FOSTER RAIL

Future of Surface Transport Research Rail

Coordination and Support Action

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Deliverable D6.5

Evaluation of finalised projects with clear understanding of the market uptake mechanism

WP	6	Monitoring to improve rail research innovation
Task	6.2	Evaluation of past rail projects

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[1] Dissemination level: **PU** = Public, **PP** = Restricted to other programme participants (including the JU), **RE** = Restricted to a group specified by the consortium (including the JU), **CO** = Confidential, only for members of the consortium (including the JU)

[2] Nature of the deliverable: **R** = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

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Executive Summary

An important part of the FOSTER RAIL project is the monitoring of rail research activity. Previously, the rail sector did not know the market impact of previous research and a great deal of research funding has been wasted on research that has had no demonstrable impact. This needed to change and ERRAC Evaluation Working Group (EWG) continued to evaluate completed rail projects within Task 6.2 of FOSTER RAIL project.

This Deliverable presents the overall results achieved within Task 6.2 during the duration of Foster Rail project (months 1 to 36), and describes the market impact evaluation of previous rail research.

The methodology is described including the selection of the projects to be evaluated, it is important to make sure that the projects have had an opportunity to have an impact to have been successfully disseminated and therefore the projects have to have been completed and finalised usually for at least 3 years. The fact that project are finished does create difficulties in contacting the people who know about the projects, but this is essential to ensure that the results of previous rail research is not.

The ***evaluation methodology*** is based on the analysis of project results and deliverables, together with a set of interviews to project participants and other stakeholders, aimed at determining the actual implementation and market uptake of the project results by the rail sector once the work has ended.

Once an evaluation is done, the impact is available and can be used by follow-on projects and taken into account in future research. The recording of past research helps to improve the effectiveness of the ERRAC rail roadmaps by preventing duplication of previous research and identifying the gaps in future research.

As a result of the evaluation related to the key questions, the market uptake is determined and the presentation is completed in the final slides with the evaluation's conclusions, in particular:

- *Reasons for Outcome;*
- *Lessons Learnt.*

The evaluation activity in Foster Rail project builds on the previous work of the Evaluation Working Group, continuing and developing its tasks. The development and administration of ***ERRAC rail research database*** is an important activity within WP6, essential to support the evaluation of past research and achieve its main objectives.

WP6 has undertaken 32 project in the timescale of the FOSTER Rail project, completed 27 evaluations and has 5 ongoing project evaluations at various stages of completeness. The completed evaluations have added to the previous EWG evaluations, meaning that 87 projects have been evaluated by ERRAC since 2006.

From WP6, ERRAC Evaluation Working Group (EWG) has developed guidelines to provide ERRAC Work Package leaders, and others who are proposing research topics, activities and actions at National and European level, with the information needed to ensure strong market uptake. This has resulted in improvement in the impact of the rail research proposed by ERRAC.

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1. Introduction

The Foster Rail project has been developed to assist ERRAC and other land-transport related ETPs to define future research needs for their strategies and programmes, so as to realise the Objectives of the Europe 2020 Strategy and work towards the aims of the White Paper 2011[3].

The CSA project itself comprises 8 Work Packages which, including project management and dissemination activities, interact to; enhance cooperation and communications between ETP, national platform and the Shift²Rail Joint Undertaking, define the a rail business scenario for 2050, assess existing strategies and roadmaps, develop these further to contribute to 2050 strategy fulfilment, assess the strategic and innovative impact of previous and new funded projects and programmes in terms of market impact and uptake. Work Package 6 (WP6) “Monitoring to improve rail research innovation” undertakes specifically the final actions mentioned.

WP6 (in both current Foster Rail and previous ERRAC Road Map projects) supports the ERRAC Project Evaluation Working Group (EWG). It addresses the strengthening of the effectiveness of research and innovation capacities of the rail sector in Europe by determining the implementation of previous research and monitoring of rail research projects from relevant programmes.

The EWG has previously used the evaluation method developed to evaluate 87 projects from over 170 projects in the ERRAC rail projects database, which is continuously enlarging.

The EWG helps to identify, check and support proposals that clearly fill a gap in the roadmaps and support ERRAC strategy particularly for strategic proposals for the good of the sector.

Previously, the rail sector did not know the market impact of previous research and a great deal of research funding has been wasted on research that has had no demonstrable impact. This needed to change.

WP6 of Foster Rail aids this effort through 3 Tasks:

- T6.1 Monitoring of Ongoing relevant Projects
- ***T6.2 Evaluation of Past rail projects***
- T6.3 Case Studies

Deliverable 6.5 report presents the overall results achieved within Task 6.2 only, during the whole duration of Foster Rail project (months 1 to 36).

This deliverable focuses on the market impact of previous rail research to improve use of research funding and to ensure a strategic approach to the prioritisation of rail research.

The selection of the individual projects is described as is how they are evaluated using the evolved methodology. It is important to make sure that the projects have had an opportunity to have an impact to have been successfully disseminated and therefore the projects have to have been completed and finalised. The fact that project are finished does create difficulties in contacting the people who know about the projects, but this is essential to ensure that the results of previous rail research is not. Once an evaluation is done the impact is available and can be used by follow-on projects and taken into account in future research. The recording of past research helps to improve the effectiveness of the ERRAC rail roadmaps by preventing duplication of previous research and identifying the gaps in future research.

[3] “Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system”

2. Objectives

During the past years and previous Framework Programmes, a great number of important railway research projects have borne fruit. Additionally, out with the Framework Programmes, valuable work has been carried out on a national level, in private and public settings, within the major European organisations. When analysing the present situation of the rail transport system and thinking about possible ways of improvement, it is not easy to be fully aware of all relevant research carried out to date. As consequence valuable research results are lost and the risk of redundant results in new projects is significant. Building on previous experiences is difficult.

The ERRAC EWG plays an advisory role for European and national projects ideas in terms of market uptake or implementation, as it evaluates finished projects and analyses their success/failure factors and market uptake in order to communicate this information to the stakeholders in general.

The main objectives[4] of the ERRAC EWG are:

1. To provide essential information to stakeholders and roadmap producers on lessons learnt from the evaluation of past projects to promote a more systemic and focused approach to the use of funding resources and to enhance real market uptake of project results.

2. To provide a database of evaluations of previous European projects to support the ROADMAPS Work Packages and ensure that lessons from valuable research undertaken in the past are not forgotten.

Within these two broad objectives, further objectives can be highlighted:

- To determine the market impact of previous rail research, in order to improve use of research funding;
- To ensure a strategic approach to the prioritisation of rail research Project Evaluation;

The EWG coordinates among different stakeholders to carry out the important information needed for the sector in terms of R&D. The goal of this Foster Rail deliverable is to improve the methodology in order to scrutinise and assess the contribution of projects (starting, ongoing, and finished) to the ERRAC ROADMAPS and SRRA goals.

Foster Rail WP6 Objectives:

- Help to identify, check and support proposals that clearly fill a gap in the roadmaps and support ERRAC strategy particularly for strategic proposals for the good of the sector.
- Monitor on-going rail projects to validate their progress towards the impacts promised in the proposal.
- Evaluation of finalised projects
- Management of all relevant information concerning monitoring innovation aspects, achieved results, and review of all research projects and evaluations see to it that all are be brought together in a common database, open to stakeholders and roadmap producers.
- Organisation of workshops to foster innovation aspects.

Specifically, the Foster Rail Task 6.2 Objectives:

- To ensure that the result of previous rail research can be taken into account for future projects, improving the effectiveness of the rail roadmaps
- To avoid weak market uptake of results by learning the lessons of previous research

[4] Evaluation Working Group -ERRAC Roadmaps WP06 - PRELIMINARY REPORT, MARCH 2012

- For the EWG to provide intelligence based on the project evaluations for input into future European Framework Programmes.

The body of this report will explain how this work has been initiated and carried out within the Foster Rail project on determining the impact of past European research projects. The EWG evaluates completed projects from the ERRAC database which has details of all Rail-related past and current rail research funded by the European Commission. A methodology has been developed to evaluate the market impact of projects and assess the contribution of evaluated projects to the ERRAC ROADMAPS and Strategic Rail Research Agenda (SRRA) goals. This information provides inputs to EC Project officers during the negotiation phase and during the course of the projects for project review. EWG has evaluated successfully completed rail research projects in order to analyse the success/failure factors related to actual market uptake and determine market uptake from an industry perspective in order to determine the return on research investment.

3. Methodology

The overall EWG philosophy and WP6 methodology are summarised in below Figure 1.

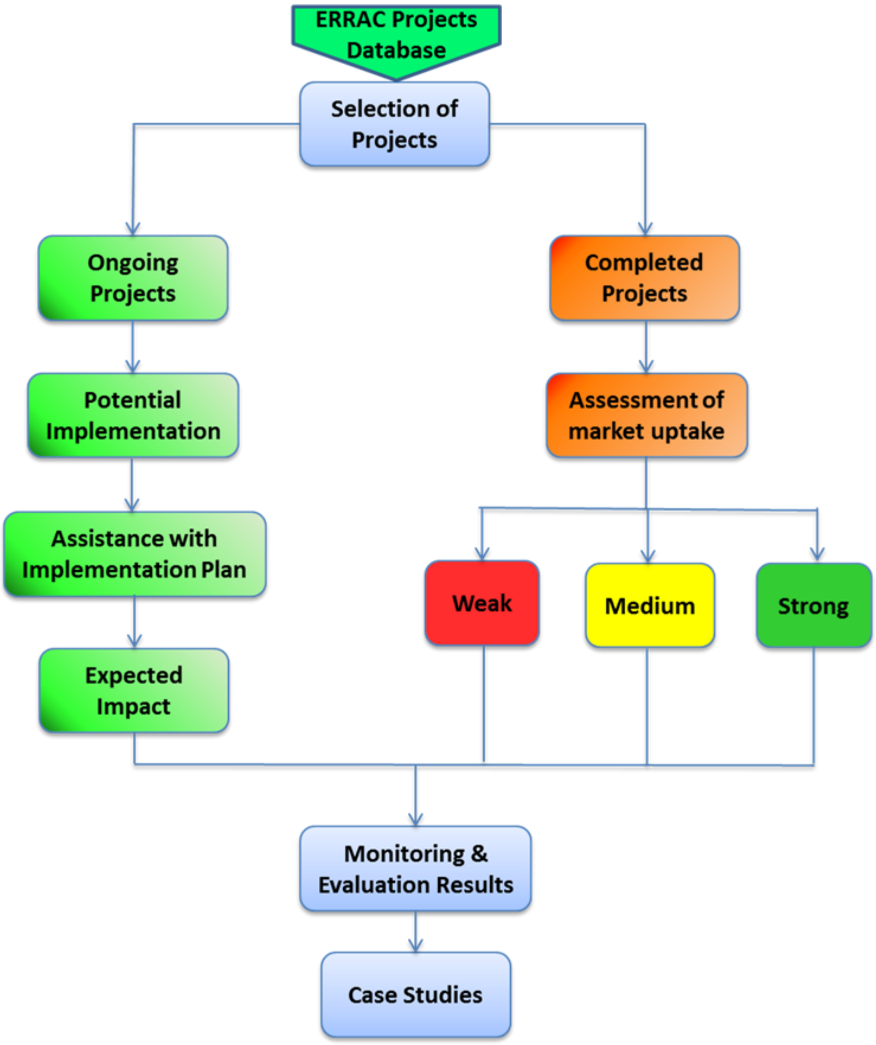

Figure 1 ERRAC EWG general methodology (monitoring and evaluation)

Overall, the WP6 focuses on the following **key activities:**

- Monitoring of ongoing projects
- ***Evaluation of past research***
- Case studies

In order to support the main above activities, WP6 has to carry out **other activities**, namely:

- ✓ *Administration of ERRAC projects database;*
- ✓ *Dissemination;*
- ✓ *Coordination with project coordinators and the EC.*

The ***evaluation methodology*** is based on the analysis of project results and deliverables, together with a set of interviews to project participants and other stakeholders, aimed at determining the actual implementation and market uptake of the project results by the rail sector once the work has ended, according to the following definitions/criteria:

- ***Strong Market Uptake:*** A project is evaluated with a strong market uptake if there is clear evidence of use of products or services, processes, dissemination of knowledge, tools etc. in several countries/products and the major objectives of the project have been implemented. These projects will sometimes lead to additional research to realise their full market potential.
- ***Medium Market Uptake:*** A project is evaluated with medium market uptake if there is some evidence of use of products, services or processes, or a limited dissemination of knowledge, tools etc. in a few countries or products. If only a small proportion of a project has some market uptake, the project as a whole is considered to have a medium market uptake. A follow up project may be necessary in some cases.
- ***Weak Market Uptake:*** A project is evaluated with a weak market uptake if no known use of products, services, processes, knowledge, tools etc. has been identified anywhere. No follow up project is needed unless the reason for the market uptake failure is clearly understood and removed.

The evaluation is prepared as a presentation, using a ***project evaluation template*** to provide the EWG with guidance in evaluation of the past project. The presentation comprises the following ***main parts:***

I. Fundamental Information;
II. Project Background;
III. Evaluation;
IV. Conclusions of the Evaluation.

I. Fundamental Information

The first slide sets the scene offering relevant information on ERRAC, in general, and the EWG and its evaluation activities, in particular.

This is followed by specific project information, a summary cover slide that needs completing with the following information:

- *Project Acronym – contains Project denomination in Acronym form as used in FP Project;*
- *FP – the Framework Programme under which the Project is funded: FP 4, 5, 6 or 7 or eventually H2020;*
- *Programme Acronym – as in the call which enabled the project funding;*
- *Project Reference;*
- *Call identifier – as in the FP programme which funded the project;*
- *Total Cost – the total cost of the project consisting including both the EU contribution and the co-funding invested by participating partners;*
- *EU Contribution – the total amount of EU contributions for the project;*
- *Timescale – the starting and ending dates of the project;*
- *Project Coordinator (name and organisation);*
- *Web references – links of the project website and other relevant databases where the project may be registered;*
- *Presented by: - the expert who prepared the evaluation;*
- *Date evaluated – when the project was presented and evaluated;*
- *Market uptake – the level of market uptake, as agreed by the members of the EWG (S – Strong, M – Medium, or W – Weak);*
- *Follow on projects: Acronym(s) of such projects, if any;*
- *Other related projects: Acronym(s) of such projects, if any.*

The next slides present key information with respect to the project's foundation and development, namely:

- *Premise*
- *Rationale;*
- *Main Objectives.*

This is followed by information on the project consortium, i.e., the list of partner organisation, coordinator and contacts' details, completing thus the administrative data.

II. <u>*Project Background*</u>

The following part of the presentation consists of the ***background information*** for supporting the evaluation, and is based both on the documentation gathered by the expert preparing the evaluation and on the interviews. The background is structured in the following sections:

- *Partners Interviewed* - a slide showing the persons which were interviewed about the project's results and implementation;
- *Project Description* – a comprehensive description of the project activities;
- *Achievements* – the project's claimed results and potential implementation.

III. <u>*Evaluation*</u>

This part includes the project evaluation slides, which are completed with respect to the 12 key questions, based both on the facts identified by the evaluator expert and on the set of interviews with the projects' partners. ***The interviews*** carried out by the EWG members for the project evaluations are based on a set of questions, which are directed towards the past project participants and/or potential beneficiaries of the project results.

The first two questions relate to actual results of the project:

> *1. Were the results implemented in the design of new products and services? Were these new products/services put into commercial operation?*
>
> *2. Is new legislation and/or standardisation based on findings from this research project?*

The following questions assess the scale of the impact (if any):

> *3. Are the results implemented across Europe or only in a small number of Member States?*
>
> *4. Were the results of the project implemented outside Europe before being accepted in Europe?*

The next questions define how the impact is realised and if/how competiveness is improved, and try and determine the qualitative and quantitative impacts:

> *5. Did the project increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?*
>
> *6. Did the project increase competitiveness of railway transportation compared to other transport modes?*
>
> *7. Are the results of the project taken into consideration when preparing public tenders?*
>
> *8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?*
>
> *9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?*
>
> *10. Can benefits be assessed in financial terms?*
>
> *11. Applicability of results to future scenarios?*
>
> *12. Are the results useful for future and new projects (incl. modelling)?*

IV. Conclusions of the Evaluation

As a result of the evaluation related to the key questions, the market uptake is determined and the presentation is completed in the final slides with the evaluation's conclusions, in particular:

- *Reasons for Outcome;*
- *Lessons Learnt.*

The evaluation activity in Foster Rail project builds on the previous work of the Evaluation Working Group, continuing and developing its tasks. The development and administration of ***ERRAC rail research database*** is an important activity within WP6, essential to support the evaluation of past research and achieve its main objectives.

The database also contains the results of the evaluations carried out by the Evaluation Working Group. All rail research information related to finalised and ongoing projects is targeted and gathered for the monitoring and evaluation activities.

The ERRAC projects' database was initially developed and further completed within the ERRAC Roadmaps project. The results of the evaluations carried out (including market uptake, reasons for outcome and lessons learnt) were later added in a separate section to the database, and it was completed with more options, versions and facilities.

The development of the internal ERRAC database consisted of the following ***main activities:***

1. Identification of rail research projects – the main source of information was the official website of the European Commission, but a wide number of projects were known and directly suggested by the members of ERRAC Evaluation Working Group. Although just projects entirely dedicated to rail topics were initially considered, the database was enlarged afterward with other projects focusing on different topics (freight and logistics, urban mobility, etc.) and connected in a certain degree to rail sector.
2. Gathering of information – a summary of essential data related to each project was captured from reliable sources such as projects' official websites, European Commission website, other organisations involved in the rail/transport data management (TRKC, UIC, TRIP, etc.)
3. Filling the database – the information gathered on rail research projects was structured and categorised in a specific template which was developed. The Excel spreadsheet format was initially selected for managing all the information; multiple spreadsheets were further developed and used to populate the database.
4. Development, maintenance and update – the database was continuously developed and improved according to the specific activities and requirements of the Evaluation Working Group. The information had to be periodically updated, considering new identified European funded projects, and the outcomes of the evaluations made on the finalised projects.

4. Evaluation of past projects

ERRAC Evaluation Working Group (EWG) has selected and initiated the evaluation process of 32 past projects as the main activity within task 6.2 since the WP6 kick off within Foster Rail project.

After 36 months, the EWG has finalised the market uptake evaluation of 27 completed projects and other 5 evaluations are still ongoing.

4.1. Finalised evaluations

The evaluated projects and the overall evaluation results obtained for each to date are briefly summarised below.

TIGER Transit via Innovative Gateway concepts solving European Intermodal Rail needs

TIGER DEMO Trans-Rail Integrated Goods European-Express Routes Demonstrators

UNEW (Dan Otteborn and Cristian Ulianov) prepared the documentation for the evaluation of the **TIGER** project and its follow up, the pilot action **TIGER DEMO**, which aimed to develop a feasible European Intermodal Rail solution to EU ports and road congestion, by introducing a new business model via dry ports. The reduction of port congestion through dry ports & hinterland innovative distribution models and a better utilisation of existing resources aimed to increase the capacity on existing rail lines, reduce the costs and transit time. After the evaluation, it was concluded that these projects have a ***strong market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

CANTOR Coordinating Noise Transportation Research and Engineering Solutions

UNEW (Dan Otteborn) prepared the documentation for the evaluation of the **CANTOR** project, which aimed to enhance the knowledge and disseminate information on noise pollution. More specifically, the main aim was to engage experts from the vehicle manufacturing industry chain, from system to component level, government agencies and renowned research groups, and to focus jointly on improved performance with a reduced impact on the environment, enabling a balanced system cost and maintaining comfort in road, rail and waterborne vehicles. After the evaluation, it was concluded that this project has a ***weak market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

NEWOPERA New European Wish: Operating Project for a European Rail Network

UNEW (Dan Otteborn) prepared the documentation for the evaluation of the **NEWOPERA** project, which aimed to contribute to invert the declining trend of EU railways by implementing the introduction of the dedicated rail freight networks concept, backed by a sound socio-economic and environmental assessment, and set up sound methodologies for the distribution of traffic flows over railway networks. After evaluation, it was concluded that this project has a ***strong market uptake*** (detailed evaluation in (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

INMAR Intelligent Materials for Active Noise Reduction

UNEW (Dan Otteborn) prepared the documentation for the evaluation of the **INMAR** project, which aimed to develop new complex multifunctional passive, semi-active and active materials, material structures and technologies for active noise reduction. After evaluation, it was concluded that this project has a ***strong market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

InteGRail Intelligent Integration of Railway Systems

UNEW (Dan Otteborn) prepared the documentation for the evaluation of the **INTEGRAIL** project, which aimed at developing an Intelligent Coherent Information System by integrating the main railway systems. The objective was to achieve a higher level of coordination and cooperation between the key railway processes. The benefit will be higher levels of performance (in terms of capacity, average speed and punctuality), safety and optimised usage of resources. After evaluation, it was concluded that this project has a ***weak market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

INESS Integrated European Signalling System

UNEW (Dan Otteborn) prepared the documentation for the evaluation of the **INESS** project, which aimed to define and develop specifications for a new generation of interlocking systems, and extend and enhance thus the standardisation process according to the current European policies. The specific technical objectives were:

- To define a common kernel of validated standardised functionalities for future interlockings;
- To propose one or more standardised system architectures and the relevant functional interface with the adjacent subsystems optimised for ERTMS L2 and L 3;
- To develop a common business model and the associated business cases and cooperation models to support intelligent migration strategies for ERTMS;
- To develop a road map (exploitation plan) towards interoperable, standardised interlocking platforms, and implement the concept of self-aware intelligent trains.

The Evaluation Working Group has concluded that the project has a ***medium market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

CarCIM Integration of Two-Component Ceramic Injection Moulding for Large-Scale Production of Novel Multifunctional Ceramic Components for Automotive and Railway Applications

UNEW (Mark Robinson) prepared the documentation for the evaluation of the **CarCIM** project, in relation with the market uptake in the rail sector (the project addressed solutions for automotive industry, as well). The project was designed to develop and test prototypes produced by 2 component ceramic injection moulding (2C-CIM) and demonstrate the capability of low-cost, large-scale shaping of complex ceramics. The project resulted in four 2C-CIM prototype parts, which were tested and assessed. One of the prototypes was relevant to rail sector, the ceramic braking pads for high speed trains.

The evaluation concluded that this project had a ***weak market uptake*** with respect to the envisaged implementation in the rail sector (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

CALM Community Noise Research Strategy Plan

CALM II Advanced Noise Reduction Systems

UIC (Dennis Schut and Axel Gougelet) prepared the documentation for the evaluation of the **CALM** project and its follow up, **CALM II**. The CALM project aimed to establish a new thematic network to define a strategic plan for future noise research which is required to promote EU wide noise reduction and to improve the quality of life in Europe, in order to support the further development of the EU noise policy. The overall strategic objective of the follow-up project was to synchronise and encourage the European transport noise research through a holistic system approach involving all related research areas. CALM II was designed to facilitate the networking of organisations, the coordination of activities and the exchange and dissemination of knowledge so as to optimise research efforts, reach critical mass, strengthen the complementarity and coherence of noise research objectives and enhance the impact at a European level.

The Evaluation Working Group evaluated the projects and agreed that they had a ***strong market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

BRAVO Brenner Rail Freight Action Strategy Aimed at Achieving a Sustainable Increase of Intermodal Transport Volume by Enhancing Quality, Efficiency and System Technologies

UNEW (Thomas Zunder and Cristian Ulianov) prepared the documentation for the evaluation of the **BRAVO** project, which aimed to develop and demonstrate an action strategy on intermodal rail-road transport services on the Brenner corridor (the link München – Kufstein – Brenner – Verona), comprising major scientific and technological as well as pragmatic activities. This strategy primarily laid the foundations for achieving a significant and sustainable increase in intermodal volume on the Brenner corridor, but over and above that, a blueprint applicable to other pan-European freight corridors. This action strategy was a most important prerequisite in leading intermodal transport on the Pass out of the current inhibition of growth.

The Evaluation Working Group has concluded that the project has a ***strong market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

MODURBAN Modular Urban-guided Rail Systems

TMB (Michael Pellot) prepared the documentation for the evaluation of the **MODURBAN** project. The main target of the project was to design, develop and test an innovative and open common core system architecture and its key interfaces (including command control, energy saving and access subsystems), paving the way for the next generations of urban-guided public transport systems. This approach was aimed to be applied to new lines, as well as the renewal and extension of existing lines, and encourage cost-effective migration from driver to driverless operation. With regard to passenger information and exchange at platforms, the objective was to harmonise the displays and push buttons as much as possible, as well as the operational procedures. Moreover, MODURNAN aimed to develop various energy saving methods (e.g., optimisation software, lightweight materials).

The Evaluation Working Group has concluded that the project has a ***medium market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

MODSAFE Modular Urban Transport Safety and Security Analysis

TMB (Michael Pellot) prepared the documentation for the evaluation of the **MODSAFE** project, which aimed to provide for the first time a coherent and agreed overview of all related aspects of urban rail safety analysis in Europe from hazards identification to safety response measures management in all its components.

MODSAFE objective was to provide a guidance on how to deal with the diversities of European countries, in order to define find a common European approach of safety management, in order to cover all issues and to reduce the efforts and manpower needs, even for a first certification.

The Evaluation Working Group has concluded that the project has a ***medium market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

ERRVIN Managing the dynamic interaction between the vehicle and the infrastructure

Chris Brown (DfT UK) prepared the documentation for the evaluation of the **ERRVIN** project, which was a preparatory, accompanying and support measure. The project it accompanied was FOOTPRINT (a Eureka project), where the practical technical research was carried out. ERRVIN (the European Road and Rail Vehicle-Infrastructure Network) was set up to consider the dynamic interaction of a road or rail vehicle with its infrastructure and discuss solutions that will reduce the environmental and economic impact of freight traffic. The overall objective of the ERRVIN project was to reduce the environmental impact of road and rail transport through a more thorough understanding of the dynamic interactions of a vehicle with its infrastructure.

