University of Valencia (UPVLC) Site leader

ACRONYM AND TITLE:	Relationship between rail service operating direct costs and speed		
RESEARCH AREA:	Area 5 – Exploitation, operation and rail system security and safety		
TYPE OF FUNDING:	Fees in return for provision of the services (contract for provision of services)		
STARTING/ENDING DATE:	2010-January to 2010-September	BUDGET:	10.000 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The purpose of this study is to establish an approach to the function of rail operating direct costs for passenger transport, focusing on medium and long distance transport, and identifying inducing factors on which such costs depend; and particularly establishing the relationship between operating direct costs and train speed1. This does therefore involve identification and analysis of operating direct costs on passenger services (long distance and regional) by analyzing how they are influenced by factors such as average speed, number of stops, infrastructure features, the size of trains or route configuration. Operating direct costs will be examined excluding costs arising from infrastructure use over the marginal cost; and excluding any commercial costs related to passenger services and ticket sales, which are considered indirect cost. Cost differences exist between countries, and even in the same country costs may evolve differently over time. The study will therefore use orders of magnitude and they will only be specified when data is available from certain specific countries.

RESULTS AND THEIR IMPACT ON THE SECTOR:

As for the content of the report:

a) The definitions needed to define and understand the study will be given first.

b) Operating costs will be identified and classified (into direct and indirect), as well as determining the annual distance covered by each train and its production, which is the divisor of the operating cost unit.

c) Thirdly, we will analyze possible factors inducing each of the items making up operating costs, and possible criteria for allocation of these costs to trains. As a fourth part, we will analyze aviation costs compared to the railway.

d) Previous results are applied to a case example in order to analyze the influence of speed as well as other factors.

e) We will end running the model in several cases to quantify the results, and by presenting the main conclusions.

LEADING ENTITY:	International Union of Railways (UIC)
PARTICIPANTS:	Spanish Railways Foundation (FFE)
CONTACT DETAILS:	Main Researcher: Alberto García Álvarez; albertogarcia@ffe.es Spanish Railways Foundation. C/ Santa Isabel 44, 28012 Madrid

ACRONYM AND TITLE:	2TRAIN.-TRAINing of TRAIN Drivers in safety relevant issues with validated and integrated computer- based technology		
RESEARCH AREA:	EXPLOITATION, OPERATION AND RAIL SYSTEM SECURITY AND SAFETY		
TYPE OF FUNDING:	Public. European Framework Program 6th.		
STARTING/ENDING DATE:	2007 / 2009	BUDGET:	2.5 M€ aprox

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

2TRAIN aimed at two objectives. The first topic was to reach a maximum utilisation of latest computer-based training technology and to develop a modular platform in order to enable an integration of these technological solutions in existing training environments throughout Europe. The second one was to increase the train drivers' competency in crisis management by defining and realising appropriate human factor training scenarios that will be evaluated and validated within the demonstration phase.

Individual European countries differ in national laws, engine technology, signalling systems and rule books. In addition, the general training structure varies. The use of computer based training tools and simulators ranges from an extensive use in some countries to no use at all in other countries. Hence, a complete unification of training contents and training methods will be unachievable. Nevertheless, as Europe grows together and cross-border operations increase there is a strong need to harmonise and coordinate the education of train drivers in those areas where it is possible. This is the aspect 2Train did focus on.

2TRAIN developed a harmonised and integrated computer-based training system that supports common standards and approaches for training of train drivers in Europe. As a consequence the project made a major contribution to safety by improving human factor issues which are the underlying cause of most accidents

RESULTS AND THEIR IMPACT ON THE SECTOR:

2TRAIN created a new concept for training tools that were connected with existing simulation systems and gave the possibility to have a unified assessment system in different countries and railways.

In this sense, the creation of the Common Data Simulation Interface (CDSI), the Virtual Instructor (VI) and the Expert System for the creation of the evaluation rules (ExSys) were a very big step forward in the utilization and expansion of training tools in European Railway

The User Forums during the project showed a very high acceptance level to the new tools and methodology and long time users of simulation systems found them extremely interesting.

LEADING ENTITY:	Coordinator: **IZVW,** Technical Leader: **UPM-CITEF**
PARTICIPANTS:	**IZVW, DB, SCNF, CORYS TESS, KMW, RTI, CD, IJP, UP, UPM-CITEF.**
CONTACT DETAILS:	CITEF, CENTRO DE INVESTIGACIÓN EN TECNOLOGÍAS FERROVIARIAS RAILWAY TECHNOLOGY RESEARCH CENTRE ESCUELA TÉCNICA SUPERIOR DE INGENIEROS INDUSTRIALES UNIVERSIDAD POLITÉCNICA DE MADRID C/. José Gutiérrez Abascal, 2 | 28006 Madrid TEL + 34 91 336 3212 | FAX + 34 91 561 8618 E-MAIL: jesus.felez@upm.es; citef.jmmera@etsii.upm.es; juandedios.sanz@upm.es ;joseantonio.lozano@upm.es WEB: www.citef.industriales.upm.es

ACRONYM AND TITLE:	**HOPE IN STATIONS – Homeless people in European train stations**		
RESEARCH AREA:	Area 5 – Exploitation, operation and rail system security and safety		
TYPE OF FUNDING:	VP/2009/005 Call for proposals for transnational actions on social experimentation		
STARTING/ENDING DATE:	Jan 2010-Dec 2011	BUDGET:	441.782,4 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The Project HOPE IN STATIONS aims to strengthen the integration of Homeless surrounding railway stations, achieving an improvement in social services available to them. Although the problems of these people are no longer on the agenda of state and local social policies, there is a particular situation in the European rail stations, becoming a strategic place for many of these people, making necessary a coordinate action between the actors involved: on one hand the agents commonly involved (local government agencies and NGOs / autonomous regions / state) and on the other hand, managers and administrators of the railway stations. HOPE seeks to coordinate the work of the various stakeholders to develop an approach that works for the welfare and the integration of the Homeless and choose the railway stations as the scene itself to analysis and social experimentation.

RESULTS AND THEIR IMPACT ON THE SECTOR:

To organise cooperation between the different parties involved in the issue of transience, the project plans to appoint a reference authority, either an individual or an organisation or railway authority. The reference authority's coordination aims to improve mutual understanding in everyone involved with wandering people and to make their work better integrated, to make their work more effective and to ensure that the existing methods and resources are put to better use.

A project organised around its participants' creativity

The aim of the Hope in Stations project is to develop innovative services once it has shown how much influence railway stations can have in organising services for wandering people. Giving wandering populations in railway stations alternative, experimental job opportunities so that they can

_ Earn money and regain their dignity,

_ or undertake a traditional integration programme.

These jobs could, for example, be governed by the job assistance framework. To give people who want to work the chance to gain more stable employment, the programme could also offer them training and jobs in railway companies or in retail outlets near railway stations.

A focus on wandering people's participation

In coordination with the project teams and researchers, Hope in Stations puts a particular emphasis on the need to get feedback from wandering people themselves, and to encourage their participation in railway stations and in preparing solutions.

LEADING ENTITY:	ANSA Solidarités Actives – France
PARTICIPANTS:	SNCF La Société nationale des Chemins de Fer, SNCB Holding, Ferrovie dello Stato s.p.s., Stadmission Bahhofsmission, La Strada, Europe Consulting, Osservatorio Nazionale sul Disagio e la Solidarieta nelle stazioni italiane, Polskie kleje paÑtswowe, Spanish Railways Foundation, Zentrum für soziale Innovation, ISFORT, Freek Spinnewijn, FEANTSA, IEP Paris, Yale University
CONTACT DETAILS:	France: Solidarités Actives, Sylvie Le Bars. sylvie.le.bars@solidarites-actives.com Spain: : Spanish Railways Foundation. C/ Santa Isabel 44, 28012 Madrid T: +34 91 151 10 99. reactiva@ffe.es