The ERRVIN projects was evaluated by taking into consideration the successful implementation of the FOOTPRINT project results. The Evaluation Working Group has concluded that the project has a ***strong market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

EUDD European Driver’s Desk

EUDDPlus European Driver´s Desk Advanced Concept Implementation

UIC (Axel Gougelet and Dennis Schut) prepared the documentation for the evaluation of the **EUDD** project and its follow-up, **EUDDPlus.**

This lack of harmonisation in train driver’s workplaces hinders seamless rail traffic across Europe and thus reduces the efficiency of international rail operation. The great variety of train driver’s desk layouts does not only concern the Train Operating Companies (TOCs) but also the suppliers who had to develop dedicated driver’s desk solutions for each of their customers and are therefore not able to profit from “economies of scale”. This situation finally impacts the competitiveness of the rail system towards other modes of transport.

EUDD aimed to support cross-border rail transport in Europe, by reducing barriers between the EU Member States through a uniform technology and interoperability. The EUDDplus project aimed at the development, on-field testing and validation of the interoperable, harmonised and modularised train driver’s desk. EUDDPlus was the logical and necessary link between the EUDD project and the large-scale exploitation of the driver’s desk concept, advanced in ergonomics, safety and life cycle costs (LCC).

The Evaluation Working Group has concluded that these projects have a ***strong market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

URBANTRACK Urban Rail Infrastructure

UNEW (Cristian Ulianov) prepared the documentation for the evaluation of the **URBANTRACK** project, which aimed to deliver an integrated series of modular track infrastructure solutions at low cost, with no or little maintenance, high availability, constant comfort and ensuring great punctuality, all this in an environmentally friendly and safe manner. In order to reach these objectives, quality and attractiveness of the tracks have to be increased and new technologies and standardisation (harmonisation) have to be introduced in the process.

The Evaluation Working Group has concluded that the project has a ***medium market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

MODTRAIN Innovative Modular Vehicle Concepts for an Integrated European Railway System

UNEW (Dan Otteborn) prepared the documentation for the evaluation of the **MODTRAIN** project, which had the scope to define and prove the necessary functional, electrical and mechanical interfaces, and validation procedures necessary to deliver the range of interchangeable modules that will make the next generation of inter-city trains and universal locomotives possible. The principal elements addressed by the MODTRAIN Integrated Project were:

- the running gear (MODBOGIE)
- the train control architecture (MODCONTROL)
- the on-board power systems (MODPOWER)
- the man-machine and train-to-train Interfaces (MODLINK).

To fulfil the objectives defined in the ERRAC agenda and in the two European railways packages, the MODTRAIN consortium proposed to carry out the R&D activities to help achieve the following targets:

1. A reduction of up to 10% in average cost per passenger per km (pkm) /tons per km (tkm);
2. 30% increase in the productivity of the new rolling stock and an increase of the percentage of service proven components built into 40-50% closer to the 80-90% found in the aerospace and automotive industries;
3. A marked reduction in bidding costs (estimated at up to 25% at the end of the process) due to increased modularisation of train architecture.

The Evaluation Working Group has concluded that the project has a ***strong market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

LOCOPROL Low Cost Satellite Based Train Location System for Signalling and Train Protection for Low Density Railway Lines

UNEW (Cristian Ulianov) prepared the documentation for the evaluation of the **LOCOPROL** project, which aimed at developing an innovative low cost signalling system, responding to the functional operational needs and meeting the safety regulations of the medium size railway lines. Main objectives:

- to define a new multi-technology location system based on satellite positioning combined with fail-safe on-board track mapping and interlocking;
- to study and prove its application to ERTMS/ETCS;
- to study and prove its short term applicability in Low Density Traffic Lines;
- to study its applicability in order to increase track side workers protection;
- to prove that a satellite positioning device may be included or associated with ERTMS equipment taking into account the hardware architecture aspects and the functional compatibility.

The Evaluation Working Group has concluded that the project has a ***weak market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

WIDEM Wheelset Integrated Design and Effective Maintenance

UNEW (Cristian Ulianov) prepared the documentation for the evaluation of the **WIDEM** project, which aimed to improve efficiency and competitiveness through a fundamental re-examination of wheelset design, which in turn will facilitate improved maintenance practices. Combining inputs from reliable service measurement of wheel-rail forces carried out by means of an innovative instrumented wheelset and extensive assessment of actual material properties, an original endurance strength design concept was developed and validated through a comprehensive testing programme on full scale wheelset prototypes.

The Evaluation Working Group has concluded that the project has a ***strong market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

ISTU Integrated Standard Transportation Unit for self-guided freight container transportation systems on rail

UNEW (Dan Otteborn) prepared the documentation for the evaluation of the **ISTU** project, which focused on the design and specification of a two-container wagon for terminal applications based on a speed of up to 50 km/h with a diesel-electric power supply unit to provide an autonomous integrated electrical propulsion system. The chosen technology would have been extended to all major future eco-efficient systems.

The Evaluation Working Group has concluded that the project has a ***weak market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

EMSET Eurocab Madrid-Seville European tests

UNEW (Dan Otteborn) prepared the documentation for the evaluation of the **EMSET** project, which aimed to perform a first step towards the functional validation of the on-board ERTMS sub-system, including the interoperability - via several STM (Specific Transmission Modules) - with some main existing systems used on the European High Speed lines and Trans European Network. It dealt with all the activities related to the tests that were carried out first in Laboratory and later on the Madrid-Seville line. The project was divided into different contracts, corresponding to several phases dealing with the planning and specification of the tests, preparation of the line and rolling stock, development of test tools, test of Eurocab prototypes and test of STMs for interoperability with existing national systems.

The Evaluation Working Group has concluded that the project has a ***strong market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

HYCOTRANS Hybrid composite structures for crash worthy bodyshells, containers and safe transportation structures

UNEW (Cristian Ulianov) prepared the documentation for the evaluation of the **HYCOTRANS** project, which focused on the development of composite sandwich panels for rail vehicle body-shells and other passenger transportation structures. The research responded to a requirement for lightweight, impact absorbent materials to replace the use of metals in such applications.

The HYCOTRANS project was evaluated in relation with its follow-up projects, HYCOPROD and DE-LIGHT, and considered the implementation of outcomes of all these projects.

The Evaluation Working Group has concluded that the project has a ***medium market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

HYCOPROD Design of an advanced composite production process for the systematic manufacture of very large monocoque hybrid sandwich structures for transport sectors

UNEW (Conor O'Neill) prepared the documentation for the evaluation of the **HYCOPROD** project, which aimed at designing an advanced composite production process for the static manufacture of very large monocoque hybrid composite sandwich structure for the transportation sector. The design was successful and a prototype was manufactured.

The HYCOPROD project was evaluated in relation with its follow-up project, DE-LIGHT, and considered the implementation of outcomes of both projects.

The Evaluation Working Group has concluded that the project has a ***medium market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

DE-LIGHT Complex lightweight modules for ships and railway will be developed using risk based design methods

UNEW (Mark Robinson) prepared the documentation for the evaluation of the **DE-LIGHT Transport** project in relation with the market uptake in the rail sector (the project addressed solutions for other modes, as well).

The lightweight, crashworthy cab that was developed in DE-LIGHT Transport contained a number of innovations compared to more traditional designs. These included a modular construction, an energy absorbing nose section, lightweight concepts for the main crash energy absorbing devices, and the use of an integrated composite sandwich for the main cab structure. A full-scale prototype of the lightweight crashworthy cab was manufactured (right). This realised significant savings in both mass (up to 50%) and part count (up to 40%).

The Evaluation Working Group has concluded that the project has a ***medium market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

RAILECT Development of an ultrasonic technique, sensors and systems for the volumetric examination of alumino-thermic rail welds

UNEW (Mark Robinson) prepared the documentation for the evaluation of the **RAILECT** project, which aimed to produce a "clamp-on" ultrasonic testing device that does an ultrasonic test of the weld, and classifies the weld according to pre-determined quality criteria. The challenge of the inspection of such welds is in the characterisation of the ultrasonic beam behaviour. The beam path will be distorted by the non linearities of the ultrasonic properties of the weld material caused by the grain structure.

The Evaluation Working Group has concluded that the project has a ***weak market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

ACEM-Rail Automated and cost effective railway infrastructure maintenance

FFE (Eduardo Prieto and Aida Herranz) prepared the documentation for the evaluation of the **ACEM-Rail** project, which aimed at developing innovative solutions, as well as the adoption of solutions from other industries, in order to reduce costs, resources, time and impact on rail services due to maintenance activities. In that sense, infrastructure managers, railway operators, maintenance companies and users of rail services for both passengers and freight transport would benefit from the innovative solutions that ACEM-Rail targeted. The final goal was to reduce the cost and the interaction of maintenance interventions with railway services as well as to improve the quality, safety, reliability and sustainability of the railway system.

The Evaluation Working Group has concluded that the project has a ***strong market uptake*** (detailed evaluation in Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project).

4.2 Ongoing evaluations

Apart from the finalised evaluations presented in the previous section, the EWG has selected other projects and proceeded with their evaluation. The other five projects currently under evaluation are listed in below Table1.

Table 1 Ongoing project evaluations

Project acronym	Project full title
INNOTRACK	Innovative Track Systems
CO-ACT	Creating Viable Concepts for Combined Air/Rail Cargo transport
INFRACLEAR	Rail Infrastructure Clearance Management
MODBRAKE	Modular Interface Definitions for Braking Systems
FOOTPRINT (EUREKA project related to ERRVIN)	Defining road and rail vehicles with a low environmental footprint

4.3 Summary of data and statistics

The overall situation of rail research projects evaluated by ERRAC EWG is summarised in Appendix 1 Summary of projects evaluated by ERRAC Evaluation Working Group (2006 – 2016). A number of 87 projects have been evaluated in the period 2006 – 2016. Figure 2 below shows the statistics on the market uptake of these evaluated projects.

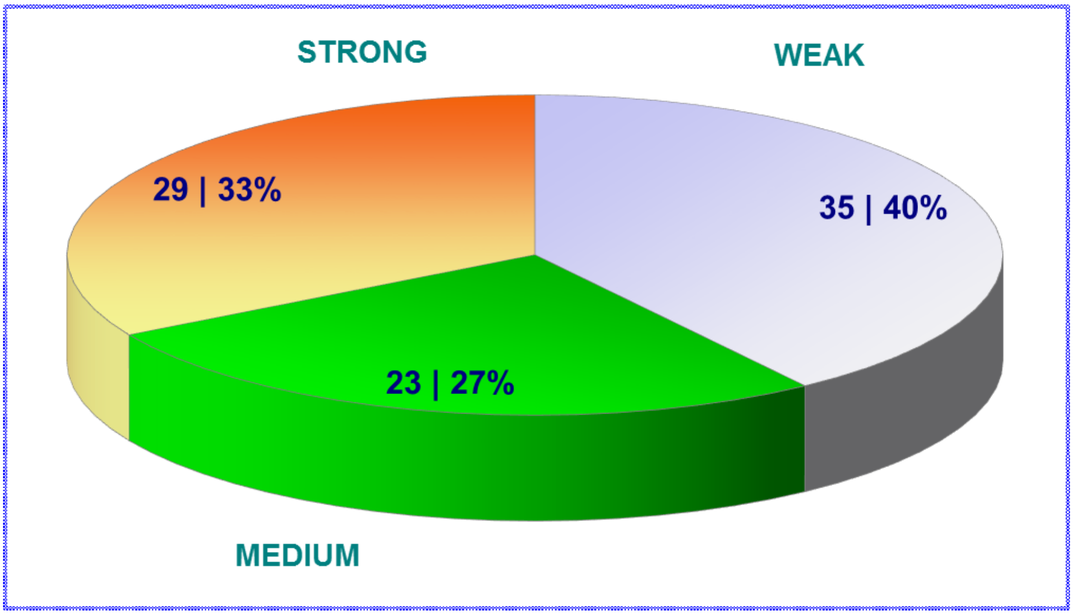

Figure 2 General statistics on the market uptake of rail research projects evaluated by ERRAC EWG

(87 projects 2006-2016)

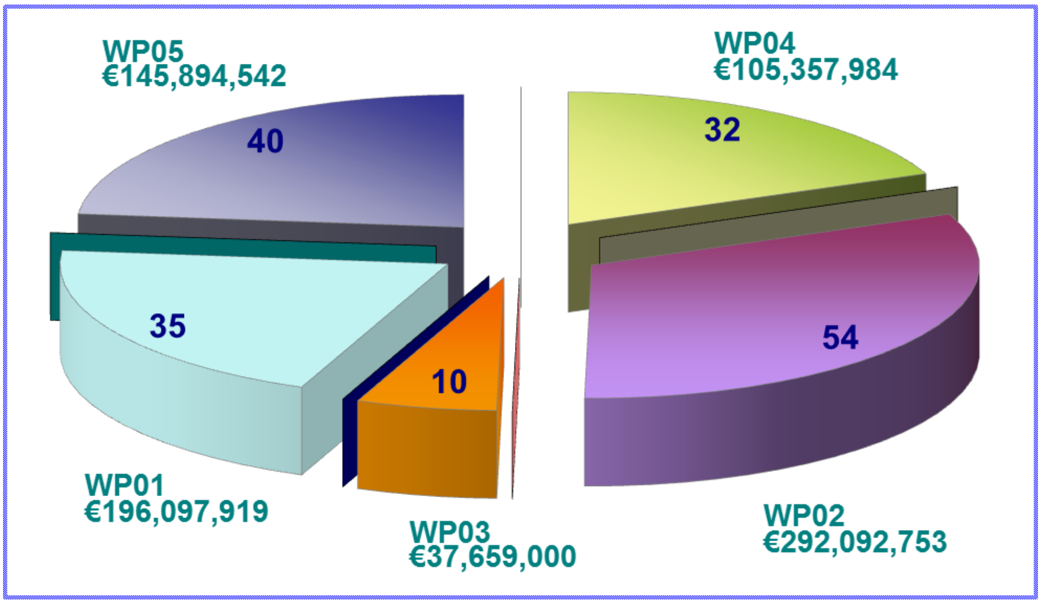

Figure 3 Breakdown of projects included in the EWG database on categories of main work package (total – 171 projects)

WP01 - The greening of surface transport;

WP02 - Encouraging modal shift and decongesting transport corridors;

WP03 - Ensuring sustainable (sub) urban transport (including modal shift, suburban and regional rail, light rail and metro, and sustainable urban mobility);

WP04 - Improving safety and security;

WP05 - Strengthening competitiveness.

5. Conclusions and recommendations

1. Make it clear that projects should search for viable solutions in terms of applicability and cost implications, and develop real business cases;
2. Think of future market uptake and what happens after project ends: the project as an enabler and not an end to itself;
3. Clearly define scope, inputs and deliverables of project at inception. Specify meta-goals of projects and develop implementation strategy/ plan (a mandatory critical factor), identifying targeted users for dissemination of results;
4. Clarify ownership of project results and deliverables at inception;
5. Select committed partners really interested in finding and applying viable solutions (e.g. for new products, involve companies that actually make them to avoid barriers to implementation);
6. Anticipate and identify possible problems/ barriers to implementation to avoid split of interest and weak market uptake, taking account of implications for strategic interests of key players to avoid strategic, commercial, technological and operational constraints (e.g. not to devise technical solutions that incur extra costs to another party, without involving them);
7. Set-up a Steering Group of experts/stakeholders familiar with context at play, to be in charge of advisory aspect and exploitation of results once the project has ended;
8. Plan for knowledge retention and dissemination at inception;
9. Establish clear communication channels and frequency of exchange;
10. Conduct a regular review on post-project progress (possibly electing a project responsible/promoter).

5.1. Reasons for outcomes

The ERRAC Evaluation Working Group (EWG) has developed guidelines to provide ERRAC Work Package leaders, and others who are proposing research topics, activities and actions at National and European level, with the information needed to ensure strong market uptake. The guidelines should also be used by project proposal coordinators before submission and project coordinators during the project execution with advice on how to initiate, build and lead a successful research project in terms of market uptake. These recommendations are based on the evaluation work carried out by the members of the group. The ERRAC Evaluation Working Group determines the market impact of previous rail research to improve use of research funding and to ensure a strategic approach to the prioritisation of rail research. The major aspects to come out of these guidelines are defined below.

There needs to be a sound business case (preferably quantitative). It is important to ensure that the results of previous rail or other relevant research are taken into account for the proposal, and there should be no wasteful duplication of results. The need for the project should be demonstrated with market analysis included in the project proposal. The target of the proposal and the implementation of project results should not be against the strategic interests of any stakeholders. As far as possible ensure that future investments based on the project results are taken into account prior the start of the project. Projects should search for viable solutions in terms of applicability and cost implications, and develop real business cases (from inception).

It is crucial to build a strong and appropriate consortium which involves key stakeholders of the sector (train manufacturers, suppliers, operators, infrastructure managers) and selecting committed partners really interested in finding and applying viable solutions. So that there is no confusion between partners it is necessary to define clearly the scope, inputs and deliverables of the project and the partners' responsibilities at the start of the proposal building. Ensure partners have the financial capacity to support the project activities.

Clarify at an early stage the ownership of project results. It is good practice to have a system so that the ownership of the concept and patents (Intellectual Property Rights) have been taken into account at project inception. Ensure that the owner of the results is identified from the beginning and is prepared to exploit the results.

As the project is part funded by the EC, dissemination and exploitation of project results is a key aspect and to achieve efficient dissemination and exploitation it is important to specify the specific market implementation goals of the project. This can be enhanced by developing an implementation strategy/ plan (a mandatory critical factor) including the identification of early implementer(s), identifying targeted users for dissemination of results. At an early stage identify deliverables that have the potential to become a European standard, enhance an existing standard or be used as a guideline. A plus point is the establishment of an Advisory Group of experts, stakeholders and end-users familiar with context at play, to be in charge of the advisory aspect and consensus building related to the exploitation of results once the project has ended.

5.2. Lessons learnt

How to ensure a Strong market uptake

Roadmaps completed have established a level of knowledge to accurately predict a success in market uptake.

As a result it is possible to:

- design future projects so that chances of successful market uptake are dramatically increased or,
- determine that an idea will have a very narrow chance of achieving any market uptake and therefore should not be proposed.

A good process of thinking in advance, based on lessons learnt from other projects, can lead to a much better focus to help devise new rail research projects that can guarantee concrete market uptake, offering widely acknowledged improvements and solutions for the future rail industry and market in general.

1. Consortium building:

Avoid weak and inappropriate partnership:

- Involvement of key stakeholders of the sector (train manufacturers, suppliers, operators, infrastructure manager)
- Selection of committed partners really interested in finding and applying viable solutions;
- Anticipate and identify possible problems/ barriers to implementation to avoid split of interest and weak market uptake, taking account implications for strategic interests of key players to avoid strategic, commercial, technological and operational constraints (e.g., not to devise technical solutions that incur extra costs to another party, without involving them);
- Ensure the partners have the financial capacity to support the project activities.

2. Ownership of project results:

- The issues related to the ownership of the concept and patents (Intellectual Property Rights) have to be properly taking into account at project inception;

- More emphasis on the fact that subsequent projects (in the same area) are taking into account the deliverables;
- What happens with the results once the project is over?
- Set-up a formal process to handover the results to the institution entitled to implement them

3. Sound business case (if applicable):

- Market analysis should be included in the project proposal;
- Ensuring that the implementation of project results are not against the strategic interests of any stakeholders;
- Ensure that future investments based on the project results are taken into account prior the start of the project;
- Projects should search for viable solutions in terms of applicability and cost implications, and develop real business cases (from inception);
- Divided business case: the ownership of implementation of project results is not clearly defined

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- Projects should search for viable solutions in terms of applicability and cost implications, and develop real business cases (from inception);
- Divided business case: the ownership of implementation of project results is not clearly defined

4. Relations with other projects:

- Avoid duplications, repetitions, overlaps of research projects (analysis of the potential past projects in the area of work) – EWG database is available for further information;
- Need for follow-up project identified from the beginning of the project;
- Include a proper input (if necessary) from past or ongoing research projects.

5. Proficient management:

- Ensure that the implementation of the project objectives is reached taking into account strategic and financial considerations;
- Ensure that co-ordination and a common comprehensive strategy are established between the different consortia building new projects in a specific domain;

- Establish clear communication channels and frequency of exchange within the consortium;
- Conduct a regular review on post-project progress (possibly electing a project responsible/promoter).

6. Dissemination and exploitation of project results:

- Clearly define the scope, inputs and deliverables of the project at inception. Specify meta-goals of projects and develop implementation strategy/ plan (a mandatory critical factor), identifying targeted users for dissemination of results;
- Set-up a Steering Group of experts/stakeholders familiar with context at play, to be in charge of advisory aspect and exploitation of results once the project has ended;
- Plan for knowledge retention and dissemination at inception.

A checklist was developed to be used before submission and during project execution.

Major aspects include:

- *Sound business case*
- *No duplication*
- *Market analysis provided*
- *Target of proposal and implementation of project results*
- *Viable solutions sought*
- *Strong consortium*
- *Clarification of ownership of project's results*
- *Clear dissemination and exploitation plan*
- *Motivation and willingness to continue forward market uptake after the completion of the research project*

Appendix 1 Summary of projects evaluated by ERRAC Evaluation Working Group (2006 – 2016)

No	Work Package / Area (main)	Project Acronym	Subject and Scope	Coordinator	Market uptake	FP	Evaluation prepared by	Evaluation Date
1.	**WP01**The greening of surface transport	**CALM**	Community Noise Research Strategy Plan	Mr. Helmut List AVL List GmbH, Graz (A)	**S**	**5**	Dennis Schut	10/06/2014
2.	**WP01**The greening of surface transport	**CALM II**	Advanced Noise Reduction Systems	Mr. Helmut List AVL List GmbH, Graz (A)	**S**	**6**	Dennis Schut	10/06/2014
3.	**WP01**The greening of surface transport	**CANTOR**	Enhance the knowledge and disseminate information on noise pollution.	Prof. Anders Nilsson - Kungl Tekniska Högskolan-Stockholm (SE)	**W**	**6**	Dan Ottenborn	28/01/2014
4.	**WP01**The greening of surface transport	**CONVURT**	Control of Underground Vibration	Mr. Michael Gellatley - London Underground Ltd.	**M**	**5**	Andrew Foster	11/09/2007
5.	**WP01**The greening of surface transport	**CORRUGATION**	Urban Rail Track Corrugation in heavy metro & light rail	Dr. Patrick Vanhonacker - Dynamics, Structures and Systems international (Belgium)	**M**	**5**	Luisa Velardi	25/01/2008
6.	**WP01**The greening of surface transport	**DE-LIGHT**	Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design	Dr. Frank Roland - Center of Maritime Technologies E. V., Germany	**M**	**6**	Mark Robinson	April 2016
7.	**WP01**The greening of surface transport	**EMC-ARTS**	CCS Sub-System: EMC impact on Signals	Prof. Maurizio Mazzucchelli - Centro Interuniversitario di Ricerca Trasporto-Genoa (It)	**W**	**5**	Davide Pifferi	06/07/2010
8.	**WP01**The greening of surface transport	**ERRVIN**	Dynamic Interaction between vehicles & Infrastructure	Dr. Rayner Mayer - SCIOTECH PROJECTS Ltd. (UK)	**S**	**5**	Chris Brown	20/10/2015
9.	**WP01**The greening of surface transport	**GREEN**	Improvements to heavy duty engine - automotive and rail vehicles	Ms. Monica Ringvik-Volvo Powertrain Aktiebolag	**W**	**6**	Mark Robinson	19/05/2010
10.	**WP01**The greening of surface transport	**HYCOPROD**	Design of an advanced composite production process for the systematic manufacture of very large monocoque hybrid sandwich structures for transport sectors	Prof. Roderick Smith - University of Sheffield	**M**	**5**	Conor O'Neill	April 2016
11.	**WP01**The greening of surface transport	**HYCOTRANS**	Hybrid composite structures for crashworthy bodyshells, containers and safe transportation structures	Prof. Mark Robinson - University of Sheffield	**M**	**4**	Cristian Ulianov	April 2016
12.	**WP01**The greening of surface transport	**INFRASTAR**	Surface coating of high stress parts of the rail surface	Mr. Peter Van Klingeren - AEA Technology Rail BV (NE)	**W**	**5**	David Fletcher	18/07/2008
13.	**WP01**The greening of surface transport	**INMAR**	Active Noise Management for road and rail applications	Prof. Holger Hanselka - Fraunhofer Gesellschaft zur Forderung der Angewandten Forschung E.V. München (DE)	**S**	**6**	Dan Ottenborn	07/03/2014
14.	**WP01**The greening of surface transport	**PROSPER* (not EC funded)**	Environmental Assessment for all mainline and urban transit Rolling Stock	Thomas Melham by University of Glasgow (UK)	**M**		V. Andriès ALSTOM	11/12/2007