Area 6

Rail freight transport

I RAIL TECHNOLOGICAL FORUM FOR INTERNATIONALIZATION

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

FUNDACIÓN DE LOS FERROCARRILES ESPAÑOLES

PTFE
Plataforma Tecnológica Ferroviaria Española

FONDO EUROPEO DE DESARROLLO REGIONAL

Unidad de Innovación Internacional · Ferrocarriles

ACRONYM AND TITLE:	TICLOG – Tecnologías de Identificación y Comunicaciones a lo largo de la cadena Logística (Identification and Communication Technologies across the Supply Chain)		
RESEARCH AREA:	Area 6 – Rail freight transport		
TYPE OF FUNDING:	National Public Funding Call (grant and loan) – Plan Nacional I+D+I 2008 - 2011		
STARTING/ENDING DATE:	January '09 / June '12	BUDGET:	1.938.540,17 €

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

The TICLOG project consists of a functional and technical specification of a new system for identification, location and monitoring of rolling stock, containers and cargo, responding to the demands of the Rail Infrastructure Manager and the Rail Operator. It also includes a demonstration to validate the system in a real environment.

The proposed solution is structured in three application levels in order to pave the way for a progressive and seamless implementation, and is based on a combination of RFID (Radio Frequency Identification) technology and radio transmission devices (using Zigbee communication) This combination allows the transmission of both, containers and rolling stock identities (with a unique serial number) and even the status of the cargo through radio communication.

The radio transmission devices add the possibility that a train can detect its own composition (self-composition), which brings enormous advantages to the logistic processes within the terminals. These devices will be installed in every single rolling stock element and container operating in the national railway network, something which will permit its identification from a reasonable distance, and its management within the terminal.

The three levels of application proposed are:

- Level 0: Use of RFID technology for identification and location of rolling stock and ITUs (Intermodal Transport Units) in order to know the identity (UIC number) and location of the resources and the goods, and monitor the operations carried out at the freight terminals.
- Level 1: Use of the radio transmission devices (using Zigbee communication) to achieve the self-composition of the train through the communication between the devices on board each coach and ITU with the hub device on board the locomotive. After that, the transport documents can be automatically prepared by the system.
- Level 2: Use of the radio transmission devices including sensing elements to achieve the monitoring of the state of the rolling stock elements and cargo (monitoring temperature, pressure, etc).

The project includes also the following activities:

- Viability Technology Study: It includes an electromagnetic characterization of the railway environment to define the frequencies in which the RFID equipments and the radio transmission devices have to work to avoid interferences.
- Functional Specifications: They are developed in accordance to the needs and requirements of the final users of the system and the current state of management of the supply chain.
- Technical Specifications: It includes the architecture of the system, the devices and the interfaces between equipments and systems.
- Demonstration on real environment: Using a prototype for each one of the defined levels, a demonstration is performed on some freight trains and on different freight terminals.
- Cost-Benefit Analysis and Implantation Plan.

RESULTS AND THEIR IMPACT ON THE SECTOR:

The expected impact of TICLOG development and the subsequent technology implementation is the improvement of daily procedures currently employed in the traceability, location and control of the rolling stock and cargo. The application of the TICLOG system on the management processes of the supply chain will enable the rail freight transport to achieve higher levels of competitiveness in the freight transport market.

Hence, this new system, by means of the application of RFID technology and Zigbee communications, improves the quality of the service provided by the Infrastructure Manager and Rail Freight Operators to their customers. Some of the most relevant advantages that the system offers are: Improvement of the reliability and traceability, automation of the association processes between rolling stock and cargo, decrease in timeout within the terminals, self-determination of the composition (including coaches and ITUs) of transiting trains, control of the actual position of rolling stock elements, dangerous goods monitoring and improvement of the information sent to the final users.

Based on the final results, future developments will be proposed aiming to achieve the standardization of a new interoperable system for the traceability of goods in the railway sector.

LEADING ENTITY:	INECO
PARTICIPANTS:	ADIF, RENFE, IMA
CONTACT DETAILS:	María José García Prieto (Principal Researcher) mjgarciap@ineco.es INECO – Innovation Area

ACRONYM AND TITLE:	REPLICA - SPANISH NETWORK OF INTERMODAL LOGISTIC PLATFORMS TO IMPROVE THE FREIGHT TRANSPORTATION COMPETITIVENESS AND ENVIRONMENTAL SUSTAINABILITY		
RESEARCH AREA:	Area 6 – Rail freight transport		
TYPE OF FUNDING:	Public		
STARTING/ENDING DATE:	2009/2011	BUDGET:	1.7 Mio Euro

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

Logistics and freight transport are lately developing due to great social changes: a considerable increase in traffic, both at national and international level; a greater competition in the international field; and a decrease in transport costs, among other changes.At the same time a modernization of the companies' productive processes is taking place and the consumer standards are changing. Therefore, the present relationship between production and consumption is becoming more relevant within industrial logistics. The new information and communication technologies must be added to the transport chain and logistics.The freight transport sector in Spain is currently undergoing a process of modernization, both at an organizational and management level and at its infrastructural and supportive level, in order to adapt itself to the new market demands and the EU guidelines.Within this process the need to improve the infrastructure is underlined, but trying to redistribute the modal distribution of the freight transport sector towards a more efficient and more sustainable proportion than the current one.

A fundamental element to achieve these aims is the rational and coordinated development of a national network of supporting Logistic Centers for the freight transport activity which avoids a heterogenic infrastructure proliferation that could cause some problems in exploiting the transport national networks and the creation of territorial inequalities between different productive areas. The current project analyzes the characteristics of the freight transport sector in Spain from the point of view of its relationship with different current complementary infrastructures, to determine the optimal functional characteristics that these infrastructures must fulfill in order to rationalize the management of the freight transport sector is Spain and to design a national coordinated network of Logistic Centers that optimize the freight transport national networks.This network will contribute to the economical, business and social development, both at national and regional level, to promote the transformation of the logistic sector, to help to reduce the dispersion of the freight transport flows, to channel the traffic and to enable the grouping of freight and the loading of vehicles. On the other hand, the intermodal function of these platforms enables the promotion of the transference between transport modes.Furthermore, the demonstration of the appropriate relationship between these intermodal logistic platforms and the ports, as attraction poles and generating of some of the main freight transport flows, leads to an improvement of the national transport system, helping to optimize both costs and operations.

RESULTS AND THEIR IMPACT ON THE SECTOR:

- Determination of the optimal functional characteristics that transport infrastructures must fulfill in order to rationalize the management of the freight transport sector in Spain
- Design of a national coordinated network of Logistic Centers that optimize the freight transport national networks.
- Contribution to the economical, business and social development, both at national and regional level, to promote the transformation of the logistic sector, to help to reduce the dispersion of the freight transport flows, to channel the traffic and to enable the grouping of freight and the loading of vehicles. On the other hand, the intermodal function of these platforms enables the promotion of the transference between transport modes.
- Optimization of both costs and operations of the national transport system.

LEADING ENTITY:	CENIT – Center for Innovation in Transport
PARTICIPANTS:	CENIT – UPC, TRANSyT – UPM ,GIST – UC, SPIM, Universidad de Sevilla,Universidad de Valencia
CONTACT DETAILS:	magin.campos@upc.edu

ACRONYM AND TITLE:	SUSTRAIL, The sustainable freight railway: Designing the freight vehicle – track system for higher delivered tonnage with improved availability at reduced cost		
RESEARCH AREA:	RAIL FREIGHT TRANSPORT / ROLLING STOCK		
TYPE OF FUNDING:	Public. European Framework Program 7th.		
STARTING/ENDING DATE:	June 2011 / May 2015	BUDGET:	€ 9,456,327.73

BACKGROUND AND DESCRIPTION OF WORK SYNOPSIS:

A sustainable and efficient freight transport in Europe plays a vital role in having a successful and competitive economy. Freight transport is expected to grow by some 50 % (in tonne-kilometres) by 2020. However rail, in many areas, has been displaced from a dominant position since road transport services have grown and developed in capability and levels of sophistication that have not been matched by rail service providers.