No	Work Package / Area (main)	Project Acronym	Subject and Scope	Coordinator	Market uptake	FP	Evaluation prepared by	Evaluation Date
15.	**WP01**The greening of surface transport	**RAVEL**	Environmental Assessment Methodology - All Mainline and Urban Transit Rolling Stock	Mr. Michael Schmmer	**M**	**4**	V. Andriès ALSTOMt	11/12/2007
16.	**WP01**The greening of surface transport	**REPID**	Environmental Assessment for all mainline and urban transit Rolling Stock	Mads Bergendorff (UIC)	**M**	**5**	V. Andriès ALSTOM	11/12/2007
17.	**WP01**The greening of surface transport	**WIDEM**	Wheel Condition Monitoring	Dr.Steven Cervello - Lucchini Sidermeccanica SpA - (It)	**S**	**6**	Cristian Ulianov	10/03/2016
18.	**WP02** Encouraging modal shift and decongesting transport corridors	**BRAVO**	Develop and demonstrate an action strategy on rail freight and intermodal rail-road services (the elaboration of a Brenner Corridor Action Strategy)	Rainer MERTEL, KOMBICONSULT GMBH (DE)	**S**	**6**	Cristian Ulianov	15/09/2015
19.	**WP02** Encouraging modal shift and decongesting transport corridors	**CarCIM**	CERAMIC Components for the Automotive and Rail Sector	Dr. Tassilo Moritz - Fraunhofer-Gesellshaft zur Forderung der angewandten Forschung E.V. (FHG) -Karlsruhe (DE)	**W**	**6**	Mark Robinson	28/04/2015
20.	**WP02** Encouraging modal shift and decongesting transport corridors	**CARGOSPEED**	Road Rail Intermodality	Mr.Karsten Bruenings - BLG CONSULT GmbH (DE)	**W**	**5**	Mark Robinson	19/05/2010
21.	**WP02** Encouraging modal shift and decongesting transport corridors	**CATIEMON**	Catenary monitoring for interoperable cross border operation in passenger and freight rail transport	Dr.Uwe Henning - SIEMENS AG - Münich (DE)	**W**	**6**	Christophe Cheron	11/09/2007
22.	**WP02** Encouraging modal shift and decongesting transport corridors	**EDIP**	Multiplle unit operation of freight trains	Mr.Salomon Berner - TEKELEC SYSTEMES (Fr)	**W**	**5**	Christophe Cheron	13/10/2006
23.	**WP02** Encouraging modal shift and decongesting transport corridors	**EMSET**	Functional Eurocab Component Validation on the Madrid-Seville Line	Prof. Jaime Tamarit - Centro de Estudios y Experimentacion de obras publicas- Madrid (E)	**S**	**4**	Dan Otteborn	April 2016
24.	**WP02** Encouraging modal shift and decongesting transport corridors	**ERTMS Test Preparation Rail 2.1.1/2.1.5**	Users Specification of the complete ERTMS System	Mr C. Carganico - EEIG ERTMS Users Group- Bruxelles (BE)	**S**	**4**	Dan Otteborn	
25.	**WP02** Encouraging modal shift and decongesting transport corridors	**EUDD**	European Drivers Desk in all interoperable RS	Mr. Wolfgang H. Steinicke – FAV Berlin (DE)	**S**	**5**	A Gougelet & D. Schut	20/10/2015
26.	**WP02** Encouraging modal shift and decongesting transport corridors	**EUDDPlus**	European Driver's Desk Plus	Mr. Wolfgang H. Steinicke – FAV Berlin (DE)	**S**	**6**	A Gougelet & D. Schut	20/10/2015
27.	**WP02** Encouraging modal shift and decongesting transport corridors	**EUFRANET**	European Freight Railway Network	Mr. Fei Jiang - Institut National de Recherche sur les Transports et leur Sécurité (Fr)	**W**	**4**	Karsten Krause	19/06/2006
28.	**WP02** Encouraging modal shift and decongesting transport corridors	**FIRE**	Freight Information on the Railway Environment	Ing. Gino Di Mambro - Ferrovie dello Stato SpA (It)	**W**	**4**		22/08/2006

No	Work Package / Area (main)	Project Acronym	Subject and Scope	Coordinator	Market uptake	FP	Evaluation prepared by	Evaluation Date
29.	**WP02** Encouraging modal shift and decongesting transport corridors	**F-Man**	Rail Car Asset Management of International Freight Wagons	Prof. Stefano Savio - University of studies of Genoa (It)	**W**	**5**		22/08/2006
30.	**WP02** Encouraging modal shift and decongesting transport corridors	**HEROE**	Harmonisation of European Rules for ERTMS operation	Mr. Claudio Traverso - EEIG ERTMS users group Bruxelles (BE)	**W**	**4**	Luisa Velardi	11/12/2007
31.	**WP02** Encouraging modal shift and decongesting transport corridors	**HISPEEDMIX**	High Speed Freight on the European HS Network	Mr. Paolo De Cicco - FS SpA - Rome (It)	**W**	**4**	Karsten Krause	19/06/2006
32.	**WP02** Encouraging modal shift and decongesting transport corridors	**INESS**	Integrated European Signalling Systems	Emmanuel Buseyne - UIC	**M**	**7**	Dan Otteborn	03/03/2015
33.	**WP02** Encouraging modal shift and decongesting transport corridors	**IN.HO.TRA**	Innovative Intermodal Freight Wagons	Mr. Christoph Seidelmann - Studiengesellschaft für den Kombinierten Verkehr E.V.- Frankfurt a M. (DE)	**W**	**5**	Frank Michelberger	08/07/2009
34.	**WP02** Encouraging modal shift and decongesting transport corridors	**INTELFRET**	Intelligent Freight Train	Mr. Gheorghe Barbu - Foundation European Rail Research Institute- Utrecht (NL)	**W**	**4**	Sonal Mitra	11/12/2007
35.	**WP02** Encouraging modal shift and decongesting transport corridors	**ISTU**	Self Guided freight container transportation systems on rail	Mr. Marek Karas - Innovative Trade and Product Strategies GmbH (DE)	**W**	**6**	Dan Ottenborn	April 2016
36.	**WP02** Encouraging modal shift and decongesting transport corridors	**LISA**	Light Foam Structures for all transport modes	Mr. Rüdiger Dorner (DE)	**W**	**5**	Andrew Foster	30/05/2007
37.	**WP02** Encouraging modal shift and decongesting transport corridors	**LOCOPROL**	Low cost ERTMS based on GPS for secondary networks	Mr.Jean Pierre Franckart - ALSTOM Belgium SA (BE)	**W**	**5**	Cristian Ulianov	10/03/2016
38.	**WP02** Encouraging modal shift and decongesting transport corridors	**MODTRAIN**	Innovative modular vehicle concepts for an integrated European railway system	Antoine LORAILLÈRE (UNIFE)	**S**	**6**	Dan Ottenborn	10/03/2016
39.	**WP02** Encouraging modal shift and decongesting transport corridors	**NEWOPERA**	Development of Rail Freight Networks	Valerio RECAGNO - Consorzio TRAIN (I)	**S**	**6**	Dan Ottenborn	29/01/2014
40.	**WP02** Encouraging modal shift and decongesting transport corridors	**OPTIRAILS**	Optimisation of Rail Traffic Corridors via ERTMS, etc	Mr.Maurice Genete -SYSTRA (Fr)	**S**	**4**	Aurora Ruiz	
41.	**WP02** Encouraging modal shift and decongesting transport corridors	**OPTIRAILS II**	Optimisation of Rail Traffic Corridors via ERTMS, etc	Mr.Michel Leboeuf -SYSTRA (Fr)	**S**	**5**	Aurora Ruiz	
42.	**WP02** Encouraging modal shift and decongesting transport corridors	**RAILSERV**	Enhancing competiveness of Rail Freight	Mr. Wladimir Segercrantz - Technical Research Centre of Finland (Fi)	**W**	**5**	Luisa Velardi	18/07/2008

No	Work Package / Area (main)	Project Acronym	Subject and Scope	Coordinator	Market uptake	FP	Evaluation prepared by	Evaluation Date
43.	**WP02** Encouraging modal shift and decongesting transport corridors	**REORIENT**	Seamless international rail freight transportation, focusing on up to 10 trans-European corridors	Mr.Mario Moya - Ingenieria de Sistemas para la Defensa de Espana, S.A. (E) and Johanna Ludvigsen TOI	**W**	**6**	Luisa Velardi	26/03/2008
44.	**WP02** Encouraging modal shift and decongesting transport corridors	**SANDWICH**	Lightweight road, rail & marine applications of Composites	Dipl.-Ing.Jochen Zerrahn - Jos. L. Meyer GmbH (DE)	**W**	**5**		
45.	**WP02** Encouraging modal shift and decongesting transport corridors	**TIGER**	European Intermodal Rail solution to EU ports and road congestion.	Valerio RECAGNO - Consorzio TRAIN (I)	**S**	**7**	Dan Ottenborn	07/03/2014
46.	**WP02** Encouraging modal shift and decongesting transport corridors	**TIGER DEMO**	European Intermodal Rail solution to EU ports and road congestion.		**S**	**7**	Dan Ottenborn	07/03/2014
47.	**WP02** Encouraging modal shift and decongesting transport corridors	**TRACAR**	Traffic and cargo supervision system	Mr. Guy Robinson - Mercury Communications Ltd (UK)	**W**	**4**	Luisa Velardi	31/01/2007
48.	**WP02** Encouraging modal shift and decongesting transport corridors	**URBANTRACK**	Improved Infrastructure Technologies for urban infrastructure	Dr. Patrick Vanhonacker - Dynamics, Structures and Systems international (Belgium)	**M**	**6**	Cristian Ulianov	09/12/2015
49.	**WP03** Ensuring sustainable (sub)urban transport	**BESTUFS**	Urban Freight Best practise	Mr. Hans Hubschneider - PTV PLANUNG TRANSPORT VERKEHR AG (DE)	**W**	**5**	Cristian Ulianov	16/09/2010
50.	**WP03** Ensuring sustainable (sub)urban transport	**BESTUFS II**	Urban Freight Best practise	Mr. Hans Hubschneider - PTV PLANUNG TRANSPORT VERKEHR AG (DE)	**W**	**6**	Cristian Ulianov	16/09/2010
51.	**WP03** Ensuring sustainable (sub)urban transport	**CROSSRAIL**	Integration of Tramtrain Systems	Hans-Ole Skovgaard - Scanrail Consult Scandinavian Engineers & Planners (DK)	**W**	**5**	Cristian Ulianov	06/07/2010
52.	**WP03** Ensuring sustainable (sub)urban transport	**ESCARV**	EMC impact investigation for mainline Rolling Stock & Infrastructure Sub-Systems	Stefan Schmidt- ABB Daimler Benz transportation GmbH (DE)	**W**	**4**	Davide Pifferi	16/09/2010
53.	**WP03** Ensuring sustainable (sub)urban transport	**EURFORUM**	Urban Mobility Research Forum	Mr. Laurent Franckx - Union Internationale des Transports Publics (BE)	**S**	**6**	Yves Amsler & Caroline Hoogendoorn	13/12/2011
54.	**WP03** Ensuring sustainable (sub)urban transport	**LIBERTIN**	Light Rail Thematic Network: standards and testing	Dr. Eng. Udo Sparmann - Transport Technologie Consult Karlsruhe GmbH (DE)	**S**	**5**	Yves Amsler & Caroline Hoogendoorn	
55.	**WP03** Ensuring sustainable (sub)urban transport	**MODURBAN**	Modular Integration of Train Busses and Signalling for LRVs and Metros	Bernard von Wullerstorff (UNIFE)	**M**	**6**	Michael Pellot	20/10/2015
56.	**WP03** Ensuring sustainable (sub)urban transport	**MODSAFE**	Modular Urban Transport Safety and Security Analysis	Peter Wigger (TÜV Rheinland InterTraffic GmbH)	**M**	**7**	Michael Pellot	20/10/2015
57.	**WP03** Ensuring sustainable (sub)urban transport	**UGTMS**	Urban Guided Transport Management System	Mr. Guy Bourgeois - Régie Autonome des Transports Parisiens	**M**	**5**	Dan Otteborn	09/03/2006 07/09/2011
58.	**WP03** Ensuring sustainable (sub)urban transport	**UNIACCESS**	Design of universal accessibility systems for public transport	Dr.Javier Urruzola - Grupo Interes Accesibilidad Transporte A.I.E. (E)	**W**	**6**	Mark Robinson	27/01/2010

No	Work Package / Area (main)	Project Acronym	Subject and Scope	Coordinator	Market uptake	FP	Evaluation prepared by	Evaluation Date
59.	**WP04** Improving Safety & Security	**ALJOIN**	Aluminium Jointing for all transport modes	Dr. Giampaolo Vaccaro - D'Appolonia SpA- Genoa (It)	**S**	**5**	Mark Robinson	28/05/2008
60.	**WP04** Improving Safety & Security	**ALJOIN plus**	Aluminium Jointing for all transport modes	Dr. Giampaolo Vaccaro - D'Appolonia SpA- Genoa (It)	**S**	**5**	Mark Robinson	28/05/2008
61.	**WP04** Improving Safety & Security	**DARTS**	Tunnel Technologies for Urban Use	Mr. Arne Steen Jacobsen - Cowi Consulting Engineers and Planners AS-Denmark	**M**	**5**	Luisa Velardi	24/06/2008
62.	**WP04** Improving Safety & Security	**FIT**	European thematic network on fire in tunnels	Mr. Alfred Haack Studiengesellschaft für unterirdische Verkehrsanlagen EV - DE	**M**	**5**	Luisa Velardi	27/01/2010
63.	**WP04** Improving Safety & Security	**HUSARE**	Managing the human factor safely in Multicultural and Multilingual environments	Dipl.-ing. Ruediger Wiedemann - TsV Euro Rail - Köln (DE)	**W**	**4**	Luisa Velardi	11/12/2007
64.	**WP04** Improving Safety & Security	**RAILECT**	Rapid ultrasonic method for the safe and reliable NDT examination of the entire volume of in-situ alumino-thermic welds.	Amanda WALTERS - TWI LIMITED (UK)	**W**	**7**	Mark Robinson	April 2016
65.	**WP04** Improving Safety & Security	**SAFETRAM**	Crashworthy structures for LRVs (streetcars & Tram/Trains)	Eng.Manuel Norton -Bombardier	**S**	**5**	Andrew Foster	
66.	**WP04** Improving Safety & Security	**SAMNET**	Safety Targets & Philosophy for Mainline Rolling Stock and Infrastructure Sub-Systems	Mrs. Elisabeth Dupont-Kerlan - Institut National de Recherche sur les Transports et leur Sécurité-France	**S**	**5**	Cristian Ulianov	13/12/2011
67.	**WP04** Improving Safety & Security	**SAMRAIL**	Safety Management approach for the EU's Railways for implementing the European Railway safety Directive	Dr Swapan Mitra - Atkins Rail Euston Travel - London (UK)	**S**	**5**	Cristian Ulianov	13/12/2011
68.	**WP04** Improving Safety & Security	**SIRTAKI**	Safety improvement in Road - Rail Tunnels	Antonio Marques - ETRA Investigacion y desarollo SA - ES	**M**	**5**	Luisa Velardi	27/01/2010
69.	**WP04** Improving Safety & Security	**TRAINSAFE**	Vehicle Passive Safety	Mr Peter Wells, Advanced Railway Research Centre at the University of Sheffield (UK)	**M**	**5**		
70.	**WP04** Improving Safety & Security	**UPTUN**	Safety in Railway Tunnels	Mr. Jan Alexander Dekker- Nederlandse Organisatie voor Toegepast Natuurwetenscappelijk onderzoek Tno Delft (NL)	**M**	**5**	Luisa Velardi	27/01/2010
71.	**WP04** Improving Safety & Security	**VIRTUALFIRES**	Real time emergency simulator for assessing the fire safety of tunnels, for training of rescue personel and for planning rescue scenarios.	Mr.Gernot Beer - Technische Universität Graz - A	**M**	**5**	Luisa Velardi	27/01/2010
72.	**WP05** Strengthening competitiveness	**ACEM-Rail**	Automated and cost effective maintenance for railway infrastructure	Dr. Noemi Jiménez-Redondo - Centro De Estudios De Materiales Y Control De Obra SA (CEMOSA)	**S**	**7**	Eduardo Prieto & Aida Herranz	April 2016
73.	**WP05** Strengthening competitiveness	**AVATARS**	Advance Virtual Agents for Station Accessibility in mainline and urban transit passenger infrastructure	Dr. Rory Doyle - British Maritime Technology Ltd. (UK)	**W**	**6**	Luisa Velardi	12/04/2012

No	Work Package / Area (main)	Project Acronym	Subject and Scope	Coordinator	Market uptake	FP	Evaluation prepared by	Evaluation Date
74.	**WP05** Strengthening competitiveness	**CAESAR**	Coordination action for the European strategic agenda of research on intermodalism and logistics	Valerio RECAGNO - Consorzio TRAIN (I)	**S**	**6**	Giorgio Travaini	06/07/2010
75.	**WP05** Strengthening competitiveness	**EUROMAIN**	Train to Trackside Maintenance Protocols	Mr. Gernot Hans - BOMBARDIER transportation GmbH	**S**	**5**	Andrew Foster	15/05/2006
76.	**WP05** Strengthening competitiveness	**EUROPAC**	Vehicle -infrastructure interaction through pantograph-catenary contact	Mr.Louis-Marie Cleon - SNCF-Paris (Fr)	**M**	**6**	Christophe Cheron	11/12/2007
77.	**WP05** Strengthening competitiveness	**EuROPE-TRIO**	Traffic optimisation	Ing. Pierluigi Guida - FS SpA- Rome (It)	**W**	**4**	Luisa Velardi	02/10/2008
78.	**WP05** Strengthening competitiveness	**EuROPE-TRIP**	Integrated Railway Planning Environment	Ing. Pier Luigi Guida - RFI-Rome (It)	**W**	**4**	Luisa Velardi	02/10/2008
79.	**WP05** Strengthening competitiveness	**EuROPE-TRIS**	Telematic Railways Information System	Ing. Pierluigi Guida - FS SpA- Rome (It)	**W**	**4**	Luisa Velardi	02/10/2008
80.	**WP05** Strengthening competitiveness	**HVB**	High Voltage Booster - Reducing the number of sub-stations on lightly used lines	Dr. Marina Fracchia-Università degli Studi-Genoa (It)	**M**	**4**	Christophe Cheron	25/01/2008
81.	**WP05** Strengthening competitiveness	**INTEGRAIL**	Train and Track Condition Monitoring Networks	Mr. Drewin Nieuwenhuis - Union of European Railway Industries (BE)	**W**	**6**	Dan Otteborn	16/06/2014
82.	**WP05** Strengthening competitiveness	**PROMAIN**	Enhancing maintenance and management of rail infrastructure through the application of new tools and methodologies	Mr. Franz Quante-Fraunhofer-Gesellshaft zur Forderung der angewandten Forschung E.V. (FHG) -Karlsruhe (DE)	**W**	**5**	Andrea Lindner	10/12/2008
83.	**WP05** Strengthening competitiveness	**ROSIN**	Train Bus Protocol Standardisation	Mr. Ulrich Schmidt - AEG Schienenfahrzeuge GmbH (DE)	**S**	**4**	Andrew Foster	15/05/2006
84.	**WP05** Strengthening competitiveness	**SMITS**	Catenary monitoring and Diagnostics	Dr. Siegfried Birkle - SIEMENS AG (DE)	**M**	**5**	Christophe Cheron	25/01/2008
85.	**WP05** Strengthening competitiveness	**SUPERTRACK**	Sustained performance of railway track	Mr. Philippe Renard - SNCF (Fr)	**M**	**5**	Christophe Cheron	25/01/2008
86.	**WP05** Strengthening competitiveness	**Sustainable Bridges**	Assessment of huge traffic demand on longer lives	Prof. Ingvar Olofsson - Skanska Sverige AB - Stockolm (SE)	**S**	**6**	Andrea Lindner	28/05/2008
87.	**WP05** Strengthening competitiveness	**TRAINCOM**	Communication system for telematics applications in the railway field, integrating the on-board network (e.g. TCN), GSM radio links and Internet technologies	Mr. Erich Renner - SIEMENS Aktiengesellschaft (DE)	**S**	**5**	Andrew Foster	15/05/2006

Appendix 2 Project evaluations by ERRAC Evaluation Working Group within Foster Rail project

Project acronym	Project full title	Market uptake
TIGER	Transit via Innovative Gateway Concepts Solving European Intermodal Rail Needs	**Strong**
TIGER DEMO	Trans-Rail Integrated Goods European-Express Routes Demonstrators	**Strong**
CANTOR	Coordinating Noise Transportation Research and Engineering Solutions	**Weak**
NEWOPERA	New European Wish: Operating Project for a European Rail Network	**Strong**
INMAR	Intelligent Materials for Active Noise Reduction	**Strong**
INTEGRAIL	Intelligent Integration of Railway Systems	**Weak**
INESS	Integrated European Signalling System	**Medium**
CARCIM	Integration of Two-Component Ceramic Injection Moulding for Large-Scale Production of Novel Multifunctional Ceramic Components for Automotive and Railway Applications	**Weak**
CALM	Community Noise Research Strategy Plan	**Strong**
CALM II	Advanced Noise Reduction Systems	**Strong**
BRAVO	Brenner Rail Freight Action Strategy Aimed at Achieving a Sustainable Increase of Intermodal Transport Volume by Enhancing Quality, Efficiency and System Technologies	**Strong**
MODURBAN	Modular Urban-guided Rail Systems	**Medium**
MODSAFE	Modular Urban Transport Safety and Security Analysis	**Medium**
ERRVIN	Managing the dynamic interaction between the vehicle and the infrastructure	**Strong**
EUDD	European Driver's Desk	**Strong**
EUDD Plus	European Driver´s Desk Advanced Concept Implementation	**Strong**
URBANTRACK	Urban Rail Infrastructure	**Medium**
MODTRAIN	Innovative Modular Vehicle Concepts for an Integrated European Railway System	**Strong**
LOCOPROL	Low Cost Satellite Based Train Location System for Signalling and Train Protection for Low Density Railway Lines	**Weak**
WIDEM	Wheelset Integrated Design and Effective Maintenance	**Strong**
ISTU	Integrated Standard Transportation Unit for self-guided freight container transportation systems on rail	**Weak**

Project acronym	Project full title	Market uptake
EMSET	Eurocab Madrid-Seville European tests	**Strong**
HYCOTRANS	Hybrid composite structures for crash worthy bodyshells, containers and safe transportation structures	**Medium**
HYCOPROD	Design of an advanced composite production process for the systematic manufacture of very large monocoque hybrid sandwich structures for transport sectors	**Medium**
DE-LIGHT	Complex lightweight modules for ships and railway will be developed using risk based design methods	**Medium**
RAILECT	Development of an ultrasonic technique, sensors and systems for the volumetric examination of alumino-thermic rail welds	**Weak**
ACEMRAIL	Automated and cost effective railway infrastructure maintenance	**Strong**

MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- To make it more competitive
- To foster increased innovation
- To guide research efforts at the European level

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
- Ensure a strategic approach to the prioritisation of rail research

Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
- To ensure that the results of previous rail research can be taken into account for future projects
- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

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ERRAC Project Evaluation Group

TIGER

EVALUATION FROM MARCH 2014

Project acronym: **T**ransit via **I**nnovative **G**ateway concepts solving **E**uropean-intermodal **R**ail needs
FP: 7
Programme acronym: TIGER
Project Reference: 234065
Call identifier: SST.2008.2.1.6
Total Cost: 13.595.279,00
EU Contribution: 8.633.020,00
Timescale: 01.10.2009-30.09.2012
Project Coordinator: CONSORZIO TRAIN

Web references: www.tigerproject.eu

- ❑ Presented by: NewOpera
- ❑ Date evaluation:
- ❑ Market uptake: STRONG
- ❑ Follow up projects: TIGER DEMO
- ❑ Other related Projects:

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PROJECT OBJECTIVES

- INTRODUCE A NEW BUSINESS MODEL VIA DRY PORTS
- REDUCE PORT CONGESTION THROUGH DRY PORTS & HINTERLAND INNOVATIVE DISTRIBUTION MODELS
- UTILIZE BETTER EXISTING RESOURCES
- INCREASE THROUGHPUT CAPACITY ON EXISTING RAIL LINES
- INDUSTRIALIZE & OPTIMIZE TRANSPORT
- REDUCE COSTS
- REDUCE TRANSIT TIME & PRODUCE BETTER SERVICES
- INTRODUCE INNOVATIVE LOGISTICS SOLUTIONS & BEST PRACTICES
- SHARE BENEFITS BETWEEN THE ACTORS
- INTERNATIONALIZE THE ADOPTED SOLUTIONS

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Background

Details

- FP 7 SST 2008.2.1.6
- Total Cost: 13.595.279,00
- EU Contribution: : 8.633.020,00
- Start and duration: 01.10.2009-30.09.2012 36 Months
- Scientific Coordinator: HACON Gmbh

Partners

•Newopera	Eurogate	Rivalta Terminal Eur.
•Consorzio Train	Trenitalia	Terminal S. Giorgio
•Hacon	RFI	DB Netze
•Unife	Hafen Hamb.Mark	Italcontainer
•Hamburg Port Auth.	Genoa Port Auth.	Kombiverkehr
•E/Log	Liguria Region	Sogemar
•Bologna Interporto	Tecnicas Territ.Y Urbanas	

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TIGER

Transit via Innovative Gateway concepts solving European-intermodal Rail needs

Partners/Personalities interviewed:

Organisation	Country	Name of interviewe
Hamburg Transport Minister	Germany	☑ Frank Horch
Former President Parliament	Italy	☑ Luciano Violante
Eurogate	Germany	☑ Thomas Eckelmann –B. Bruegelmann
Consorzio TRAIN	Italy	☑ Valerio Recagno
NewOpera	Belgium	☑ Franco Castagnetti
F&L	Belgium	☑ Frank Arendt – Gavin Roser
DUSS DB NETZE	Germany	☑ Wolfgang Mueller – Alexander Stern
KombicoInsult /KV	Germany	☑ Uwe Sondermann- Rainer Mertel
Autorità Portuale Genoa	Italy	☑ Luigi Merlo – Luciano Boselli
Hamburg Port Authority	Germany	☑ Sebastian Doderer – Axel Mattern
Hacon	Germany	☑ Marian Gaidzik-Lars Deiterding
Terminal San Giorgio	Italy	☑ Maurizio Anselmo
Hupac	Switzerland	☑ Aldo Croci

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TIGER

Transit via Innovative Gateway concepts solving European-intermodal Rail needs

Partners/Personalities interviewed:

Organisation	Country	Name of interviewe
RFG	UK	☑ Lord Tony Berkeley
Athens Tech University	Greece	☑ Dimitros Tsamboulas
IKEA	Italy	☑ Milena Benzi
Hamburg Forwarder Assoc.	Germany	☑ Will van der Schalk
Dakosy	Germany	☑ Evelyn Eggers
Gruppo Messina Shipping	Italy	☑ Ignazio Messina
Mortara Intermodal Terminal	Italy	☑ Davide Muzio
EIA	Belgium	☑ Peter Wolters
TTU	Spain	☑ Emilio Fernandez, Rodrigo Perez
Port of Barcelona	Spain	☑ Santiago Milà
Gefco	France	☑ Antoine Mengin

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Background

	Total TEU	Average TEU
2008	1.674.227	8.372
2005	1.308.581	6.543
2000	986.608	4.933
1995	733.155	3.666
1990	600.958	3.005