SUSTRAIL aims to contribute to the rail freight system to allow it to regain position and market. The proposed solution is based on a combined improvement in both freight vehicle and track components in a holistic approach aimed at achieving a higher reliability and increased performance of the rail freight system as a whole and profitability for all the stakeholders.

The SUSTRAIL integrated approach is based on innovations in rolling stock and freight vehicles (with a targeted increased in speed and axle-load) combined with innovations in the track components (for higher reliability and reduced maintenance), whose benefits to freight and passenger users (since mixed routes are considered) are quantified through the development of an appropriate business case with estimation of cost savings on a life cycle basis. In fact, a holistic approach to vehicle and track sustainability has to be taken, since improvements in track design and materials alone are not enough as demands on the rail system increase.

RESULTS AND THEIR IMPACT ON THE SECTOR:

Strategic Impact: A sustainable and efficient freight transport in Europe plays a vital role in having a successful and competitive economy, in meeting consumer demands and in creating a considerable number of jobs and wealth for European citizens. Freight transport is expected to grow between 2000 and 2020, in line with forecasts in the Commission White Paper entitled '*European transport policy for 2010: time to decide'* (COM(2001)0370). This growth of freight travel is explained by changes in intercontinental trade and a decrease of barriers within the European continent. According to the ERRAC Strategic Railway Research Agenda 2020, the freight market is changing with the changing focus of the European economy. In this framework, SustRail will have an impact to improve the performance of freight rail by implementing a combined approach to innovation in rolling stock by developing advanced vehicles components and subcomponents concepts using innovative materials and production processes and benefiting from economies of scale and adaptability to change and reduction of complexity and diversification of currently available products. SustRail will finally deliver the ideal combination of novel freight vehicle design coupled with novel sustainable track concepts with respect to the project core pillars of sustainability, competitiveness, and availability. *System impact:* Sustrail through his activities will lead to reduced maintenance cost and, as a consequence, to potential improvements is system reliability, which will free up capacity for freight at the times when maintenance is normally carried out. Its approach is to use condition monitoring of the total performance of both vehicle and infrastructure to support the maintenance activities made within the whole system. Higher system reliability and the integration of smarter functionality in the system can help to prevent accident, collisions and derailments, having an impact on the safety related aspects vehicle/track interaction. *Socio-economic and environmental impact:* Extending the life, durability, safety and reliability of railway infrastructures can lead to massive economic savings, which, indirectly, will stimulate economic growth. By achieving the SUSTRAIL objectives, there are many socio economic benefits that can be achieved through higher availability, less accidents and derailments of vehicles, increased life of both wheel and rail due to the decreased wear through better utilization of the equipment. Other benefits are achieved because through the success of SUSTRAIL more goods will get off roads and onto railways, which is an important and needed step in developing a more sustainable transportation system.

LEADING ENTITY:	TRAIN
PARTICIPANTS:	TRAIN, NR, NRIC, ADIF, BDZEAD, LUCCHINI, MERMEC, GCLAS, MARLO, AFER, DAMILL, TATA STEEL, ECOPLAN, VTU, UNEW, LTU, MMU, TUB, UNILEEDS, USHD, UPM, KTH, POLIMI, SPT, GTU, UIC, UNIFE, SIRV
CONTACT DETAILS:	CITEF, CENTRO DE INVESTIGACIÓN EN TECNOLOGÍAS FERROVIARIAS RAILWAY TECHNOLOGY RESEARCH CENTRE, ESCUELA TÉCNICA SUPERIOR DE INGENIEROS INDUSTRIALES, UNIVERSIDAD POLITÉCNICA DE MADRID C/. José Gutiérrez Abascal, 2 | 28006 Madrid / TEL + 34 91 336 3212 | FAX + 34 91 561 8618/ E-MAIL: jesus.felez@upm.es; citef.jmmera@etsii.upm.es; juandedios.sanz@upm.es ;joseantonio.lozano@upm.es WEB: www.citef.industriales.upm.es