- Emma Maersk over 14000 TEUs

NO CHANGES IN OVERLAND INFRASTRUCTURES

SOURCE: Port of Hamburg

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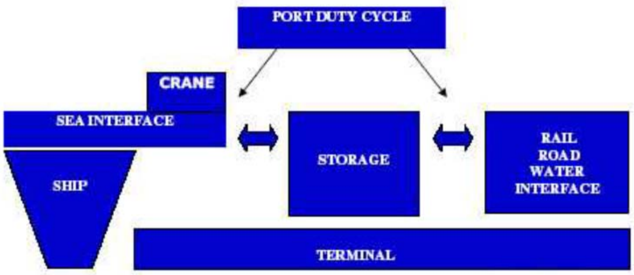
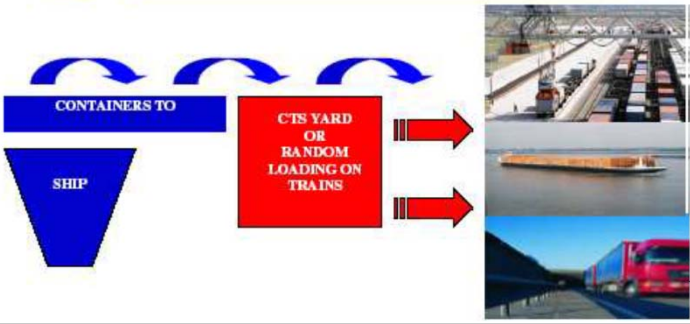
Background : Crisis Point Moved to Port Cts Yard from there to Inland Distribution either via Rail, Road & Inland waterways





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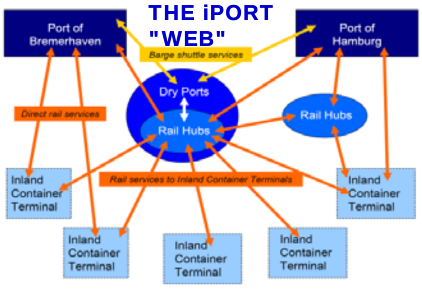
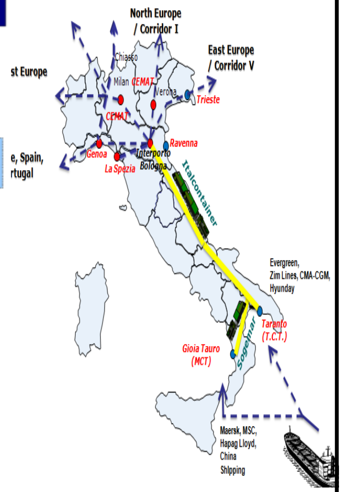
The Project 4 Demonstrators – 4 Separate Solutions -4 Geog.Areas

THE GFC "LOOP"

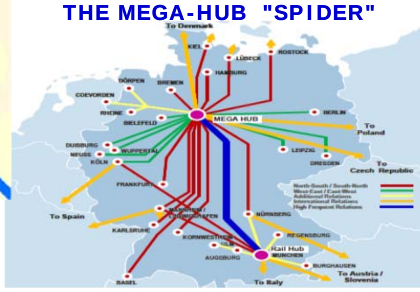
THE iPORT "WEB"



THE MARIPLAT "Y"



THE MEGA-HUB "SPIDER"



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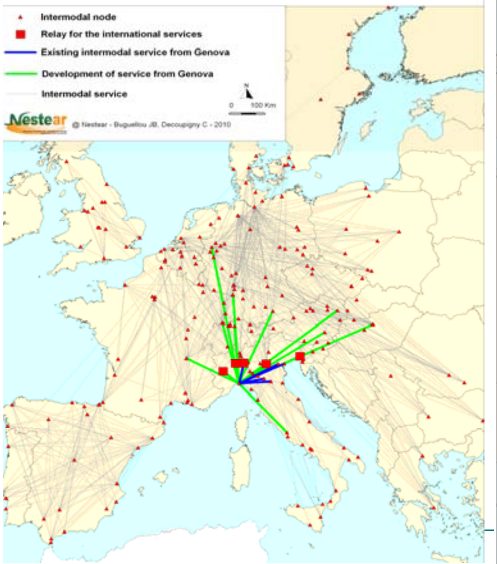
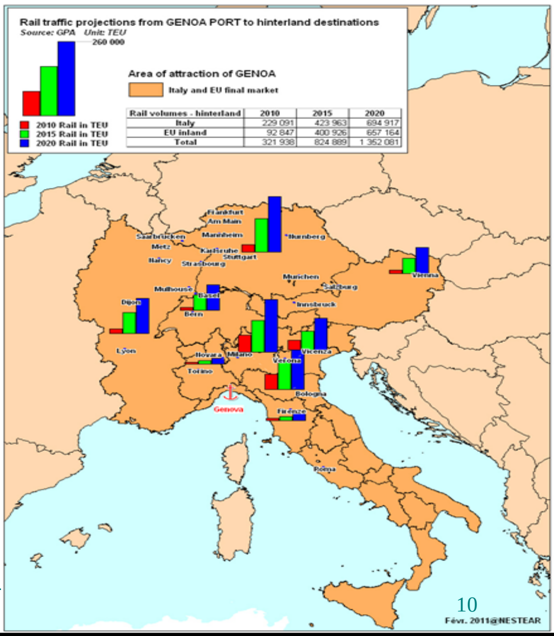
GENOA COMPETITIVE REACH BEFORE & AFTER TIGER

Structure of the services of combined transport of Genova





Rail volumes - hinterland	2010	2015	2020
Italy	229 091	423 963	694 917
EU inland	92 847	400 926	657 164
Total	321 938	824 889	1 352 081

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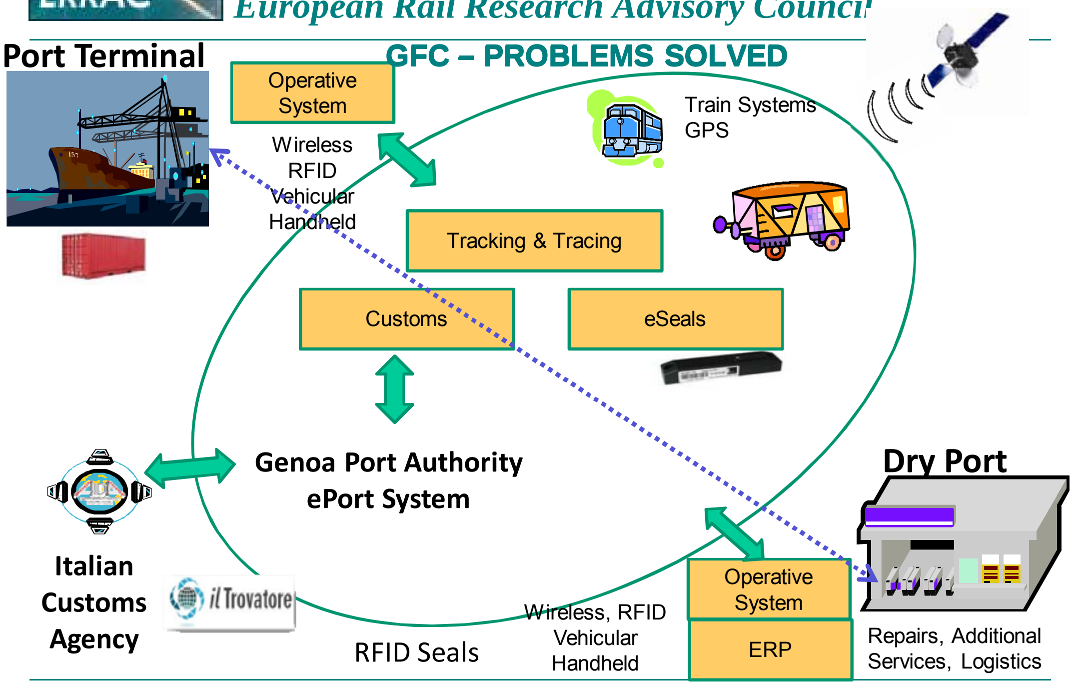
GFC – PROBLEMS SOLVED



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GFC Achievements

▪ Best Practices	▪ Cooperation between 3 different terminals in the Genoa Port: PSA Voltri, ATI Ignazio Messina - TSG ▪ Introduction of new operational concepts involving processes + technologies + rules ▪ RTE authorized as Genoa Port Customs Authority ▪ Deployment of ICT Technologies in the whole logistic chain: T&T, Integrated CTS management systems producing shorter transit time & service improvement
▪ Technologies & innovations	▪ New Business Model for "shuttle train loading and dispatching" ▪ E-customs, E-seals, E-freight ▪ Electronic seals, reading devices, Gates in gates out applied
▪ Investments	▪ TSG + RTE € 5Mln eligible costs ▪ TSG+RTE invested more than € 10 MM on GFC ▪ In addition to RTE investments of € 100 MM
▪ Results & Achievements	▪ Sea Port dwell time & transit time reduction 37% ▪ Operational costs & service quality improvements ▪ Improved geographical accessibility& competitive reach ▪ Extended quay concept: Volumes exceeding 40000 TEU were moved with about 500 shuttle trains

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Achievements

▪ Market uptake conditions for full implementation into TIGER DEMO	▪ Pilot upgrade into full commercial scale operating about 500 shuttle trains from Genoa Port to RTE & continue thereafter. ▪ RTE throughput capacity up to 1 MM TEUs/Year ▪ Fine-tuning of Hardware & Software Tools applied in the TIGER pilot phase ▪ Complete Rail Tracks connection on the various Genoa Terminals for another 20% transit time reduction ▪ Complete personnel training on systems & operations ▪ Stabilized KPI management & monitoring ▪ Demonstrate the need of 3rd Rail tunnel through the Apennines ▪ Liguria Region to identify another inland Terminal behind the Mountains (Alessandria) for another step change in its Ports productivity.

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MARIPLAT – PROBLEMS SOLVED

- Introduction of innovative Production Model
- Operations started on 7th March 2012
- Joint Commercial strategies; MARIPLAT logo
- ICT integration of all MARIPLAT Partners
- MARIPLAT Demonstrator, Planning /Management control
- Production highly Innovative services at lower costs to Market by Integrating maritime/overland traffic

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Achievements

Best Practices	2 Ports Traffic bundling: "Y" scheme Rail service opening to operators in competition Cooperative approach between intermodal operators
Technologies & innovations	Longer & heavier trains on the Adriatic line New wagons technology deployment ICT technology track & trace and traffic planning & management
Investments	Rail Infrastructures in Taranto & Cattolica for 9'6" Introduction of common ICT Platform Joint Marketing strategy New wagons
Results & achievements	9'6" CTS traffic on the whole Adriatic Rail line Taranto City by pass with dedicated Port Rail line Common ICT Platform accessible to operators in Bologna Common Marketing strategies for MARIPLAT Overland set timetable Taranto & G. T. operators Competitive advantage Vs. N. African Ports

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Achievements

Market uptake conditions for full commercial implementation into TIGER DEMO postponed due to changing infrastructure & traffic flows condition.	Gioia Tauro has maintained its traffic volumes with increased projections. Taranto is undertaking major infrastructures works in the Port for dredging for accommodating larger CTS Vessels in future and for building the Logistics Park. This has reduced its throughput from 1M TEUs to 200K TEUs making impossible the traffic bundling with Gioia Tauro traffic during the project lifetime . The Y system implemented during the pilot phase to be resumed after the Taranto major works completion. The MARIPLAT budget of TIGER DEMO into the three remaining Demonstrators.

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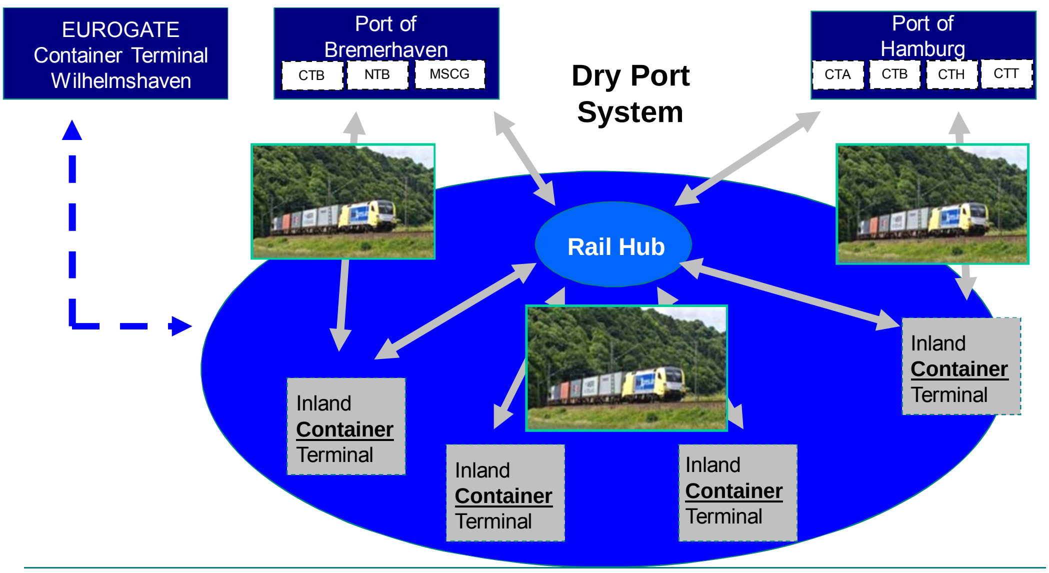
iPORT – PROBLEMS SOLVED



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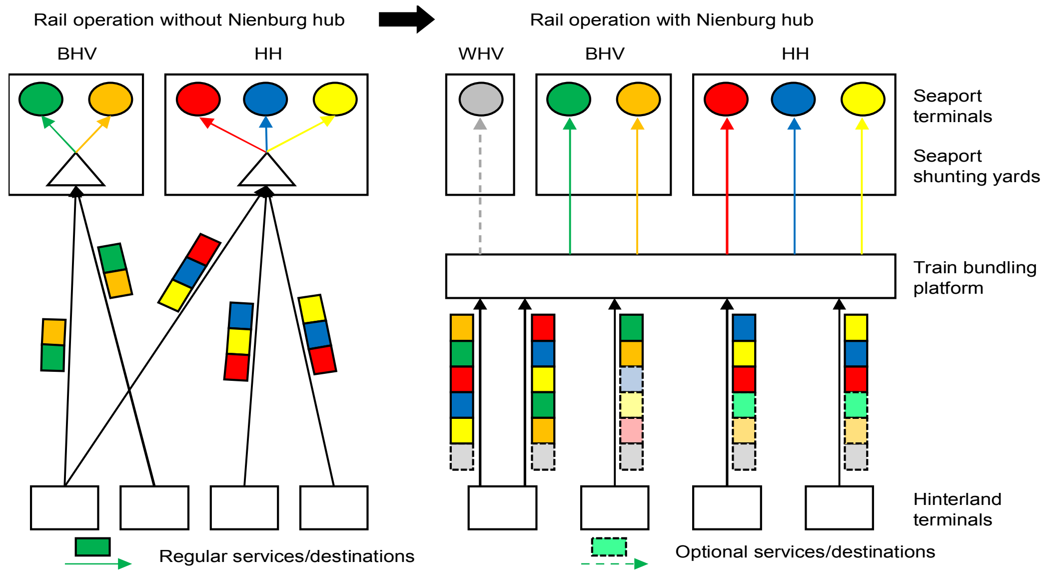
Achievements

Hinterland process via "Close to the port" train bundling platform in Nienburg



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Achievements

Optimisation of hinterland processes via a “Close to the market” concept

A) Findings of TIGER were used for the implementation planning of Hub Poznan

B) Major parts of this concept are tested in an existing terminal (Munich Riem)

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iPORT Achievements

Best Practices ”Close to Port”	▪ “Close to the Port” concept realised at Nienburg rail hub; ▪ Pilot phase: 3 trains/week (export, weekend service) scaled up to 18 trains/week at project conclusion . More than 400 trains moved and 32000TEU. Operation replicated in Bremen 80 Trains 7000TEU ▪ Centralised maintenance and repair concept; ▪ Terminal dedicated trains: No shunting in the seaport.
Technologies & Innovations	▪ Bundling concept in Nienburg → Traffic optimising; ▪ IT tool to support wagon dispatching and slot management.
Investments	▪ Infrastructure adaptations + lease in Nienburg; ▪ IT tool (Steering and monitoring); ▪ Additional staff in Nienburg for new rail production concept; ▪ Additional wagons: Backup fleet for balancing irregularities during pilot phase.
Results & Achievements	▪ New rail production very successful; ▪ Dwell time on Hamburg seaport rail net reduced by 92 %; ▪ Increased punctuality in the seaport terminals to 85 %; ▪ Overall improved competitiveness of intermodal transport already in the first test operation phase; ▪ Decongestion objective: achieved.

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iPORT Achievements

Best Practices " Close to Market"	▪ Layout definition for maritime inland terminals needs; ▪ TIGER findings used for Poznan hub planning; ▪ TIGER concept testing in Munich Riem; ▪ Increased shuttle train frequency between seaports & Munich; ▪ Poznan hub & shuttle concept.
Technologies & Innovations	▪ Process optimisation along the hinterland chain; ▪ Hinterland customs processes finalisation; ▪ "BLU Opti": Optimisation of hinterland processes; ▪ Train monitoring with customer interface.
Investments	▪ New hub in Poznan; ▪ Set-up of new or upgrading of existing intermodal links; ▪ Planning for new greenfield inland terminals financed by private investors will proceed.
Results & Achievements	▪ Increased punctuality up to 85-90 %; ▪ Optimised utilisation of train capacity; ▪ Optimised utilisation of Infrastructure capacity; ▪ Same capacity with 15-20 % less trains; ▪ Constantly maximum train capacity; ▪ Reduced transit time Hamburg – Poznan 18 h →12 h.

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iPORT Achievements

Market uptake conditions for full implementation into TIGER DEMO	▪ Market → Demand for overall seaport rail service concept ➢ Containers in import & export direction ➢ Optimised, terminal dedicated services for seaport & hinterland terminals ➢ "Everyday" service (weekend & weekdays) ➢ Integrated seaports with rail volumes too small for own dedicated hinterland block trains (Wilhelmshaven) ➢ Implemented additional rail hub with rail-rail transhipment and access to further hinterland destinations (Bremen) → Proved commercial, technical and operational feasibility; ▪ Continue the optimization of existing infrastructure and service providers for fulfilling quicker results; ▪ TIGER innovations into TIGER DEMO full commercial services is a natural stepwise implementation; ▪ Continue dissemination of cooperative business models between different actors along the supply chain;

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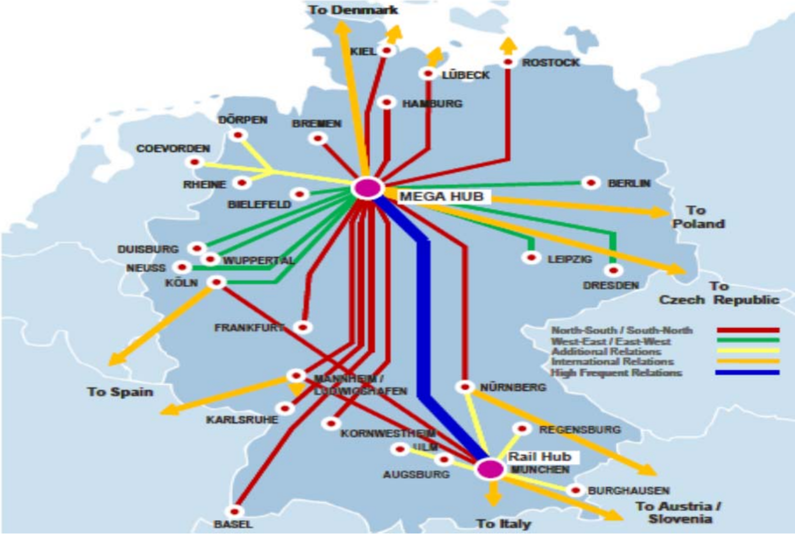
MEGA HUB – PROBLEMS SOLVED



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MEGA HUB Achievements

Best Practices	▪ Integration of „medium-size“ and „small-size“ terminals into nat/int networks. Rail-rail transshipment performed in dedicated Hubs ▪ Operational concepts implementation for train to train transfer ▪ Double sided electrified frictionless rail access reducing costs ▪ Direct trains entrance & exit without shunting reducing costs
Technologies & innovations	▪ Improved IT-System in terminal operation including timing control of rail-rail transfer ▪ IT system for train capacity management ▪ IT-System for Real-time train monitoring with ETA-information
Results & achievements	▪ Lehrte new Hub investments of ca. 105 Mio. € ▪ Extension of Hamburg-Billwerder of 30 Mio. € ▪ New Hub in Duisburg of 50 Mio. € - start of operation in 2013 ▪ München-Riem 3rd module of 25 Mio. €

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MEGA HUB Achievements

Market uptake conditions for full implementation into TIGER DEMO	▪Continued into full commercial basis the infrastructure adaptation of terminal-layout including double-sided electrified rail access, gantry cranes equipped with positioning system and collision protection with trains. ▪Implemented the timing & controlling of crane operation for optimized direct rail-rail-transfer ▪Developed into full commercial basis the strong IT-Support on improved IT-systems for Terminal & Intermodal operators ▪Disseminated the direct train entrance solution with momentum and direct exit ▪Developed the Central capacity management of hub-trains, real-time train controlling and timing ▪ Achieved full close co-operation between RU, TO and IM

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TIGER Pilots	TIGER DEMO Transition & Upgrading	TIGER DEMO Full Market Uptake

- Completed management of the full logistic chain from O/D
- Interoperable collaboration platform ready to be used between SE Asia and the EU intermodal chain customers
- Industrial dimension of CTS transfer from Genoa to Rivalta Terminal Europe and into Europe from there

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TIGER -TIGER DEMO – GFC – Full Market up-take Success Story

- TIGER Project forecasted **a total volume of 1,985,000 TEUs** performed by Port of Genoa in 2015
- In 2012 the Genoa Port achieved CTS traffic in excess of 2MM TEUs 3 years ahead of target
- 500 shuttle trains during project lifetime
- Reduction of transit & dwelling time by 37%+ planned further 20%
- Increased Competitive reach for Accessible Area

A dedicated video has been published summing up the GENOA - GFC TIGER DEMO Success Story

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TIGER Pilots → TIGER DEMO Transition & Upgrading → TIGER DEMO Full Market Uptake

NIENBURG(wagons shift)

- Rail operator: boxXpress;
- Nienburg infrastructure rented by boxXpress;
- 4 hinterland terminals connected in Southern Germany with Hamburg CTA, CTB & EUROKOMBI;
- Optimal dedicated trains;
- Optimal timing for seaport: Pull-concept
- Wagon group exchange in Nienburg by electric line locomotives → lean rail production

BREMEN(CTS shift)

- Fully loaded shuttle trains from Bremerhaven/Hamburg to Bremen operated by ACOS;
- 90 TEU per train for all German hinterland destinations;
- Containers are either buffered in Bremen or shifted immediately to other trains for the final destination;
- Container storage and dispatching in dry port according to consignee instructions;
- Shuttle train service to be extended to Wilhelmshaven:

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TIGER Pilots → **TIGER DEMO Transition & Upgrading** → **TIGER DEMO Full Market Uptake**

Nienburg

- 3 trains (export) per week within TIGER;
- TIGER DEMO: demonstration of export and import flows;
- Number of trains increased to 12 trains per week in TIGER DEMO;
- 18 trains per week in the full-scale demonstration phase;
- In total, more than 400 trains via the rail hub system during the project lifetime, transporting 32,000 TEU.

Bremen

- TIGER DEMO demonstrator started March 2013 with weekly round trip;
- increased to 8 trains per week;
- Optional services to Wilhelmshaven, depending on market demand;
- 80 trains via Bremen, transporting more than 7000 TEU.

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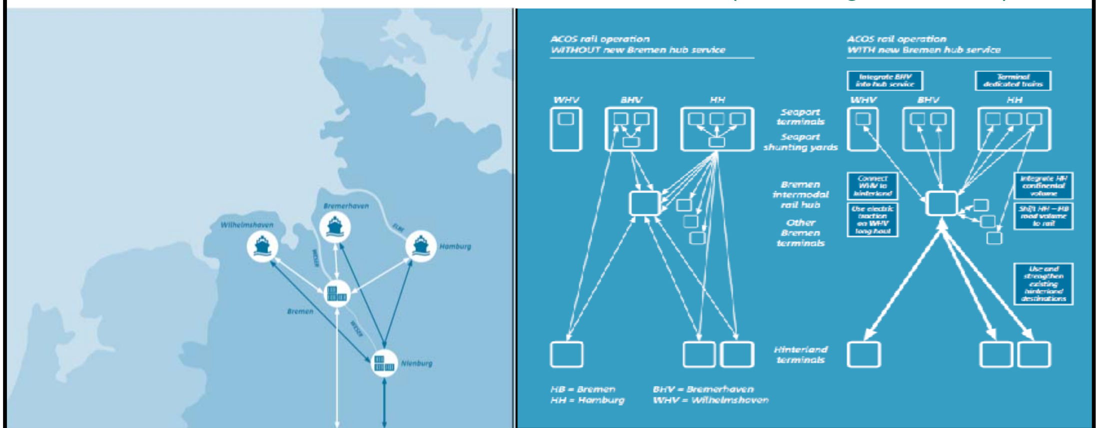
iPort - Full Market Uptake

- Traffic industrialisation to all terminals Nienburg – Bremen - Munich Riem - Nuremberg - Mannheim - Frankfurt – Stuttgart;
- Services improvements both on rail an inside seaports;
- Shift of short distance road traffic from road to rail (Hamburg – Bremen).



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TIGER + TIGER DEMO - iPort - Success Story

- Bremerhaven exceeded 6 MM TEUs 3 years ahead of TIGER forecast;
- Dwell time on Hamburg seaport rail network reduced by 92 %;
- Slot utilisation of Hamburg seaport terminals increased up to nearly 100 %;
- Trains punctuality in Hamburg seaport terminals improved to 85%;
- Reduction of operating costs by avoiding shunting movements in the port;
- Traffic industrialisation in Bremen dry port achieved;
- Environment benefits by using electric traction in Nienburg for shunting instead diesel traction inside the seaport;
- Better utilisation of existing resources achieved by centralised maintenance and repair facilities in Nienburg securing better equipment utilisation.

A dedicated brochure has been published summing up the iPort TIGER + TIGER DEMO success story **- a full Video was presented at Intermodal Europe in Hamburg on October 9th with a statement from Eurogate President Thomas Eckelmann**

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TIGER Pilots	TIGER DEMO Transition & Upgrading	TIGER DEMO Full Market Uptake

MEGAHUB

- Lehrte Construction;
- Munich Riem extension;
- Duisburg new Terminal;
- Hubs having industrial scale;
- Double sided electrified access for momentum operations;
- High performance Gantry Crane servicing several Rail tracks;
- ICT technology;
- Technical management tool;
- Capacity management tool;
- Train monitoring.

TRIESTE to FRANKFURT link

- Start in October 2013
- 3 departures in both direction
- Departure days: Tue, Thu, Sat
- North-South (22h):
- 21:00 CT*→ 19:30 PT* day B
- South-North (23,5h):
- 06:30 CT* → 06:00 PT* day B
- Maritime and continental transport
- Shorter transit time to Greece
- Train monitoring on entire train run
- Hub function at Trieste
- Capacity management system
- Closing time, Pick-up time

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TIGER Pilots | TIGER DEMO Transition & Upgrading | TIGER DEMO Full Market Uptake

TIGER - TIGER DEMO - MEGAHUB – Full Market Uptake

- Implementation of the Capacity management system in Munich on 18.08.2013
- Procurement of new double pocket wagon for the transport of semi-trailers on the new service Trieste – Frankfurt
- Start of a new train between Trieste and Frankfurt in October 2013.

Development of transshipment volume in Rail-hub Munich-Riem during TIGER/TIGER DEMO

Market segment	increase 2010 - 2013
continental	8%
maritime	19%
gateway	18%
total	13%

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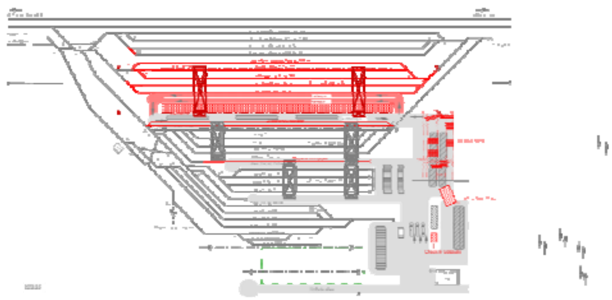
TIGER -TIGER DEMO – MEGAHUB - Full Market Uptake

- New Terminal investments in Lehrte – Munich Riem - Duisburg
- Double-sided electrified frictionless rail access
- Industrial chain through high performance gantry cranes
- ICT-system for terminal operation including rail-rail
- ICT-system for capacity mgmnt & space guarantee at hub connections.
- Real-time train monitoring with ETA-information



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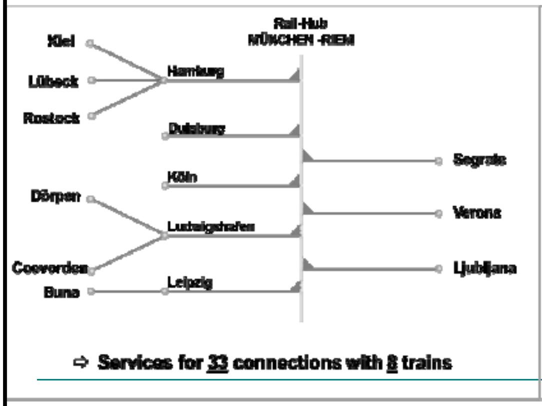
TIGER - TIGER DEMO – MEGAHUB – Success Story

- Improved service quality through 33 services connections
- Increased Volumes up to 70% - Reduced costs in Hubs
- Efficient Train Monitoring Systems
- Capacity mgmnt for train loading optimization & slot guarantee
- Energy efficiency through train momentum



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Evaluation:

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation - YES.

- TIGER -TIGER DEMO market uptake far exceeded the expectations at the project start up. Although hoped the Sea Ports and Rail operators supported with determination the proposed business model transforming it into permanent rail services continued to be scaled up after the project termination. This is due to the extraordinary economic results achieved.
- **GFC** moved volumes of 40000 TEU with more than 500 shuttle trains from Genoa to RTE, continuing thereafter. This became a permanent feature with RTE being approved full Genoa Customs Area
- E Customs E Seals E freight procedures tested and in operation

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Evaluation:

- Transit time+dwell time reduced by 37% + 20% to be further achieved when Genoa Port Rail investments completed
- ICT Technology implementation, Gate in Gate Out by automatic reading devices.
- 3 Terminals TSG+Messina+PSA supporting the service
- **iPort** introduced “Close to the Port” “Close to the Market” business models.
- For Close to the Port via Nienburg services were scaled up from 0 to 18 trains a week during project lifetime with 400 trains moved and 32000TEU continuing thereafter.
- Shunting in the seaport totally eliminated
- Centralized Preventing maintenance implemented
- Dwell time in Hamburg sea port reduced up to 90%
- Train punctuality increased by over 85%
- In March 2013 the business model was introduced in Bremen terminal replicating Nienburg. 80 trains moved 7000TEU continuing.

Evaluation:

- The “Close to Market “ was realized in Munich Riem and Poznan
- Substantial Increase train frequency with secondary terminals being linked via Munich Riem.
- Poznan transit time reduced from 18 to 12 hours.
- Constant full train capacity achieved.
- BLU Opti train management and customers interface implemented
- **MEGAHUB** fulfilled Munich Riem Extension improving services through 33 rail connections within Germany and Cross Border
- Driven Lehrthe Mega Hub under construction
- Driven Duisburg completion in 2013
- Driven expansion in Frankfurt and Stuttgart
- Train Monitoring Systems implemented with Capacity mgmnt for train loading optimization & slot guarantee in real time
- Energy efficiency through train momentum –Double sided electrified access- direct train entrance – no shunting in terminal -

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Evaluation:

- High performance Gantry Crane
- Munich Riem Capacity increase up to 19%
- New SERVICE Baptized Frankfurt-Ludwigshafen to Trieste
- 3 departures weekly in Each direction
- New Double Pocket Wagons T3000 deployed transporting 2 full semitrailers 4m high, 135 tons total weight- 100 Tons payload
- Trimodal Road- Rail Sea being a prosecution to Greece- Turkey

ALL SERVICES CONTINUING AFTER PROJECT CLOSURE

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Evaluation:

2 Is new legislation and standardization based on findings from this research project -It is up to the EU Commission to adopt this project results as best practices for any emerging future decision making. The project had influence on German Dutch and Italian Transport plan. In Italy TIGER project entered into the Italian legislation for Ports system restructuring with the picture of the Genoa Demonstrator included into the plan for increased accessibility. ESPO and other Intermodal Association are using it as example.

3 Are the results of the project implemented across Europe or only in a small number of Member States. YES The project itself through 5 dedicated workshops disseminated its results through "Internationalization of the demonstrated solutions" Work Package". Final workshop was at INTERMODAL EUROPE 2013 In Hamburg. Final event in Genoa on Dec 13th 2013. During the workshops contacts were established with other EU Ports such as Barcelona, Valencia, Marseille, Le Havre, Rotterdam, Antwerp.

4 Are the results of the project implemented outside Europe before being accepted in Europe. TIGER was presented at an official Ministerial Delegation from Thailand who came in Italy specifically for that purpose. They visited in addition to Genoa the Hubs involved in the Project. Tiger was presented at DUBAI exhibition by Hamburg Marketing.

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Evaluation:

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design. YES since the project results delivered more efficient and competitive services at inferior costs and continuing thereafter.
6. Did the project increase competitiveness of the railway transportation compared to other transport modes. YES. The new economy of scale generated at sea by the giant CT vessels require on land an industrial dimension that only rail and inland waterways can deliver, not road. TIGER project was instrumental for proving rail competitive advantage.
7. Are the results of the project taken into consideration when preparing public tenders. YES The project is strengthening the EU Ports competitive profile making them to have accessibility to new attraction zones. Port Authorities are Public bodies. Those participating to the project included Tiger business model into their procurement culture.
8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability. YES – Hamburg is now connected with several trains/day to Prague- Poznan and via Munich they reach Austria, Hungary, Italy, Slovenia, Croatia. Genoa is increasing its penetration to Switzerland, France, Austria, Hungary. Frankfurt and Ludwigshafen are now connected via Trieste to Greece and Turkey. All of them integrating all modalities. The services are permanent features.

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FIRE: Evaluation **Evaluation criteria:**

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality YES. They are all Intermodal and in the case of Germany to Trieste Greece and Turkey "Trimodal"
10. Can benefits be assessed in financial terms - YES as per declared official substantial economic results supported by declarations of the Chief executives.
11. Applicability of results to future scenarios - YES These innovative solutions/services/routings/investments/technologies are consolidated and continue to produce and maximize results in future. The increased productivities make the Tiger Business model a consolidated business model.
12. Usefulness of research procedures for future projects (incl. modeling) YES. Research is very useful for promoting technologies evolution innovations and new business models. When projects have strong market uptake impacts they become drivers for future investments programs and innovative commercial activities

The Tiger achievements were recognized by Thomas Eckelman Eurogate chairman of the Board – Mr. Frank Horch Hamburg Transport Minister, Dr Luigi Merlo President of Genoa Port Authority and summed up in a published book.

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Reasons for outcome

TIGER since its conception in May 2007 before the economic downturn was totally market driven with the objective of solving traffic problems in the EU Ports affected by serious congestion. When TIGER started in October 2009 recession started, congestion disappeared and the economic circumstances totally changed from the project conception. The Consortium formed by key market players was strong, did not panic because of the traffic downturn and took the recession as an opportunity for making the necessary changes to old encrusted practices. The planned investments were executed, the equipment and technologies were introduced and continued thereafter. The project plan continued, the innovations and technologies implemented and the economic/service efficiency results which started to appear became themselves the drivers for further innovations initiatives. The original pilots are upgraded for full permanent market fruition.

The TIGER project partners through the innovative services introduced in the market place have increased their competitive profile. The TIGER demonstrated solutions can be replicated elsewhere in Europe modified for the local morphological situations and circumstances. Rail Intermodality has gained awareness of its transport industrialization possibilities and economy of scale generation opening up new horizons. The Hubs/dry Port role has been greatly enhanced by this project as integral part of the future Rail Freight network.

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Lessons learnt

- Projects must have a strong/sound market uptake foundation with consortium partners being key actors in the market place
- Transport industrialization a key project driver to be demonstrated proved to be a winner. Rail Freight is a capital intensive business. The only way by which Rail Freight can gain new spaces is by developing intensive widespread utilisation & fast asset rotation.
- Horizontal cooperation between various partners sometimes competing between themselves, proved to be key for generating critical mass. The TIGER Project in Hamburg, Genoa, Bremerhaven but also in Gioia Tauro, Rivalta, Taranto, Bologna, Munich Riem acted as aggregator putting together otherwise fragmented interests.
- There are redundant productivities to be extracted from the EU rail system. Nienburg which was a disused rail yard was given a new life, new mission, new work with relative modest investments. There are many of those in Europe. Not only Green field project must be planned but also Brown Field projects based on what we have got.
- Fragmentation is enemy of industrialisation & standardisation vital rail freight ingredients. It is also enemy of Technology innovation, transport system implementation. Technologies are available but not enough implemented because of excessive fragmentation. When aggregation-horizontal co-operation is achieved implementation becomes easier.
- Tiger demonstrated that Sea Ports must regain their original mission of linking sea with land other operations to be executed elsewhere(Dry Ports/Hubs) for maximizing productivity.

MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- To make it more competitive
- To foster increased innovation
- To guide research efforts at the European level

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
- Ensure a strategic approach to the prioritisation of rail research

Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
- To ensure that the results of previous rail research can be taken into account for future projects
- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

ERRAC Project Evaluation Group

CANTOR

EVALUATION FROM JANUARY 2014

Project acronym:	Cantor
FP	6, 2005
Programme acronym:	
Project Reference:	
Call identifier:	
Total Cost:	964 000 €
EU Contribution:	600 000 €
Timescale:	
Project Coordinator:	Prof. Anders Nilsson KTH
Web references:	Interviewed Siv Lett Bombardier

- ❑ Presented by: Dan Otteborn
- ❑ Date evaluation: 2013-11-10
- ❑ Market uptake: WEAK
- ❑ Follow up projects:
- ❑ Other related Projects:

Objectives of the project

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

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

A concrete aim of the project was to develope a larger follow project with more concrete deliverabels

Background

Partners

- Universita degli studi di Ferrara IT
- Chalmers SE
- Institut National des science appliquees de Lyon FR
- Technical University Berlin DE
- Ku Leuvan - Research and development BE
- University of Southampton UK

Advisory Board:

- Bombardier and Scania SE
- BBM DE
- SNCF and Akeryards FR
- LMS BE
- Fiat IT

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Achievements

The project delivered a number of documents including the draft specification for the intended larger follower project. However no follow up project was initiated.

No evidence that the project stimulated a network which was not already in existance based on normal contacts between academic and manufacturing researchers in a specific field.

The project have not left any evidence of having contributed to the establishment of a network or contributed to the survival of such network.

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Evaluation:

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation NO
2. Is new legislation and standardization based on findings from this research project NO
3. Are the results of the project implemented across Europe or only in a small number of Member States NO
4. Are the results of the project implemented outside Europe before being accepted in Europe NO

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Evaluation:

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design NO

6. Did the project increase competitiveness of the railway transportation compared to other transport modes NO

7. Are the results of the project taken into consideration when preparing public tenders NO

8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability NO

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Evaluation:

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality NO

10. Can benefits be assessed in financial terms NO

11. Applicability of results to future scenarios NO

12. Usefulness of research procedures for future projects (incl. modeling) NO, the intended follow-up project did not materialize.

Reasons for outcome

- The only concrete objective of the project was to create a large follow-up project when this did not happen there was no substance left.
- Manufactures are seeking contacts with academia on specific problem when these problem occur if no in house solution can be found.
- To much divergence in the project rail, road and waterborne very little common problem.

Lessons learnt

- Do not engage in such un-specific general project, especially when the future is out of control.
- Follow up did not materialize.

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MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

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ERRAC Project Evaluation Group

NEWOPERA

EVALUATION FROM January 2014

Project acronym: NEWOPERA
FP 6
Programme acronym:
Project Reference: FP6 – 006172
Call identifier: SUSTDEV-2002-3.3.1.3.1
Total Cost: € 3.944.015
EU Contribution: € 3.596.946
Timescale: 45 Months – 01.01.2005 -30.09.2008
Project Coordinator: Consorzio TRAIN

Web references: www.newopera.org

- ❑ **Presented by: Dan Otteborn**
- ❑ **Date evaluation: 28.01.2014**
- ❑ **Market uptake:** Strong
- ❑ **Follow up projects:** TIGER – TIGER DEMO – MARATHON - VIWAS
- ❑ **Other related Projects: TREND and REORIENT**

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NEWOPERA

New European Wish Operating Project for European Rail Network

Premise: The centrality of rail in a pan-European dimension is the ultimate goal of the European Transport Policy encouraging long-term sustainable mobility and

promoting a competitive environment. In order to achieve this goal, a modal shift towards rail is necessary, while reverting the erosion of the rail freight market share. The NEW Opera project will contribute to this goal by assessing ways for:

- Implementing the ERRAC Strategic Rail Research Agenda 2020 by capturing the threefold increase in
- freight volumes by 2020.
- Providing grounds for the establishment of 15.000 km of new and existing lines predominantly dedicated to freight.
- Revitalising the rail business by applying NEW business models and a NEW service culture through the use of freight dedicated infrastructure.
- Envisaging transitions from the existing rail business model based on rail infrastructure dual use, to one
- more capable of capturing market demands and achieving productivity and efficiency gains based on
- dedicated freight networks.

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NEWOPERA

New European Wish Operating Project for European Rail Network

Rationale:

Mr Jan Scherp of the European Commission introduced the NEW Opera project as an important milestone towards competitive rail freight services. NEW Opera can be seen as complementary to the regulative approach of the European Commission to trigger the modal change, with a special focus on high-performance rail freight infrastructure.

NEW Opera was a Coordinated Action in the area of joint European railway research. NEW Opera studied the necessary step changes for achieving a long-term scenario 2020 of a core network predominantly dedicated to rail freight. NEW Opera coordinated and cooperated with the Coordinated Actions TREND and REORIENT of the same call for proposals.

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Objectives of the project

NEW Opera will contribute to invert the declining trend of EU railways by:

- Implementing the **introduction of the dedicated rail freight networks concept** backed by a **sound socio-economic and environmental assessment**.
- **Setting sound methodologies for the distribution of traffic flows** over railway networks;
- **Precisely localizing traffic flows** in the European area so as to give development forecasts;
- **Providing a sound analysis of transport demand and supply** over railway networks;
- **Establishing simulation and modeling tools of traffic flows** on medium and long-term
- Providing an **efficient decision-making tool**
- Removing the barrier for achieving **Shift to Rail** . Shift to rail will not take place automatically but has to be induced by competitive costs and services
- Envisaging and proving the **sustainability and environment** dimensions.

Background

Details

- FP 6 - FP6 – 006172
- Total Cost: **€ 3.944.015**
- EU Contribution: **€ 3.944.015**
- Start and duration: **01.01.2005 -30.09.2008**
- Scientific Coordinator:**Consorzio TRAIN**

Partners

Consorzio TRAIN, F & L, ALSTOM, NESTEAR,TRANSFESA,RAIL4CHEM, Ansaldo Breda, LKW Walter, CEMAT Stora Enso,Rail Traction Co, Bombardier Transp, Autorità Portuale Genoa, GYSEV, SIEMENS Transp, Kombiverkehr, DB Netz, RFF, PRORAIL,UNIFE, SOGEMAR, ERMEWA, DHL, Volkswagen Transport, Port Autonome du Havre, RFI

European Rail Research Advisory Council

NEWOPERA

New European Wish Operating Project for European Rail Network

Partners interviewed:

Organisation	Country	Name of interviewee
Consorzio TRAIN	Italy	☑ Valerio Recagno
European Freight F& L	Belgium	☑ Franco Castagnetti
UIRR	Belgium	☑ Eugenio Muzio/Rudy Colle
CER	Belgium	☑ J. Ludewig/ L. Lockmann
SNCF	France	☑ A. Toubol /F. Adroit
RFF	France	☑ H. Du Mnesnil, J.P. Orus, C. Keselievic
DB	Germany	☑ Hedderich, Harald Heusner
KTH	Sweden	☑ Prof. Bo Lennart Nelldal
Karlsruhe Univ.	Germany	☑ Prof. Werner Rothengatter
Montreal Univ.	Canada	☑ Prof. Marc Gaudry
La Sapienza Univ	Italy	☑ Prof. Antonio Musso
Bombardier Transportation	Sweden	☑ Andrew Foster/ Dan Ottebon
RFG	UK	☑ Lord Tony Berkeley

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Background

The rebalancing of transport modes will not take place automatically. Assuming NEWOPERA approach of establishing a Rail network predominantly dedicated to Freight the following goals are to be set:

- Significant increase of speed on the main European corridors up to 100% . Actual measurements made on railway networks (RFF) show, that the most critical point is the time lost on nodes to leave priority to passengers trains rather then the speed of the freight train.
- Increase in reliability and consistency of rail services competitive with those offered by road (hypothesis taken from EUFRANET).
- Important reduction of cost due to increase rotation of rolling stock, increase of "effective" driving hours of drivers and possible increase in length of trains: these are expected to lead a reduction from 30% up to 50% of operating costs.
- Very significant increase in rail network capacity due to more homogenous speed of the trains, pointing at bottlenecks which have to be removed.
- Better combined utilization of new infrastructure for High Speed Train and former rail lines, leading to an improved combination of lines respectively dedicated to freight or to passengers, avoiding conflicts between types of traffic

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Achievements: This Artistic impression of NEWOPERA dedicated rail freight network produced in year 2000 at project conception was forward looking when compared to TENT network and European Rail Network for Competitive Freight, arrived 13 years later.

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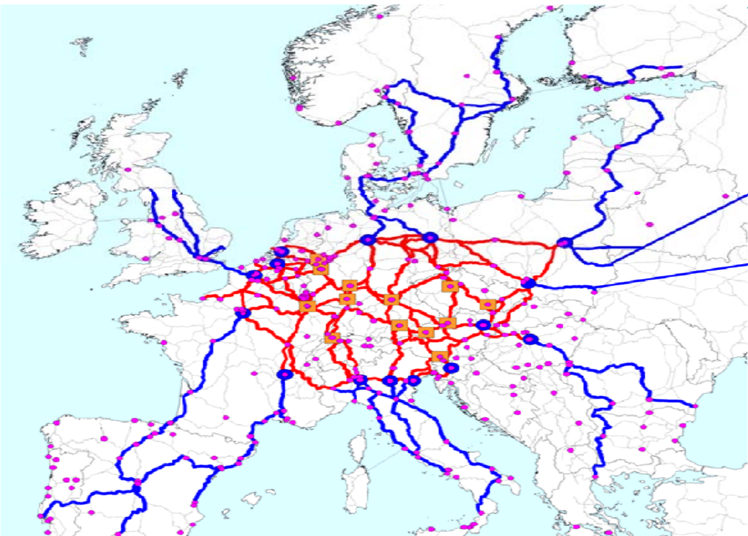
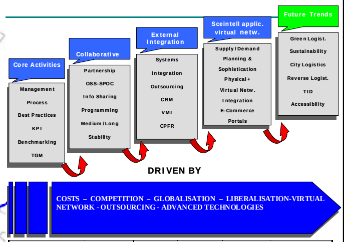
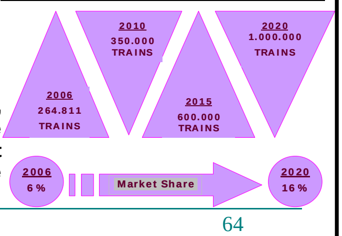




SEGMENTS	SYMBOL	Rail Market Share	Size of Market	Growing Potential	Customers Group
Raw Materials		High	Very Large	Linked to Growth	Heavy Industry
Durable Goods		Medium	Very Large	High	Large Shippers and LSP
Fast Consumer		Very Small	Very Large	Very High	LSP
Furniture, Toys, Household Ornam.		Very Small	Large	Very High	LSP
Process Industries		Medium	Very Large	High	Large Shippers and LSP
General Cargo		Negligible	Very Large	Very High	LSP, Optimisers, Consolidators
Specialties, Dangerous		Medium	Medium	Medium	Large Shippers and Specialised LSP



This map indicates the Central European Rail Network, Network Hubs, Gateways, Connections and Intermodal Terminals. As one can notice these Intermodal Terminals are scattered all over Europe and do not appear to be connected to the assigned network. This is one of the expected effects of a borderless Union. © NEWOPERA COPYRIGHT

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Assuming NEWOPERA Fulfilment

- Volumes Increase for rail freight in Europe in 2020: +300% (ref. ERRAC SRRA)
- Increase Capacity: 50%-100% (depending on Scenarios)
- Increase of Commercial speed in corridors: +100%
- Railway freight Market share: 16%
- Decrease of road haulage market share: 6%
- Decrease in operational costs: 30-50%
- Impact on EU GDP: Sensible increase
- Impact on peripheral areas:
- Relocation; intra-industry trade;
- know-how transfer
- Benefit to final consumers:
- Sustainable mobility; decrease of production cost; price transparency
- Positive network effects:
- Enlarged economics of scale;
- Cost-saving in transport supply-chain:
- Improved just-in-time logistics

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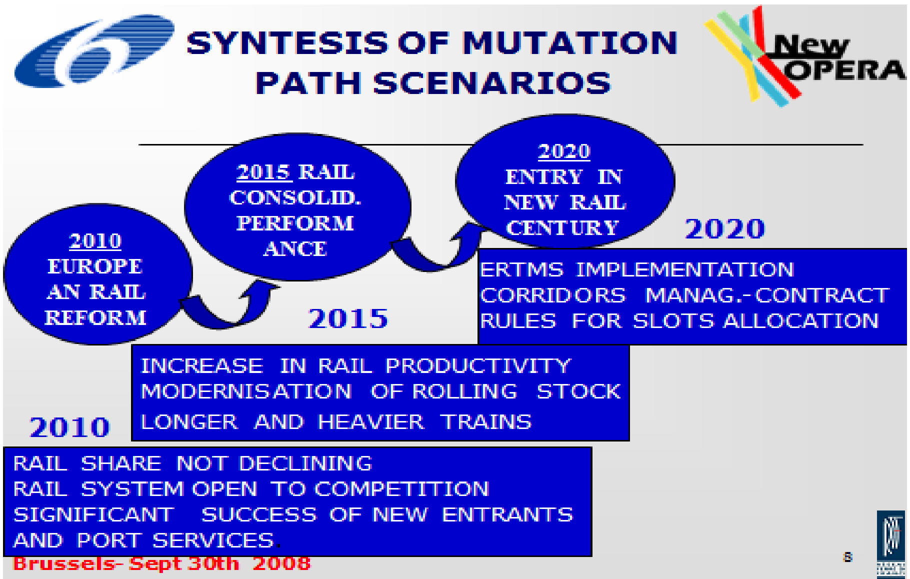

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TRAFFIC PROJECTIONS

New OPERA

TOTAL FLOWS 2020

	MM TK GLOBAL RAIL	MM TK NEW OPERA NETWORK	MM TK ROAD	MM TK FEEDER
REFERENCE 2020	497799	321403	1582326	249654
NEWOPERA SCENARIO 2020	731535	563149	1423027	162001
GAIN/LOSS	233736	241747	-159299	-87653

NEWOPERA NETWORK ABSORBS SIGNIFICANT SHARE OF THE TOTAL RAIL FREIGHT IN TONS/KM IN EUROPE. THE **NEWOPERA** NETWORK UTILISATION REPRESENTS 59 % OF THE TOTAL RAIL TRAFFIC AND 66 % FOR TRANSPORT DISTANCES ABOVE 800 KM.

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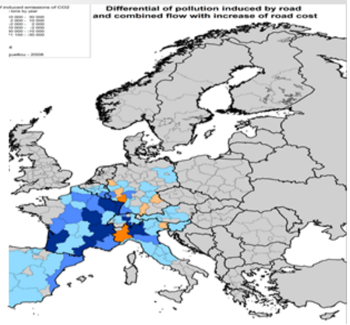
CO2 EMISSIONS FOR ROAD

New OPERA

DIFFERENTIAL OF CO2 EMISSIONS BY ROAD AND COMBINED FLOWS WITH + 30 % ROAD COST ON TRANSALPINE - TRANS PYRENEE TRAFFIC



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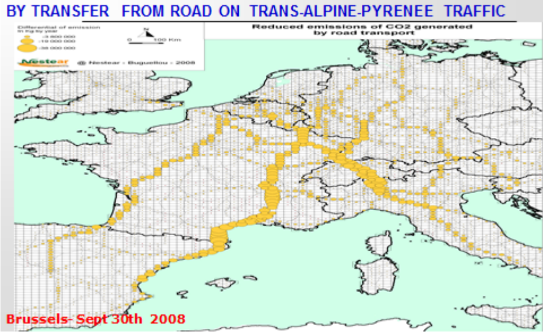
REDUCED CO2 EMISSIONS 2020

New OPERA

BY TRANSFER FROM ROAD ON TRANS-ALPINE-PYRENEE TRAFFIC



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PRINCIPLES OF A COST BENEFIT ANALYSIS

COMPARISON WITH/WITHOUT PROJECT

IS THE PROJECT WORTHWHILE ?
OVERALL ECONOMIC IMPACT
=
CHANGE IN TRANSPORT USER BENEFITS (CONSUMER SURPLUS)
+
CHANGE IN SYSTEM OPERATING COSTS AND REVENUES(PRODUCER GOVERNMENT SURPLUS)
+
CHANGE IN COSTS OF EXTERNALITIES
-
INVESTMENT COSTS INCLUDING MITIGATION MEASURES

€€€

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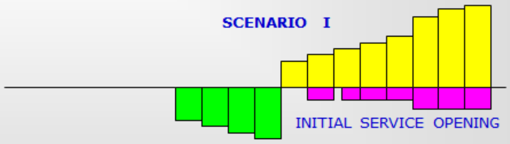
PRINCIPLES OF COSTS BENEFITS ANALYSIS

ANNUAL BENEFITS OF THE PROJECTS

SAVED TIME SAVED COSTS COMPARED TO OTHER MODES
EXTERNAL BENEFITS SECURITY & ENVIRONMENT



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STAKEHOLDERS / EFFECTS MATRIX

MATRIX FOR MADRID-BERLIN CORRIDOR IRR 5,5%

	ROAD TO RAIL SHIPPER	ROAD OPER.	RAIL OPER.	RAIL MANAGER	INVEST MENTS	NON USERS	ECON. € VALUE
Users							
Change in transport costs	12 251,8						12 251,8
Additional revenues			23 790,9				23 790,9
OPERATION							
Track charges			-7 655,4	7 655,4			0,0
Additional operating costs			-13 972,7				-13 972,7
Change in benefit		-2 161,2					-2 161,2
ASSETS							
Infrastructure					-13 000,0		-13 000,0
Infrastructure maintenance				-7 655,4			-7 655,4
Safety						922,5	922,5
Green house effect gaz emissions						514,8	514,8
Air pollution							0,0
Climatic change							0,0
ECONOMIC PROFITABILITY	12 251,8	-2 161,2	2 162,8	0,0	-13 000,0	1 437,3	690,7

CHANGE IN TRANSPORT COSTS

CHANGE IN BENEFITS

ADDITIONAL REVENUES, TRACK CHARGES, OPERATING COSTS

NEUTRAL EFFECT

ADDITIONAL NEEDED FINANCIAL CONTRIBUTION

CHANGE IN EXTERNAL EFFECTS

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CORRIDOR MADRID - BERLIN RESULTS

NEWOPERA ASSUMPTIONS

WHEN VALUING POSITIVE EXTERNAL EFFECTS INDUCED BY A MODAL SHIFT FROM ROAD TO RAIL IT WOULD BE SOCIO-ECONOMICALLY VIABLE TO INVEST -GLOBAL AMOUNTS IN RAIL FREIGHT INFRASTRUCTURE ONLY-

- **13 G€ ON THE CORRIDOR**
- **43 G€ ON THE WHOLE NEW OPERA NETWORK**

SUFFICIENT TO IMPLEMENT ALL THE MEASURES IDENTIFIED WITHIN THE NEWOPERA SCOPE SCENARIO ?

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IMPLEMENTATION PLAN
EXTREME SYNTHESIS
NEEDED TO BE DONE ON THE MADRID-BERLIN CORRIDOR AND PROSECUTION TO WARSAW

New OPERA

- RECONSTRUCTION OF 8 BORDER BRIDGES ON THE ODER AND THE NEISS STARTING 2008 WITH THE ODERBRUCKE IN FRANKFURT/ODER.
- MODERNIZATION OF THE TRACK AND ELECTRIC POWER SUPPLY BETWEEN BERLIN AND POZNAN
- DOUBLING OF THE TRACK FROM KNAPPENRODE TO HORKA AND ELECTRIFICATION THROUGHOUT TO WEGLINIEC IN ORDER TO CREATE A SECOND ALL ELECTRIFIED TRUNK ROUTE BETWEEN GERMANY AND POLAND WITH A HIGH FREIGHT PRIORITY.

PROVIDED BY Die Bahn DB

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GENOA-ROTTERDAM INTERMODAL CORRIDOR IN 2020

New OPERA

- BASEL-MANNHEIM FREIGHT DEDICATED LINE: COMPLETED IN VARIOUS STAGES IN 2012-2015-2020
- TWO ALTERNATIVES IN SWITZERLAND: LOETCHBERG/SIMPLON/LUINO/B.ARSIZIO/NOVARA COMPLETED 2007 AND GOTHARD/CHIASSO IN 2015
- MONTE CENERI TUNNEL IN COMPLETED 2019
- TWO ADDITIONAL TRACKS FROM MONTE OLIMPINO OI COMO-MILANO COMPLETED 2017
- GENOA/MILAN THIRD RAIL TUNNEL???? PRIVATE INTEREST OFFERED TO BUIL IT BY 2016 ON 50 YEARS CONCESSION.

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GENOA-ROTTERDAM TECHNICAL DETAILS

New OPERA

- FULL CORRIDOR OPENING 2020
- HUGE CAPACITY GENERATED FOR FREIGHT
- GAUGE "C"
- MAXIMUM GRADIENT 12%O
- CORRIDOR DISTANCE REDUCTION
- REDUCTION 50% ON PREVIOUS TRANSIT TIME
- CORRIDORS MANAGEMENT IN OPERATION
- HUBS AND TERMINALS ON THE LINE MUST BE ADEQUATE TO NEW CAPACITY (B.ARSIZIO-NOVARA-WOIPPY-MANNEHEIM-RTD-ANTWERP)
- LONGER TRAINS 1000 TO 1500 MT
- STANDARDISED EUROPEAN ERTMS/ETCS LEVEL 2 SIGNALLING SYSTEM LEADING TO LEVEL 3

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BETUWE LINE INTERMODAL CORRIDOR IN 2020

New OPERA

- DEDICATED TO FREIGHT IN 2007 RTD-ZEVENAAR
- EMMERICH/OBERHAUSEN BY 2015
- GAUGE "C"
- TECHNICAL SPECIFICATION DOUBLE STACK
- LONGER TRAINS 1500M
- CORRIDORS MANAGEMENT
- STANDARDISED EUROPEAN ERTMS/ETCS LEVEL 2-3
- HUBS/TERMINALS ADEQUATE TO NEW CAPACITY
- LINE'S CAPACITY DOES NOT MAKE NECESSARY DOUBLE STACK FOR THE TIME BEING

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Evaluation:

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation. The rail network design envisaged at the NEWOPERA project conception is being implemented:

- The greatest Market uptake is the Betuwe Line investment to full operational profile
- Betruwe Line is being scaled up with further 2 Billion € Investment in the Emmerich /Oberhousen leg in Germany for accessing the Ruhr area
- The Iron Rhine upgrading from Antwerp to Germany for accessing the Ruhr area is the object of negotiation between the Countries involved. This is judged to be a strategic connection for the Port of Antwerp. This is a dedicated cargo Rail Line.
- The Port of Antwerp invested inside the port area in 3 rail terminals which have been immediately utilized and filled up with rail traffic
- The Port of RTD in its Masvlake 3 has planned a dedicated Rail CT terminal for exiting the traffic in an industrial way with volumes coherent with the Betuwe Line capacity
- As a result of these actions the Modal split of both Antwerp and RTD ports which had a modest rail share of about 5% with the rest being moved either by road and barges in roughly equal quantities has jumped now to 15% in about 5 years and growing.
- The Basel – Mannheim quadrupling East of the Rhine is being realized as per program making two additional rail tracks available for freight
- In Switzerland Loetchberg is fully operational, the Gothard in the course of completion(2016)

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Evaluation:

- Monte Ceneri Tunnel in Switzerland is set to be completed in 2019 for debottlenecking the Gothard line to Chiasso
- In Italy RFI has approved the investment on Monte Olimpino Tunnel and debottlenecking the Como Milano line coherent with the additional capacity of Gothard Tunnel realizing in practice a rail freight two tracks corridor from Milano to North Sea
- A new agreement has been recently signed between Italy and Switzerland for upgrading the Gallarate Luino rail tracks up to 4 meters “gauge C” high gauge and 750 meters length trains debottlenecking the Genoa RTD corridor increasing the productivity of Loetchberg Line where the maximum gradient is 12% all along the line.
- In Italy the 3rd Milano /Genoa Tunnel is already in execution while the restructuring of the entire Genoa rail network is also in execution with an investment of € 600 MM.
- The ERTMS level 3 has already been decided although it will take few more years to come to full fruition
- The trains of 1500 meters length have been favourably tested between Lyon and Nimes
- The corridors Management at least on the OSS is in operation via Rail Net Europe as indicated inside the project. The Corridors Governance is being examined at EU level. For each TEN T corridor a manager responsible for each corridor has been already named.
- The Gallarate/Busto Arsizio terminal has been doubled to be the biggest in Europe for Intermodal traffic serving the Milano/Antwerp/RTD corridor. The Novara CT terminal is also being expanded, with MELZO Milano supported by SBB becoming ready to receive 750 M trains and doubling its CT capacity.

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Evaluation:

- In the Ports of Hamburg and Bremerhaven bottlenecks have been removed, bridges built and terminals upgraded allowing the doubling of traffic by 2016 up to 400 trains/day from the 200/250 trains/day moved now.
- The TIGER project has introduced new services to/from these ports & the hinterlands
- A massive investment program is course of execution in Germany for hinterland terminals. Lehrte the new mega hub is in execution. Munich Riem new module is operation since 2012. Duisburg new DUSS terminal completed, with new modules in Stuttgart and other terminal in execution. Total investment 500MM in terminals facilities.
- All the measures indicated by the project are in course of execution or already executed.
- The German Part indicated into the project is in course of execution. The Berlin Poznan line modernization is nearing completion. The new Border bridge in Oderbrűke is in service. Other bridges already in operation. The Kappenrode-Horka-Wegliniec freight line is on its way and is due to be completed in 2016. Delays due to Nimby attitude is affecting the Geltendorf – Lindau electrification project. This is the missing link of the Munich – Zurich International axis which is now due to be completed by 2020.
- The underground by pass of the double track bottleneck in Rastatt is in full swing and expected to be completed by 2023. This will remove the last capacity limitation between Karlsruhe and Offenburg which is already 4 rail track throughout.

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Evaluation:

- The Brenner second rail Tunnel is in execution and terminal capacities both in the Verona Area and in Austria are being expanded.
- The Turin Lyon new Tunnel in Valle Susa despite the very strong "Green" opposition has started and the base tunnel excavation is in execution. The French and Italian Government have renewed confirmation of this execution.
- The doubling of Genoa/Ventimiglia rail line connecting via France to Spain is in course of execution.
- The doubling of La Spezia/ to Parma rail line across the Apennines is in course of execution for prosecution to Brescia and Verona for the Brenner Tunnel. It is connecting the Tyrrhenian Sea with the North sea also linking the Tyrrhenian sea to Corridor 5 in Brescia.
- Both the Loetchberg and the Gothard despite having debottlenecked the line, need further works along the corridor. On the Loetchberg line the Simplon tunnel needs refurbishing due to be completed by 2018. On the Gothard the Basel-Ertstfed section needs to be adapted to 4 meters 4 angles trucks gauge which will be completed by 2019-2020.
- Thanks to all these actions the full corridor Rotterdam Genoa will be fully standardised to the most advanced gauge/technologies by 2019/2020 up to Gallarate/Milano and from Milano to Genoa the third tunnel across the Apennines already in execution is due to be ready not before 2025.

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Evaluation:

2 Is new legislation and standardization based on findings from this research project. Yes. NEWOPERA Project has fathered the European Rail Network for Competitive Freight legislation which was passed by the EU Parliament on 2011. This was achieved through CER that promoted PERFN Preferential European Rail Freight Network, mitigating the word" Dedicated" with " Preferential". This "semantic" modification allowed the legislator through the Parliament Rapporteur to make the issue Passengers – Freight competing for the same rail track more "politically" acceptable. NEWOPERA involved at that time Gabriele Albertini chairman of the EU Parliament Transport Committee as well as Paolo Costa MP.

3 Are the results of the project implemented across Europe or only in a small number of Member States. The TEN T network and its full implementation expected by 2030 is the actual demonstration of the NEWOPERA Project recommendations validity. For the Investments in course of execution refer to point 1. For the total European network refer to the TEN T network and the European Rail Network for Competitive Freight legislation

4 Are the results of the project implemented outside Europe before being accepted in Europe. NEWOPERA was a European research. A dedicated presentation was made on NEWOPERA under the UIC auspices to the Russian Railway who perceived NEWOPERA Project as being the FLAGSHIP Project in the Union. Regular Intermodal service connections were introduced following the NEWOPERA project. The Transiberian service linking Peking to Hamburg operated by DB Schenkers, and the Trans Asia via Kazakstan operated by Trans Eurasia Logistics.

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Evaluation:

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design. Projects such as TIGER, TIGER DEMO,MARATHON,VIWAS,SPIDER PLUS,CAPACITY4RAIL are proving the NEWOPERA recommendations in the market place increasing competitiveness, effectiveness and shifting traffic to Rail.
6. Did the project increase competitiveness of the railway transportation compared to other transport modes. Tiger Project from NEWOPERA introduced a new business model in the sea Ports/Hinterland destinations via Dry Ports proving a formidable success story both for costs savings and service performances.
7. Are the results of the project taken into consideration when preparing public tenders. Yes TEN T network is included in Public Tenders It is certain that NEWOPERA project influenced the implementation of the TEN T corridors. It was the first project to introduce "Officially" the Rail Freight dedicated lines approach provoking a new philosophy in Europe about the need to give more priority to freight trains if shift to rail is to be achieved and environmental benefit to be pursued.
8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability. The Betuwe line cross border expansion up to Oberhousen in the Ruhr area, as well as the Iron Rhine from Antwerp to the Ruhr together with the Genoa RTD debottlenecking all along the line, the new Brenner tunnels and Valle Susa on Lyon/Turin prove the NEWO entering into the full implementation phase.

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Evaluation:

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality: Very much so. The generation and availability of additional capacity on the European rail network is a pre-requisite for effective competition. NEWOPERA has seen the advent of newcomers into the traction/full trains/intermodal operators field. RTC, RAIL4CHEM, TRANSFESA were project partners. They have been incorporated into bigger companies. Many newcomers have obtained EU traction licenses. Some have been very successful such as BoxXpress, Acos TX logistics, ERS, etc others have been consolidated into bigger companies. The traditional intermodal operators such as Kombiverkehr, Hupac have obtained licenses. Without the additional capacity being generated by the NEWOPERA project implementation the competition to the Incumbents would have been only theoretical.. NEWOPERA advocated the need to interoperability and rolling stock cross acceptability well before ERA constitution.
10. Can benefits be assessed in financial terms: Yes. One can argue on the figure produced by the RAILPAG system elaborated by RFF, but they are as good as any other system. In fact RAILPAG is the only model incorporating all the costs dimensions. The investments being carried out on rail and debottlenecking prove this point. The EU Commission drive in favor of sustainable mobility and the internalization of external costs through Eurovignette stand to indicate that the Railpag system is correct for calculating the IRR rate of return of the rail infrastructure investments.

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Evaluation:

11 Applicability of results to future scenarios. Yes The EU White Paper is going in this direction both for 2030 and 2050 vision.

12 Usefulness of research procedures for future projects (incl. modeling). Modeling have been used extensively during the project lifetime and in the production of the results for NEWOPERA scenario.

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Lessons learnt

- Consortium had to win scepticism &opposition. Some incumbents were against.
- The Viareggio accident proved the need to move away from city centres the cargo traffic in the same way ring roads motorways diverted juggernauts
- NEWOPERA indicated , OSS application, multi channel distribution approach, service segmentation, wagons fleet rejuvenation, costs benefit analysis, positive environmental impacts, decongestion approach, shift to rail drive, rail freight industrialization, research on actual traffic data movements, technology impacts
- NEWOPERA indicated that it was necessary to transport more with the available resources opening up to longer faster and heavier trains & Transport industrialisation for increased competitiveness
- NEWOPERA indicated a step change in Wagons tech for higher productivity. New wagons T3000' carrying 2 trailers of square gauge & 9'6'' high Cts. Are operative
- NEWOPERA indicated the Cooperative approach between operators already existing in other transport modes such as Air, Sea, Road

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Reasons for Outcome

- Clever Prediction of future traffic flow already at the project conception phase in 2000 paved the way for legislation in 2011
- High focus on a realistic business case with demanding targets of costs reduction
- Skilful and active project management able to unify and enthusiasm both project internal and external stakeholders
- The Project worked with an active implementation during the project conception phase right up to the final end of the project
- Extensive analysis of "IF NOT" scenarios and consequences
- Right mix of partners
- Riding and supporting decided investment in infrastructure and hubs
- Several associated EU projects supported the implementation.

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MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- To make it more competitive
- To foster increased innovation
- To guide research efforts at the European level

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
- Ensure a strategic approach to the prioritisation of rail research

Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
- To ensure that the results of previous rail research can be taken into account for future projects
- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

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ERRAC Project Evaluation Group

INMAR

EVALUATION FROM March 2014

Project acronym:
FP: 6
Programme acronym:
Project Reference:
Call identifier: NMP2-CT-2003-501084
Total Cost: € 27 M
EU Contribution: About 50%
Timescale: Jan 2004 to Jan 2008
Project Coordinator: Prof. Dr-ing Holger Hanselka

- Presented by: Dan Otteborn
- Date evaluation: 20.01.2014
- Market uptake: Strong
- Follow up projects: Not known
- Other related Projects: Cantor

Web references: http://www.inmar.info http://cordis.europa.eu/projects/501084

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INMAR | Intelligent Materials for Active Noise Reduction

Main Objectives

- New complex multifunctional passive, semi-active and active materials and material structures
- Actuator and sensor system based on the developed materials, fully operational under harsh environment, high and broad-band load and under large deformation.
- Their manufacturing technologies.
- Novel miniature control and electronics system for multifunctional materials and for the actuator and sensor system.
- Simulation and optimization tools for the design of intelligent systems
- Technologies to integrate intelligent materials system in structural components.
- Methods and procedure to assess their reliability, environmental impact and life-cycle including condition monitoring.

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Background

Details

- FP
- Total Cost:
- EU Contribution:
- Start and duration:
- Scientific Coordinator:

Partners

- Totally there were 44 partners in the project of them only 2 were railway related, Bombardier and Lucchinni.

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Background

The INMAR project was created at a time when new technology for noise abatement was starting to appear on the market, so called active noise abatement simultaneously the pressure to decrease noise become stronger and stronger.

The project was consequently created at the right time

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Achievements

According to the website with last update April 2008, just after the closing of the project the project published 19 newsletter, press releases and publications.

None of these reports were about specific rail issue.

Rail was subject to one sub WG dealing with Wheels & brakes, Powertrain & bogies, and ventilation

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Evaluation:

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?

   Yes Bombardier use the results
2. Is new legislation and standardization based on findings from this research project?

   No
3. Are the results of the project implemented across Europe or only in a small number of Member States?

   Yes Bombardier have implemented the result as standard on all trains
4. Are the results of the project implemented outside Europe before being accepted in Europe?

   Yes see above point 3

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Evaluation:

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design: Yes It helped satisfying demanding requirements for noise reductions
6. Did the project increase competitiveness of the railway transportation compared to other transport modes: Yes it increased the rail particular diesel traction ability to meet noise requirements so that no advantages exist compared to other mode of transport in the noise domain.
7. Are the results of the project taken into consideration when preparing public tenders: Yes indirectly trough noise level specifications.
8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability. No

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Evaluation:

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality Yes, Noise are not so much an issue now.

10. Can benefits be assessed in financial terms **No**

11. Applicability of results to future scenarios: Yes Usefulness of research procedures for future projects (incl. modeling)

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Reasons for outcome

- The project was launched at the right time addressing a real problem of relatively high scientific complexity.
- The strong driver for implementation was there trough the demanding customer requirements on noise levels.
- The right technical team from bombardier was involved, i.e. the centre of competence for noise and vibrations (which is also involved in TSI and standardisation process).

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Lessons learnt

- It is possible to implement results from a multi mode research project where rail is only a small part providing that the focus of research is to solve a real problem existing at the time of research execution. Researches and implementers should be very close to each other or the same team.
- A clear route to market was overseen from the start of the project.
- The existence of a specialised topical department (i.e., the excellence centre within Bombardier) was empowered and trusted to make this implementation possible.

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- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

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ERRAC Project Evaluation Group INteGrail

EVALUATION FROM JUNE 2014

Project acronym:	INteGrail
Fp:	FP6
Programme acronym:	Intelligent integration of railway Systems
Project Reference:	
Call identifier:	
Total Cost:	
EU Contribution:	
Timescale:	2008-2009
Project Coordinator:	
Web references:	

- ❑ Presented by: Dan Otteborn
- ❑ Date evaluation:
- ❑ Market uptake: Weak
- ❑ Follow up projects: No
- ❑ Other related Projects: No

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Objectives of the project

The InteGRail project aims at developing an INTELLIGENT COHERENT INFORMATION SYSTEM by integrating the main railway systems. The objective is to achieve a higher level of coordination and cooperation between the key railway processes. The benefit will be higher levels of performance (in terms of Capacity, average speed and punctuality), safety and optimised usage of resources.

The direct project objectives are:

- Increase capacity and efficiency by intelligent integration of railway systems.
- Favour convergence and integration between rolling stock, infrastructure, signalling systems, train control and traffic management.
- Allow for full remote supervision of trains from a control centre.
- Achieve automatic monitoring of train status and equipment condition
- Implement the concept of self-aware intelligent trains.
- Maintain the current high safety level in railways.
- Implement predictive maintenance and lean maintenance concepts.
- Implement intelligent system management and dynamic path allocation.
- Improve passenger information and information system interactivity.
- Improve interoperability based on new open standards.
- Pave the way for implementation of TSIs.

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Background

Details

- FP 6
- Total Cost:
- EU Contribution:
- Start and duration: 01012005-
- Scientific Coordinator:

Partners

- total: 39 partners

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Background

Coordinator: UNIFE

Alstom	Ceske drahy a.s	ANSALDO BREDA
MAV	Unicontrols	Structon Rail
Bombardier	Deuta-Werke GmbH	Heriot-Watt University
Siemens	IMEC	OFFIS university oldenburg
D'Appolonia	Tevevic nv	Seebyte. Ltd
FAV	Kontron nv	University of Chile
AEA Technology rail	INREDS	Wireless future
Ansaldo	University of Birmingham	ADIF
CAF	Corridor X	Network Rail
Nortel networks	Prorail	SNCF
Laboratori G. Marconi	UIC	RFF
ATOS orgin	ATOC	RFI
Mermec	Trenitalia	

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Partners interviewed:

Name	Organisation	Feedback
Antonio Ruggieri	ATSF	Some minor internal use
Paolo Umiliacchi	CNC	No known use
Imrich Korpanec	UIC	No known use. Railway undertakings negative to the project at the beginning and trough out completion.
Wolfgang Steinicke	Fav	No answer
Thomas Meissner	Fav	No answer
Gerhard Lange	Siemens	No answer
Didier Abeele	Alstom	No answer (has left Alstom)
John Amoore	Network Rail	No answer

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Achievements

Project claimed benefits arise as a result of implementation of the above stated objectives

- Enhanced integration through implementation of high-speed communication backbone
- Removal of bottlenecks through better information flow and decision support
- Enhancing safety as a prerequisite for increased capacity
- Improve safety by harmonisation
- Improve safety by optimised maintenance
- Increase capacity by better availability and reliability of rolling stock and infrastructure
- Creation of new service for passenger using available and new infrastructure
- Define a migration path from existing to future technologies and applications

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Evaluation:

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation? NO, possibly only in small company specific applications.
2. Is new legislation and standardization based on findings from this research project? NO
3. Are the results of the project implemented across Europe or only in a small number of Member States? NO, no implementation at all.
4. Are the results of the project implemented outside Europe before being accepted in Europe? NO

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Evaluation:

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design? NO
6. Did the project increase competitiveness of the railway transportation compared to other transport modes? NO
7. Are the results of the project taken into consideration when preparing public tenders? NO
8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability? NO

ERRAC *European Rail Research Advisory Council*

Evaluation:

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality? NO
10. Can benefits be assessed in financial terms? NO
11. Applicability of results to future scenarios? Yes, possibly
12. Usefulness of research procedures for future projects (incl. modeling)? YES, possibly

Reasons for outcome

- Implementation of InteGrail research outcomes would have required deep cooperation between independent stakeholders in the rail sector
- Decision on such cooperation and its economical consequences would have to be taken on a very high level, a level never made aware of InteGrail and probably not interested to quickly go to required level of cooperation and sharing of operative data.
- There were no plan on how a possible implementation would be realised after project end. No agreement among the 39 partners on a future implementation.
- The project was to ambitious to implement and therefor nothing was achieved.

ERRAC European Rail Research Advisory Council

Lessons learnt

- A project with 39 partners doing bits and pieces here and there is very difficult to bring to real implementation.
- A project aiming at created vast and unseen level of cooperation among individual independent stakeholders must ensure that this is achievable before doing all research and development.

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MARKET IMPACT EVALUATION

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- To guide research efforts at the European level

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
- Ensure a strategic approach to the prioritisation of rail research

Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
- To ensure that the results of previous rail research can be taken into account for future projects
- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

European Rail Research Advisory Council

ERRAC Project Evaluation Group
INESS

Evaluation from March 2015

Project acronym:	INESS
Fp:	FP7
Programme acronym:	Integrated European Signalling systems
Project Reference:	
Call identifier:	FP7-SST-2007-RTD-1
Total Cost:	16 598 365 Euro
EU Contribution:	10 265 769 Euro
Timescale:	2008-2011
Project Coordinator:	UIC
Web references:	

- ❑ Presented by: Dan Otteborn
- ❑ Date evaluation: 03/03/2015
- ❑ Market uptake: Medium
- ❑ Follow up projects: No
- ❑ Other related Projects: No

European Rail Research Advisory Council

Objectives of the project

The INESS project aimed to define and develop specifications for a new generation of interlocking systems and, thus, to extend and enhance the standardisation process according to the current European policies.

It aimed to further lead to industry being more directly involved with Infrastructure managers in developing innovative solutions for the future based on an enhanced and common understanding of the operational requirements needing to be delivered into the railway transportation system.

The main scientific and technological objectives were the following:

- To define a common kernel of validated standardised functionalities for future interlockings, including functionalities specially required by ERTMS L 2 and L 3 and which will support the common operational requirements of various railways.
- To propose one or more standardised system architectures and the relevant functional Interface between the interlocking and the adjacent subsystems optimised for ERTMS L2 and L 3.
- To develop a common business model and the associated business cases and cooperation models to support intelligent migration strategies for ERTMS and therefore accelerate the realization of European ETCS corridors and to realize cost reductions within the entire supply chain.

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The main scientific and technological objectives (cont.)

- To develop a road map (exploitation plan) torwards interoperable, standardised interlocking platforms.
- Implement the concept of self-aware intelligent trains
- Maintain the current high safety level in railways
- Implement predictive maintenance and lean maintenance concepts
- Implement intelligent system management and dynamic path allocation.
- Improve passenger information and information system interactivity
- Improve interopability based on new open standards
- Pave the way for implementation of TSIs.
- To define standardised and optimised methods and tools for requirement management and for verification and validation.
- To identify an sufficient way for an interpretation of the safety case process according to the relevant CENELEC standard and to develop improvement strategies coherent with the yet to be harmonized requirements of the various national safety authorities thus reducing time and money for the safety case in industry by avoiding unnecessary or redundant processes. This activity has the potential to lead, in addition to the facilitation of the development of a harmonized approach by all such authorities.

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European Rail Research Advisory Council

Background

Details

- FP 7
- Total Cost: 16 598 365 Euro
- EU Contribution: 10 265 769 Euro
- Start and duration: 2008/06/05
- Scientific Coordinator: UIC

Partners

- total: 31 partners

European Rail Research Advisory Council

Background

Coordinator: UIC

ADIF
ALMA
Alstom
Ansaldo STS
AZD
Banverket
BBR I
Bombardier
DB Netz
TUE University
Eliop s.a
Funkwerk IT
Invensys
MerMec
Network Rail
Prorail B.V
Railsafe Consulting
RFI
RWTH Aachen
Scheith & Bachman
Siemens
University of Southampton
TIFSA
Thales
Technical University Braunschweig
Universidad de Madrid
University of York
UNIFE
German Aerospace Centre
NUCLEO

Achievements Main outputs

Project claimed benefits arise as a result of implementation of the above stated objectives

- Common business model and the associated business cases and cooperation models to support intelligent migration strategies for ERTMS.
- Common kernel of validated standardised functionalities for future interlockings.
- Standardised and optimised methods and tools for requirements management and for verification and validation.
- Efficient way for an interpretation of the safety case process according to the relevant CENELEC standards.
- Standardised system architecture and the relevant functional interfaces between the interlockilng and the adjacent subsystems.
- Standardised data flow design tools, file formats linked with system architecture.
- Training platform and training materials ensuring the wider dissemination and understanding of the INESS project result.

Emmanuel Buseyne	UIC	(Project manager)
Umberto Foschi	RFI	
Paolo de Cicco	UIC	
Ralf Kaminsky	Siemens	
Javier Serrano Lopez	TIFSA	
Angel Arranz	ADIF	Head of new technology
Norbert Kuhne	Thales	
Didier Gouttenegre	Alstom	
Maurizio Rosi	Ansaldo	
Vladimir Kampik	AZD	
Christer Löfving	Banverket	
Theo Lange	BT	
Dr Bernd Elsweiler	DB	
Frans Heijnen	Invensys	
Andy Doherty	Network rail	

European Rail Research Advisory Council

Evaluation:
Summary of responses

Q.	Answers							summary majority
	BT	Thales	Trafikverket	Infrabel	DB	INECO Spain	ADIF Spain	
1	no	no	no	yes	no	no	no	**no**
2	no	no	no	no	no	no	no	**no**
3	no	no	no	yes	no	no	yes	**no**
4	no	no	no	no	no	no	no	**no**
5	no	yes	Possibly	yes	no	no	yes	**yes**
6	no	no	no	no	no	no	no	**no**
7	no	no	no	yes	yes	no	no	**no**
8	no	no	no	yes	no	no	yes	**no**
9	no	no	no	yes	no	no	no	**no**
10	no	no	no	yes	yes	no	no	**no**
11	Partly	Partly	Partly	yes	yes	no	no	**yes**
12	no	no	Partly	yes	yes	no	yes	**yes**

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Evaluation:

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation? NO
2. Is new legislation and standardization based on findings from this research project? NO
3. Are the results of the project implemented across Europe or only in a small number of Member States? NO
4. Are the results of the project implemented outside Europe before being accepted in Europe? NO

Evaluation:

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design? **YES**
6. Did the project increase competitiveness of the railway transportation compared to other transport modes? NO
7. Are the results of the project taken into consideration when preparing public tenders? NO
8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability? NO

Evaluation:

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality? NO
10. Can benefits be assessed in financial terms? NO
11. Applicability of results to future scenarios? **YES**
12. Usefulness of research procedures for future projects (incl. modeling)? **YES**

Lessons learnt

- The infrastructure managers wanted to open up a number of interfaces meaning that an interlocking was to be divided into a number of independent components; the supply industry on the other hand wanted a generic standard set of requirements to be developed so that individual adaption to different customer could be minimized. The lesson learnt is, as for many other projects, that the parties must agree to the tasks before starting the project and stick to the agreement during the project execution phase.

ERRAC *European Rail Research Advisory Council*

MARKET IMPACT EVALUATION

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- **To guide research efforts at the European level**

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- **Determine the market impact of previous rail research to improve use of research funding**
- **Ensure a strategic approach to the prioritisation of rail research**

Project Evaluation

- **Individual projects are evaluated after they have been completed to ensure successful dissemination of project results**
- **To ensure that the results of previous rail research can be taken into account for future projects**
- **To avoid weak market uptake of results by learning the lessons of previous research**
- **The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes**

ERRAC *European Rail Research Advisory Council*

ERRAC Project Evaluation Group

CARCIM

EVALUATION FROM 27 March 2015

Project acronym: CARCIM
FP: 6
Programme acronym: FP6-2005-TRANSPORT-4
Project Reference: 031462.
Call identifier: SUSTDEV-2005-3.2.2.2.4 - Research domain 2.2
Total Cost: € 3,743,560
EU Contribution: € 2,000,000
Timescale: September 2006- August 2009
Project Coordinator: Tassilo Moritz (Fraunhofer IKTS)

Web references: http://www.carcim.eu/

- ❑ **Presented by: C. Ulianov**
- ❑ **Date evaluation: 27 March 2015**
- ❑ **Market uptake (rail sector): Weak**
- ❑ **Follow up projects: none**
- ❑ **Other related Projects: none**

European Rail Research Advisory Council

CARCIM

Integration of two-component ceramic injection moulding for large-scale production of novel multifunctional ceramic components for automotive and railway applications

Premise: The Carcim project was designed to develop and test prototypes produced by 2 component ceramic injection moulding (2C-CIM) and demonstrate the capability of low-cost, large-scale shaping of complex ceramics. The used four case studies to evaluate various combinations of ceramics to build on specific characteristics of individual materials. One for the rail sector was brake pads with a combination of good friction, strength and heat conductivity.

The results led to identification of several important requirements for the successful development of two-component ceramic parts. In addition, the Carcim project demonstrated the feasibility of applying 2C-CIM to produce complex ceramic shapes with novel properties. The results could lead to large-scale, low-cost production of ceramic components for the automotive and **railway industrie**s, with additional future applications **to be developed**.

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European Rail Research Advisory Council

CARCIM

Integration of two-component ceramic injection moulding for large-scale production of novel multifunctional ceramic components for automotive and railway applications

2C-CIM will facilitate production of advanced ceramic products at a large scale with increased functionality, high degree of complexity, but at a lower cost level in comparison to other shaping techniques. The reason is that ceramic materials offer the possibility to combine properties like electrical conductivity with electrical isolation, high toughness with extreme hardness and wear resistance, etc. Moreover, all these property combinations can be achieved in only one shaping step without additional joining processes by 2C-CIM.

This project aimed to launch 2C-CIM as a high-throughput production process for complex shaped ceramic components in Europe. Besides for automotive and **railway applications** this new technology is of enhanced interest for all branches requiring ceramic materials or property combinations as mentioned above, because novel products could be produces by using 2C-CIM which cannot be achieved today for technical or economical reasons.

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CARCIM

Integration of two-component ceramic injection moulding for large-scale production of novel multifunctional ceramic components for automotive and railway applications

Main Objectives:

The project resulted in four 2C-CIM prototype parts. Functional testing and verification such as techno-economical assessment of the complete processing chain had been carried out for the four parallel case studies:

(1) ceramic glow plug,

(2) ceramic gear wheel;

(3) ceramic valve seat, and

(4) ceramic braking pads for high speed trains.

For developing the 2C-CIM technology for both, low pressure and high pressure injection moulding, one case study resulted in a prototype produced by low pressure injection moulding (glow plug) and three case studies are attributed to high pressure injection moulding (gear wheel, valve seat, and brake disc).

CARCIM: Background

Details

- **FP** 6
- **Project Reference** 031462…..
- **Total Cost:** **€ 3,743,560**
- **EU Contribution:** **€ 2,000,000**
- **Timescale:** **September 2006- August 2009**
- **Project Coordinator:** Tassilo Moritz (Fraunhofer IKTS)

Partners

- **Participants**
- AET DRUZBA ZA PROIZVODNJO VZIGNIH SISTEMOV IN ELEKTRONIKE D.O.O. Slovenia
- AIT AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH Austria
- BAIKOWSKI France
- ROBERT BOSCH GMBH Germany
- CENTRO RICERCHE FIAT S.C.P.A. Italy
- EVONIK DEGUSSA GMBH Germany
- FUNDICIONES DEL ESTANDA, S.A Spain

+ Others

CARCIM: Background

Partners interviewed:

Organisation	Name of interviewee	Country
ESTANDA	☑ Luis Angel ERAUSQUIN	Spain

CARCIM:Background

Project description-Rail related:

The CarCIM project showed the feasibility of ceramic components with novel functionalities by two-component injection moulding. It emphasized the importance of non-destructive testing methods for ensuring the quality of the products in each processing step. Simulation of the processing chain can also be a helpful tool for avoiding problems in mould filling or with distortion and delamination of components. However, for improving the reliability of the simulation results further development work will be necessary. Tooling is a very challenging task for two-component ceramic injection moulding. For future works in this field more reworking cycles of the tool should be taken into consideration. The increase in difficulties for tooling in the case of two-component ceramic parts had been underestimated in this project. The rail demonstrator produced:

- braking pads - property combination high friction and mechanical strength/high strength with sufficient heat conductivity: Zirconia Toughened Alumina/Al2O3

The braking pads had been inserted into a steel braking disk in a casting process. A bonding of the components in the steel disk could be obtained, and a braking test emphasized that the braking time from 180 km/h down to hold-up could be reduced by 17%.

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CARCIM: Background

Achievements:

Case study 4: Brake disc for high-speed trains

ESTANDA was involved in internal research activities on next generation brake disc concepts for railway applications. One of the strategic lines identified is to study the potential use of ceramic materials to enhance/modify specific features/performances of the conventional metallic discs. Among other possibilities, the use of ceramic inserts (small monolithic elements) is being considered. Basic targets are: reduction of weight, improvement of the braking performances and enhancement of thermal management. The use of ceramic inserts inherently affects the reduction of weight. In addition, the right selection of ceramic material (high thermal conductivity) would also improve thermal evacuation. Finally, the capability to adequately formulate the composition of ceramic materials allows potential improvements on braking performances if present in the friction surface.

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CARCIM: Evaluation Rail focus

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   NO – the project showed that the ceramic brake discs were theoretically better. Unfortunately they did not perform well with heat and they cracked and./or fell out of the brake housing.
2. Is new legislation and standardization based on findings from this research project
   NO
3. Are the results of the project implemented across Europe or only in a small number of Member States?
   NO
4. Were the results of the project implemented outside Europe before being accepted in Europe?
   NO

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CARCIM: Evaluation

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
   NO

6. Did the project increase competitiveness of railway transportation compared to other transport modes?
   NO

7. Are the results of the project taken into consideration when preparing public tenders?
   NO

8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
   NO

European Rail Research Advisory Council

CARCIM: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
   NO

10. Can benefits be assessed in financial terms?
    NO benefits

11. Applicability of results to future scenarios?
    NO

12. Usefulness of research procedures for future projects (incl. modeling)
    Yes – important to know other active research organisations, networking etc.

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CARCIM: Reasons for outcome

- Steel brake discs are reliable and an industry standard product
- There is no business case to change to ceramics with poorer properties which make them less reliable

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CARCIM: Lessons learnt

- Technically risky projects do not always have a positive result
- Working in a consortium is useful especially with the right partners
- New ideas come from networking

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MARKET IMPACT EVALUATION

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ERRAC Project Evaluation Group

CALM I

Meeting of 19th May 2010

Final evaluation: 10th June 2015

Project acronym: GROWTH
FP: 5
Programme acronym: Competitive and Sustainable Growth
Project Reference: G4RT-CT-2001-05043
Total Cost: 655,800 EURO
EU Contribution: 655,800 EURO
Timescale: 01.10.2001 - 31.10.2004
Project Coordinator: J.Affenzeller
A.Rust of AVL List GmbH
Web references: www.calm-network.com

- ❑ Presented by: N. Debachy (on behalf of D. Schut
- ❑ Date evaluation: 18.05.10 / 10/06/2015
- ❑ Market uptake: STRONG
- ❑ Other related Projects:

CALM II (2004-2007)

COREN (starting end of 2010)

CALM : define the strategic plan for future noise research which is required to promote EU wide noise reduction and to improve the quality of life in Europe

Overview:

The CALM network was to establish a Community Noise Research Strategy Plan based on the work and reports of expert Noise Working Groups appointed by the European Commission and in cooperation with the relevant industry sectors, research institutions and interest organisations.

The main focus is to clearly identify links and gaps between current noise abatement technology and future EU noise reduction and regulation goals in the fields of air traffic, road and rail transport, marine technologies and outdoor equipment.

CALM : Noise research Strategy for a Quieter Europe

Rationale:

Noise is a serious environmental problem throughout Europe. About 20 percent of the population is highly annoyed by environmental noise especially stemming from transportation. In the vicinity of very busy roads and airports the exposure to noise can be so strong that it may cause detrimental effects on health. The European Commission has started a new policy towards a quieter environment. It is based on a coherent set of regulations to limit the emission of noise from various sources and to assess and reduce the total exposure to environmental noise.

To support the further development of the EU noise policy, the European Commission has supported the creation of a new thematic network "CALM". It will define the strategic plan for future noise research which is required to promote EU wide noise reduction and to improve the quality of life in Europe.

ERRAC *European Rail Research Advisory Council*

CALM: Background

Details

- FP5
- Project Reference: G4RT-CT-2001-05043
- Total Cost: 655,800 EURO
- EU Contribution: 655,800 EURO
- Timescale: 01.10.2001 – 31.10.2004
- Project Coordinator: RUST, Alfred / AFFENZELLER, Josef
  AVL LIST GmbH A-8020 Graz, Austria / Hans-List-Platz 1
  Tel +43 316 787 253 / +43 316 787 1076

Partners

- IMM - University, Department of Psychology *Stockholm*
- UBA - Federal Environmental Agency *Germany*
- BCC - Birmingham City Council *UK*
- YMPARISTO - Ministry of Environment in *Finland*
- UNOCOMA - Ministero dell'Ambiente e Tutela del Territorio *Italy*
- RWTUEV - Ministry of Housing, Spatial Planning and Environment *Netherlands*

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CALM I and II: Background

Partners interviewed:

Organisation	Name of interviewee	Country
SNCF	☑ Pierre-Etienne Gautier	France
SNCF	☑ Franck Poisson	France

ERRAC *European Rail Research Advisory Council*

CALM Project - Background

Objectives:

- **Establish a „Community Noise Research Strategy Plan"to support the transposition and implementation of the Environmental Noise Directive and to promote EU wide noise reduction"**
- **Aggregate achievements and results of the Noise Working Groups**
- **Define new technology requirements for new research areas**
- **Involve industry and research partners in preparation of policy guidelines** to increase acceptance and awareness
- **Reveal synergy effects between different types of industry** (e.g. aeronautics, automotive, railway industry) leading to cost effective use of existing noise

abatement technologies

- **Establish a communication platform for partners and the public** stimulating more environmental and political awareness of the community noise issue
- **Provide administration assistance for WG Research**

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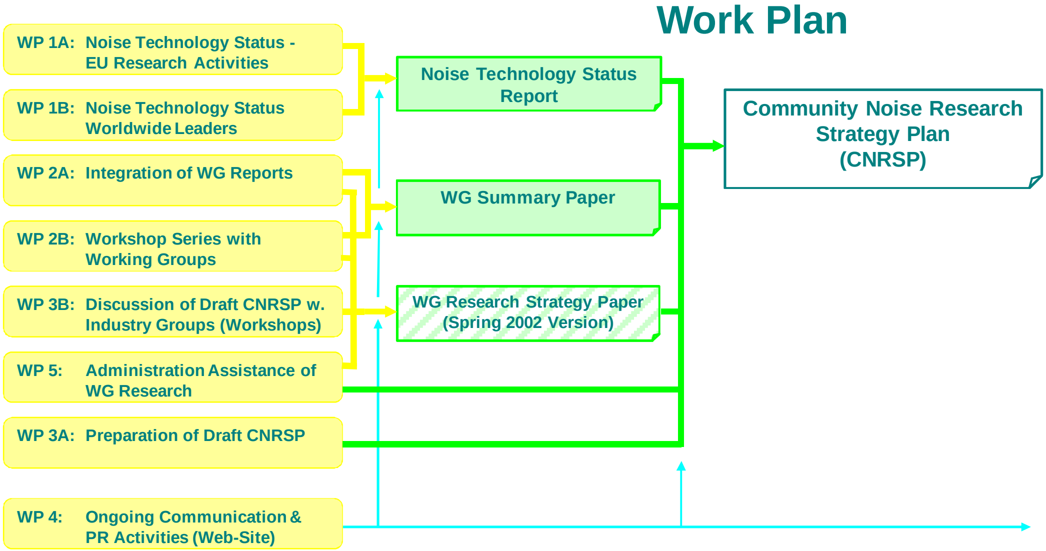
Work Plan



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Specific Objectives

WP 1 - RTD Activity Networking:
Monitoring European RTD activities and identification of remaining RTD needs

WP 2 - Sectoral Integration:
Coordination of different noise sectors (including European Noise working groups, Research Advisory Councils and National Networks) and agreement on common research needs and targets

WP 3 - Noise Research Strategies:
Updating of the CALM Noise Research Strategy Plan (with agreement of all stakeholders involved) and updating of CALM project data base

WP 4 - Dissemination and Exploitation of Results:
EU-wide dissemination with special focus on new member states, candidate countries and young researchers (meetings, papers, presentations, brochures …)

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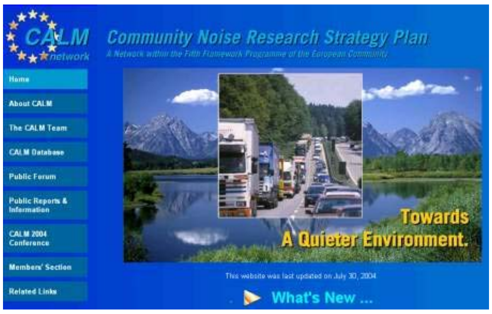
Outcomes of CALM

- *Website : www.calm-network.com*
  - Public Information & CALM Reports
  - Data Base about noise research projects (free access)
- *Strategy Papers*
  - Strategy Paper 2002
  - Updated Strategy Paper 2004



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Public Results

- **Project Noise research Data Base on CALM Homepage**
  with continuous updating
- **Final CALM I Conference** (with report)
  2004
- **Papers and Presentations at International Events**
  once per year

ERRAC European Rail Research Advisory Council CALM Network

CALM: Evaluation

1- Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?

The main results of CALM I were the:

- ❑ Public noise research project data base on www.calm-network.com
- ❑ Strategy Papers 2002 and 2004 (noise research strategy plan and technology road maps)

These results contribute to the planning of future (transport) noise research in Europe and setting-up of research programs (national, EU)

It is coherent for such type of projects (coordination and support activities)

2- Is new legislation and standardization based on findings from this research project?

No, results not suitable as input to legislation and standardization but strong connections to legislation and regulations. One of the results were, as roadmaps, to draw how to face reinforced noise legislation.

3- Are the results of the project implemented across Europe or only in a small number of Member States?

Across Europe

4- Were the results of the project implemented outside Europe before being accepted in Europe?

No

European Rail Research Advisory Council

CALM: Evaluation

5- Did the project increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
No, not directly. Only on long-term perspective via promoting research in railway noise

6- Did the project increase competitiveness of the railway transportation compared to other transport modes?
No

7- Are the results of the project taken into consideration when preparing public tenders?
Probably yes

8- Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
No

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European Rail Research Advisory Council

CALM: Evaluation

9- Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
No

10- Can benefits be assessed in financial terms?
No

11- Applicability of results to future scenarios?
Yes, to future noise research scenarios

12- **Usefulness of research procedures for future projects (incl. modeling)?**
The results support the planning of future noise research projects and programs

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Market uptake and lessons learnt

Market Uptake: strong.

The goal of CALM I were to coordinate and to prepare future research activities on noise topics. Workshops organised gathered a relevant number of people from the transport sector. The documents / roadmaps produced were of good quality. CALM I helped the transport sector in a time of high level activity period about noise legislation to face and to prepare reinforcement of regulations.

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MARKET IMPACT EVALUATION

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European Rail Research Advisory Council

ERRAC Project Evaluation Group

CALM II

EVALUATION FROM 10 June 2015

Project acronym: CALM II
FP: 6
Programme acronym: FP6-2003-Transport 3
Project Reference: TCA4-CT-2005-516237
Call identifier: FP6-SUSTDEV-2 - Sustainable Surface Transport
Total Cost: € 500,000
EU Contribution: € 500,000
Timescale: November 2004 - October 2007
Project Coordinator: Josef Affenzeller (AVL List GmbH)
Alfred Rust (AVL List GmbH)

Web references: http://www.calm-network.com/ (*defunct*)

- ❑ Presented by: A. Gougelet for D. Schut
- ❑ Date evaluation: 10 June 2015
- ❑ Market uptake: STRONG
- ❑ Follow up projects: none
- ❑ Other related Projects: CALM I (2001-2004), COREN (starting end of 2010)

CALM II

Advanced Noise Reduction Systems

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

To complete its missions, CALM II would monitor European research activities and identification of research synergies, identify remaining research needs and setting research directions leading to updated noise research strategy plan; consider the situation in the new Member States and integrating the demands of national research initiatives support the exploitation and dissemination of European noise research results, increase public awareness of environmental noise and the awareness of noise research with young people (e.g. by involving promising young researchers with CALM II workshops).

European Rail Research Advisory Council

CALM II

Advanced Noise Reduction Systems

Rationale

Noise still belongs to the most concerned environmental pollutants. An estimated 80 million Europeans (ca. 20 % of the EU population) suffer from unacceptable noise levels. Estimations of the related annual financial damage lie between 0.2 and 2 % of the gross domestic product. This is an essential societal problem, and transportation is seen as the primary source. Accepting mobility as a basic human need and as an essential precondition for maintaining economic prosperity and wealth in an enlarging Europe, it is clear that the adverse effects of noise must be reduced while facing a continued increase in freight and passenger transport.

European Rail Research Advisory Council

CALM II

Advanced Noise Reduction Systems

Main Objectives:

- Improved coordination and information exchange between different sectors and stakeholders leading to synergy effects for RTD, a cost effective and cross-sector use of existing noise abatement technologies and new cooperation structures
- Identification of new technology requirements, remaining research needs and setting of targets
- Comparison of European with Third Country status
- Support of the European Commission in setting up the agenda for future transport noise policy
- Support of the Research Advisory Councils in creating a vision and Strategic Research Agenda for future transport research
- Active involvement of promising young researchers
- Dissemination of transport noise state-of-the-art to new member states
- Maintenance and update of CALM homepage and CALM project database
- Promotion/presentation of CALM at international events and via publications
- Stimulation of network-dynamics beyond FP6 (to FP7) to optimise synergies and efficiency of joint

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European Rail Research Advisory Council

CALM II: Background

Details

- **FP** **6**
- **Project Reference TCA4-CT-2005-516237**
- **Total Cost:** **€ 500,000**
- **EU Contribution:** **€ 500,000**
- **Timescale:** **November 2004 - October 2007**
- **Project Coordinator:** **Josef Affenzeller & Alfred Rust (AVL LIST GmbH)**

Partners

- **Participants**
- TÜV NORD Mobilität Germany
- Federal Environmental Agency Germany
- Birmingham City Council United Kingdom
- 01 dB Acoustics & Vibration France
- Adam Mickiewicz University Poland
- Ministero dell'Ambiente e Tutela del Territorio (UNACOMA) Italy
- Ministry of Housing, Spatial Planning and Environment (Ministry VROM) Netherlands
- Forum of European National Highway Research Laboratories (FEHRL) Belgium

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European Rail Research Advisory Council

CARCIM: Background

Partners interviewed:

Organisation	Name of interviewee	Country
SNCF	☑ Pierre-Etienne Gautier	France
SNCF	☑ Franck Poisson	France

European Rail Research Advisory Council

CALM II: Background

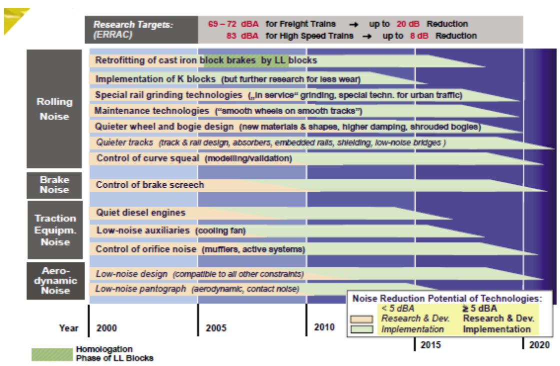
Rail-related impact:

CALM II collaborated with ERRAC to list and collect data on all completed & ongoing rail noise projects concerning rail as well as to establish rail noise objectives in strategic documents. Railway people attended Workshops and networking events and contributed with their expertise.

Several areas have been identified for future projects:

- -Rolling noise
- -Brake noise
- -Traction Equipment Noise
- -Aerodynamic noise

These research areas were divided in few sub-areas and a time line was established to foster projects development and implementation.



ERRAC *European Rail Research Advisory Council*

CALM II: Structure

WP1 (Networking of European transport noise research activities) - designed for the monitoring of European noise research activities and noise abatement technologies at EU and national level across all relevant research areas of transportation noise, including outdoor equipment and generic issues like noise exposure, health and socio-economic aspects, city planning and infrastructure.

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

WP3 (Noise research strategies) - designed for identifying technology gaps and research needs which is done in close co-operation with the European Noise Working Groups.

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

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

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ERRAC *European Rail Research Advisory Council*

CALM II: Outcomes & Public Results

- **Updated project noise research Data Base on CALM Homepage**
  Free access (*now defunct*)

- **Workshops + Final CALM Conference** (with report)
  June 2005, Oct. 2005, March 2006, Sept.2006 & June 2007 + Final Conference on Oct. 2007

- **Blue Book** (with CD-ROM)
  Inventory of most relevant European noise research projects, May 2006

- **CALM Strategy for a Quieter Europe**
  Feb. and Sept. 2007 updates

- **Papers and Presentations at International Events**
  once per year

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CALM II: Evaluation Rail focus

1. **Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?**

The main results of CALM I and CALM II were the:
- Public noise research project data base on www.calm-network.com
- Blue Book 2006 (inventory of EU noise research projects)
- Strategy Papers 2004 and 2007 (noise research strategy plan and technology road maps)

These results contribute to the planning of future (transport) noise research in Europe and setting-up of research programs (national, EU)

It is coherent for such type of projects (coordination and support activities)

2. **Is new legislation and standardization based on findings from this research project**

No, results not suitable as input to legislation and standardization but strong connections to legislation and regulations. One of the results were, as roadmaps, to draw how to face reinforced noise legislation.

3. **Are the results of the project implemented across Europe or only in a small number of Member States?**

Across Europe

4. **Were the results of the project implemented outside Europe before being accepted in Europe?**

No

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CALM II: Evaluation

5- **Did the project increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?**

No, not directly. Only on long-term perspective via promoting research in railway noise

6- **Did the project increase competitiveness of the railway transportation compared to other transport modes?**

No

7- **Are the results of the project taken into consideration when preparing public tenders?**

Probably yes

8- **Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?**

No

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CALM II: Evaluation

9- Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
No

10- Can benefits be assessed in financial terms?
No

11- Applicability of results to future scenarios?
Yes, to future noise research scenarios

12- Usefulness of research procedures for future projects (incl. modeling)?
The results support the planning of future noise research projects and programs. Projects on noise reduction following CALM II were successful developed and noise reduction is integrated in several Shift2Rail Innovation Programmes and, moreover, is a specific Cross-cutting activity.

ERRAC European Rail Research Advisory Council

CALM II: Reasons for outcomes

- ✓ Future significant reduction of environmental noise requires a well-balanced portfolio of research in both perception-related items and source-related topics
- ✓ Source-related research has to focus on: further develop and transpose the Environmental Noise Directive; improve the assessment of exposure to noise; enhance the knowledge on health effects and socio-economic aspects;
- ✓ Research in the field of noise perception shall contribute to: improving and adapting regulations closer to real world situations and developing noise reduction technologies and abatement procedures towards higher efficiency and cost-effectiveness

Market uptake and lessons learnt

Market Uptake: STRONG

The goal of CALM II, based on CALM I, was to continue to coordinate and to prepare future research activities on noise topics. Workshops and dissemination activity managed to reach a fair number of transport stakeholders. Strategic documents / roadmaps produced were of good quality. This networking project supported the transport sector in a time of high level activity period about noise legislation to face and to prepare reinforcement of regulations.

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MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- To make it more competitive
- To foster increased innovation
- To guide research efforts at the European level

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
- Ensure a strategic approach to the prioritisation of rail research

Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
- To ensure that the results of previous rail research can be taken into account for future projects
- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

European Rail Research Advisory Council

ERRAC Project Evaluation Group

BRAVO

EVALUATION FROM September 2015

BRAVO: BRAVO
FP: 6
Programme acronym: SUSTDEV-2
Project Reference: 506391
Call identifier: Priority 6.2
Total Cost: € 10,356.080
EU Contribution: € 4,483,606
Timescale: May 2004- May 2007
Project Coordinator: Rainer Mertel, Klaus-Uwe Sonderman (KombiConsult GmbH)

Web references: http://www.bravo-project.com/home/index.shtml

- ❑ Presented by: Cristian Ulianov
- ❑ Date evaluation: 15/09/2015
- ❑ Market uptake: Strong
- ❑ Follow up projects: none directly
- ❑ Other related Projects: TREND + CREAM

European Rail Research Advisory Council

BRAVO

Brenner Rail Freight Action strategy aimed at achieving a sustainable increase of intermodal transport VOlume by enhancing quality, efficiency, and system technologies

Premise:

As one of the key European freight arteries, the Brenner corridor takes up about two thirds of the current trans-alpine freight volume transiting through Austria and Switzerland. At the heart of the Brenner corridor, the link München – Kufstein – Brenner - Verona is functioning like a pipeline “absorbing” practically all individual transport flows on one side and “ejecting” them on the other. This pipeline ensures pan-European goods transport between all countries North and South of the Alps. However, the corridor primarily is serving the trade between Germany and Italy.

However, in recent years, the growth dynamics of intermodal transport on the Brenner corridor have eased off.

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European Rail Research Advisory Council

BRAVO

Brenner Rail Freight Action strategy aimed at achieving a sustainable increase of intermodal transport VOlume by en-hancing quality, efficiency, and system technologies

Rationale:

Against this background, representatives of the Ministries for Transport of Austria, Germany, Greece, and Italy as well as all relevant stakeholders of the rail and intermodal transport industry engaged on the Brenner corridor, amongst them many members of this project consortium, elaborated the "Brenner 2005" action plan. It contains a list of activities required to organize the short- to medium-term enhancement of intermodal services in this corridor.

Advancing from this *political* action plan, the project partners developed as the primary scientific objective of this project a more comprehensive **Brenner corridor action strategy** composed of a set of coherent technological components mentioned below, which are due to be implemented and demonstrated in the course of the project.

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European Rail Research Advisory Council

BRAVO

Brenner Rail Freight Action strategy aimed at achieving a sustainable increase of intermodal transport VOlume by en-hancing quality, efficiency, and system technologies

Main Objectives:

Its overall objective was to develop and demonstrate an action strategy on intermodal rail-road transport services comprising major scientific and technological as well as pragmatic activities. This strategy primarily laid the foundations for achieving a significant and sustainable increase in intermodal volume on the Brenner corridor, but over and above that, a blueprint applicable to other pan-European freight corridors. This action strategy was a most important prerequisite in leading intermodal transport on the Pass out of the current inhibition of growth.

European Rail Research Advisory Council

BRAVO: Background

Details

Germany

- **FP** 6
- **Project Reference 506391**
- **Total Cost:** **€ 10,356,080**
- **EU Contribution:** **€ 4,483,606**
- **Timescale:** **May2004 – May2007**
- **Project Coordinator:** **Rainer Mertel, Klaus-Uwe Sondermann**

Partners

- KombiConsult GmbH; Germany
- CEMAT Combined Transport Management and Transportation S.p.A.; Italy
- Railion Deutschland AG; Germany
- Ferriere Cattaneo SA; Switzerland
- HaCon Ingenieurgesellschaft mbH; Germany
- Kombiverkehr Deutsche Gesellschaft für kombinierten Güterverkehr mbH & Co. KG;
- Lokomotion Gesellschaft für Schienentraktion mbH; Germany
- ÖBB Österreichische Bundesbahn; Austria
- Rail Traction Company; Italy
- Trenitalia Logistica; Italy
- Interporto Bologna; Italy
- University of Darmstadt Germany

European Rail Research Advisory Council

BRAVO: Background

Partners interviewed:

Organisation	Name of interviewee	Country
KombiConsult	☑ Klaus Uwe Sondermann	DE
HaCon	☑ Lars Deiterding and Volker Sustrate	DE

European Rail Research Advisory Council

BRAVO: Background

Project description:

In this project, any intermodal shipment transiting the Brenner pass independent of the countries or areas of origin and destination, is regarded to be related to the ‘Brenner corridor’. So the Brenner corridor action strategy basically was to apply to the entire volume of transports on the corridor from the Benelux and Northern European countries to Sicily and Greece. Since, however, the “pipeline” München-Verona described above, does represent both the very core and the “Achilles heel” of the entire Brenner corridor, so this project approached the freight corridor topic as follows:

- The project covered the entire geographical catchment area for Brenner intermodal services;
- Most of the technological components envisaged, from the beginning, were applied to the entire Brenner corridor, though demonstrations – for reasons of effectiveness and efficiency – were performed on the core section.
- Therefore the project focused on the bottleneck, having a positive effect on all traffic, irrespective of origin or final destination.

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BRAVO: Background

Project description (continued):

• The focus of the quality management system and customer information system, however, were on the core section München-Verona because, if the performance on this section is not sufficient, the following sections also suffer. But if the core section is controlled and managed on a high standard, an excellent basis is established to achieve a competitive logistical performance on the entire door-to-door route.

- All the objectives set for this project were considered as a most important prerequisite to ensure the achievement of the following overall objectives on the Brenner corridor:
- Enhancing the quality and efficiency of intermodal services thus inducing an increased customer retention;
- Developing and demonstrating innovative system technologies suitable for broadening the intermodal market base;
- Raising the awareness of the benefits of intermodal services both with customers, i.e. freight forwarders and shippers, and interested parties on the Brenner corridor;
- Thus, ensuring an increase of intermodal rail transport volume on the Brenner corridor by 50 % within a three years project period.

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BRAVO: Background

Achievements:

An increase in traffic volumes of about 57% in unaccompanied combined transport (CT) on the Brenner axis has been reported by the operators and railways, which have been participating in the BRAVO project over the three years. Thus, its demanding objectives have been fully achieved, as the 120 or so invited experts of the European railway and logistics branch, representatives of the European Commission and transport ministries of Corridor countries learned during the final conference in München (Bavaria) on April 17/18, 2007.

The remarkable traffic volume development was explained by – among others – the implementation of a range of innovative methods have been developed in the BRAVO-Project, and which are part of the **Brenner Rail Freight Action Strategy**.

The Brenner corridor which was used to develop, demonstrate and validate the Action Strategy and the innovations under operational conditions is one of the most loaded trans-European transport corridors, and transiting the sensitive Alpine region.

The strategy was also designed as a blueprint applicable to other pan-European freight corridors.

European Rail Research Advisory Council

BRAVO: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   – Yes, technical and software products from the project were implemented in commercial operations immediately. Improvement and extension of combined transport services were implemented commercially immediately. The system is operational on Brenner. Since the project results were implemented, the volume increased with 57% in 3 years.
2. Is new legislation and standardization based on findings from this research project
   – The project has been cited by EC personnel as a forerunner and influence on the development of the following regulations: railfreight corridor EU913/2010, TEN-T EU 1315/2013 and Connecting Europe Facility EU 1316/2013.
3. Are the results of the project implemented across Europe or only in a small number of Member States?
   – Pocket wagons and multi system locos are used across Europe. The intermodal hub terminals are linked to a European wide service network.
4. Were the results of the project implemented outside Europe before being accepted in Europe?
   – No

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European Rail Research Advisory Council

BRAVO: Evaluation

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
   – Siemens F4 implemented interoperability for the project may well be sold internationally. **[CHECK]**
6. Did the project increase competitiveness of railway transportation compared to other transport modes?
   – Yes, proven by the volume growth and modal shift
7. Are the results of the project taken into consideration when preparing public tenders?
   – No
8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
   – Yes, one of the major outcomes of the project.

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BRAVO: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?

   – Yes, the major focus of the project and proven by results. The locos and the timetabling innovations were used here before transfer to conventional rail freight operations.

10. Can benefits be assessed in financial terms?

    – No cost/benefit work package in original DoW.

11. Applicability of results to future scenarios?

    – Loco and rolling stock innovation transferred to wider intermodal and conventional rail freight. Timetabling and intermodal innovations transferred. Transfer the approach of collaboration between partners which are competing under commercial conditions in a project (co-opetition) was exposed positively and was transferred to other corridors, e.g. TREND and in particular CREAM. The lessons from BRAVO were studied and lessons learnt in the RETRACK project that successfully led to a viable pan European rail freight corridor service.

12. Usefulness of research procedures for future projects (incl. modelling)

    - This is not the area of innovation in this project but the holistic approach combining innovation partners and users into one was beneficial.

European Rail Research Advisory Council

BRAVO: Reasons for outcome

- ✓ The project was initiated from the beginning to respond to a real critical transport problem and market demand
- ✓ The right end-users were involved in the consortium and the agreement was easily reached towards the most feasible solutions.
- ✓ The opportunity for implementation already existed at the project completion, and there were no barriers to implementation.

ERRAC *European Rail Research Advisory Council*

MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

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ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
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Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
- To ensure that the results of previous rail research can be taken into account for future projects
- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

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ERRAC *European Rail Research Advisory Council*

ERRAC Project Evaluation Group

ModUrban .

EVALUATION FROM OCTOBER 2015

Project acronym: ModUrban
FP: 6
Programme acronym: FP6-SUSTDEV-2
Project Reference: FP6-PLT-516380 / TIP4-CT-2005-516380
Call identifier: SUSTDEV-2003-3.2.2.2.2
Total Cost: € 20,000,000
EU Contribution: € 10,400,000
Timescale: January 2005- December 2008
Project Coordinator: Bernard von Wullerstorff (UNIFE)

Web references: http://www.modurban.org/

- ❑ Presented by: M. Pellot
- ❑ Date evaluation: 20/10/2015 2014
- ❑ Market uptake: <u>Medium</u>
- ❑ Follow up projects: ModSafe
- ❑ Other related Projects: NGTC. UGTMS

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European Rail Research Advisory Council

ModUrban
Modular Urban Guided Rail System

Premise:

The Modular Urban Guided Rail System project, or in short MODURBAN, is a 50% EU funded Integrated Project. It is the first of its kind on a truly European level in the area of joint, pre-competitive Research. It brings together all major rail industry suppliers and all major European rail operators. The project officially started on January 1st 2005 and will last four years.

The main target of the MODURBAN project is to design, develop and test an innovative and open common core system architecture and its key interfaces (this covers Command Control, energy saving and access subsystems), paving the way for the next generations of urban-guided public transport systems. This approach will be applied to both new lines as well as the renewal and extension of existing lines and will encourage cost effective migration from driver to driverless operation. It will also avoid the risk of new rolling stock and subsystems being built from unproven prototype sub-assemblies.

The prototypes issued from the different modules will be tested in real conditions (Metro de Madrid).

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European Rail Research Advisory Council

ModUrban
Modular Urban Guided Rail System

Rationale:

According to the ERRAC (European Rail Research Advisory Council) study, “Light Rail and Metro Systems in Europe: Current market, Perspectives and research implication”, there are 170 LRT networks and 36 metro networks in Western Europe. It is expected that the number of new LRT systems could expand by more than 50% over the next 20 years. For metros, the number of new systems is expected to be limited to around five, whereas 55% of existing metro networks are currently extending existing lines or planning new lines. Most of the existing metro systems will have their rolling and signaling equipment replaced over the next 20 years and/or transformed from driver to driverless operation.

Passenger trips are expected to grow by 40% over the next two decades, across all the transport modes. ERRAC’s vision is that the rail market share could double and that the rail market volume could increase by more than a 150% in passengers over current volumes. To meet this expectation – which means a reverse in the current trends of the last 20 years – it is of utmost importance to develop reliable, affordable, attractive and even more energy-efficient urban rail systems for use in European cities. This calls for innovative and interchangeable constituents and subsystems with common harmonized interfaces. This will reduce the cost of ownership as well as the operation and maintenance of rail installations. It is vital in view of the growing complexity of new IT based subsystems that new products are developed along common interchangeable modular principles.

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ModUrban
Modular Urban Guided Rail System

Main Objectives:

The main target of the project is to design, develop and test an innovative and open common core system architecture and its key interfaces (this covers command control, energy saving and access subsystems), paving the way for the next generations of urban-guided public transport systems. This approach will apply to new lines as well as the renewal and extension of existing lines, and will encourage cost-effective migration from driver to driverless operation. This integrated approach will avoid the risk of new rolling stock and subsystems being built from unproven prototype sub-assemblies. With regard to passenger information and exchange at platforms, the objective is to harmonize the displays and push buttons as much as possible, as well as the operational procedures. Moreover, various energy saving methods (e.g. optimization software, lightweight materials) will be developed.

1. A reduction of up to 10% in average cost per passenger per km (pkm) (including the result of achieving better energy efficiency), a 30% increase in the productivity of the new rolling stock and an increase of the percentage of component reusability into new series owing to standard interfacing currently almost non existent. Within the ERRAC objectives for 2020, MODURBAN will specifically increase the percentage of component reusability into new series owing to standard interfacing up to a level of around 50%-60%.
2. For the Supply Industry - a marked reduction in bidding costs (estimated at up to 25% at the end of the process) due to increased modularization of system architecture. Furthermore, increased harmonization of sub-systems, components and interfaces together with uniform conformity assessment procedures would foster platform-based production patterns combined with a decrease (estimated at 20-30%) in design, manufacturing and validation costs and a reduction in the time-to-market (estimated at 30%).

ModUrban
Modular Urban Guided Rail System

Main Objectives (cont.):

3. For public transport operators - In addition to the savings from the above-mentioned economies of scale achieved by the supply industry, it is anticipated that reliability may improve by up to 25% and maintenance costs be reduced by up to 30%. Substantial benefits could be expected thanks to the further automation of metro systems in terms of additional capacity provided at off-peak and night operations (no extra costs for staff and more staff flexibility). Whatever the rail mode (metro or light rail), the use of modularized components and interfaces shall bring cost reductions that can tip the competitive balance decisively in favor of rail -based systems and deliver first class time-to-market services. The use of a common core architecture will drastically reduce by 40% the duration of the migration phases and to facilitate the upgrading of existing networks.
4. For the European citizen - It is expected that overall European transport demand over the next 20 years will have grown by 40% (all motorised road and rail based modes) and that the total rail transport share will almost double. The objective is to enable the citizen to have confidence in travelling by rail in a stress free environment and to use rail rather than private motorized means for urban trips. That's why the passenger needs will be integrated at design stage of the new systems.
5. Increase capacity on existing infrastructure (e.g.), in order to reach for metros headways of 80 seconds (peak-time), and average commercial speeds of a minimum of 30 km/h (in comparison to bus operation of no more than 10 km/h on average in congested areas).
6. Increase the energy efficiency of an already environmental friendly means of transportation by at least 10% while offering an increased level of comfort able to attract more passengers from private cars.

ModUrban: Background

Details

- FP 6
- Project Reference FP6-PLT-516380 / TIP4-CT-2005-516380
- Total Cost: € 20.000.000
- EU Contribution: € 10.400.000
- Timescale: 48 months (January 2005- December 2008)
- Project Coordinator: Bernard von Wullerstorff (UNIFE)

Partners

- ALMA Consulting Group — France;
- ALSTOM TRANSPORT SA — France;
- ANSALDO-BREDA SpA — Italy;
- ATAC ROMA — Italy;
- Berliner Verkehrsbetriebe – BVG — Germany;
- BOMBARDIER Transportation GmbH - BT — Germany;
- Budapest University of Technology and Economics - TUB — Hungary;
- CSEE Transport SA - ANSALDO STS — France;
- DIMETRONIC - INVENSYS — Spain;
- Division IFE Doorsystem Knorr Bremse GmbH — Austria;
- ELTA — France;
- ESTEREL TECHNOLOGIES — France;
- European Commission – Joint Research Centre - JRC — Italy;
- Ferrocarril Metropolità de Barcelona S.A - TMB — Spain;

ERRAC European Rail Research Advisory Council

ModUrban: Background

Partners (Cont.)

- FRENSISTEMI SRL — Italy;
- Institut National de Recherche sur les Transports et leur Sécurité - INRETS — France;
- FUNKWERK — Germany;
- KITE Solutions SNC — Italy;
- KNORR BREMSE Systeme für Schienenfahrzeuge GmbH — Germany;
- KNORR BREMSE Rail Systems (UK) Ltd — United Kingdom;
- London Underground Limited — United Kingdom;
- Metro de Madrid SA — Spain;
- Metro Warsaw — Poland;
- Metropolitano de Lisboa — Portugal;
- NAVECOM — France;
- PPD - Metro PRAGUE — Czech Republic;
- Régie Autonome des Transports Parisiens - RATP — France;
- RHEIN-CONSULT — Germany;
- RHEINBAHN — Germany;
- SIEMENS Aktiengesellschaft — Germany;
- SIEMENS Transportation System — France;
- Technische Universität DRESDEN — Germany;
- Thales Group
- Union Internationale des Transports Publics - UITP — Belgium;
- Union of European Railway Industries - UNIFE — Belgium;
- Universidad de Chile - Centre Mathematical Modeling — Chile;
- Université de Valenciennes et du Hainaut Cambrésis — France;
- University of Newcastle Upon Tyne / NEWRAIL - — United Kingdom;

European Rail Research Advisory Council

Contacts:

Bernard Von Wullerstorff	UNIFE	(Project manager)
	Ansaldo-CSEE	(WP1 leader)
	Alstom	(WP2 leader)
	BT RCS	(WP3 leader)
	Alstom	(WP4 leader)
	Alstom	(WP5 leader)
	CSEE	(WP6 leader)
	Ansaldo-CSEE	(WP7 leader)
	Alcatel	(WP8 leader)
	Alcatel	(WP9 leader)
	Alcatel CIT	(WP10 leader)
	Eurotelec	(WP11 leader)
	Ansaldo-CSEE	(WP12 leader)
	Knorr/Frensistemi	(WP13 leader)

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European Rail Research Advisory Council

Contacts (cont.):

Knorr/IFE	(WP14 leader)
Knorr/WUK	(WP15 leader)
Alstom	(WP16 leader)
Siemens	(WP17 leader)
Bombardier/Newrail	(WP18 leader)
Siemens TS	(WP19 leader)
RATP	(WP20 leader)
BVG	(WP21 leader)
UNIFE	(WP22 leader)
JRC	(WP23 leader)
Metro Madrid	(WP24 leader)
UITP+UNIFE	(WP25 leader)
UNIFE	(WP26 leader)

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European Rail Research Advisory Council

ModUrban: Background

Partners interviewed:

Organisation	Name of Interviewee	Country	Email
Bombardier/UNIFE	☑ Dan Otteborn	Sweden	dan.otteborn@osbornconsulting.se
UNIFE	☑ Bernard Von Wullerstorff	Belgium	bernard.von.wullerstorff@unife.org
Siemens	☑ Andrew Price	Germany	andrew.price@siemens.com
RATP	☑ Stephane Dubois	France	stephane2.dubois@ratp.fr
Metro Madrid	☑ Antonio de Santiago	Spain	antonio_santiago@mail.metromadrid.es
UITP	☑ Yves Amsler	Belgium	yves.amsler@uitp.org
TMB	☑ Jordi Picas	Spain	jpicas@tmb.cat
Alcatel	☑ David Dimmer	Canada	David.DIMMER@thalesgroup.com

European Rail Research Advisory Council

ModUrban: Background

Partners answering:

Organisation	Name of Interviewee	Country	Email
Bombardier/UNIFE	☑ Dan Otteborn	Sweden	dan.otteborn@osbornconsulting.se
RATP	☑ Stephane Dubois	France	stephane2.dubois@ratp.fr
Metro Madrid	☑ Antonio de Santiago	Spain	antonio_santiago@mail.metromadrid.es
UITP	☑ Yves Amsler	Belgium	yves.amsler@uitp.org
TMB	☑ Jordi Picas	Spain	jpicas@tmb.cat

European Rail Research Advisory Council

ModUrban: Background

Project description:

The MODURBAN IP will define the necessary functional, electrical and mechanical interfaces, and validation procedures necessary to deliver the range of interchangeable modules that will make the next generation of affordable urban guided public transport a reality. The principal elements to be defined in MODURBAN using end-user requirements and validation are:

- Onboard intelligent interfaces
- Wayside intelligent interfaces
- Passenger and access-related items
- Communication systems
- Energy savings related aspects
- System approach for functional requirements and technical specifications and global risk assessment.

There was also a Users' Group, which consisted of operators not direct members of the consortium. Their input and feedback on key deliverables has been important in order to validate and disseminate some of the results.

European Rail Research Advisory Council

ModUrban: Background

Achievements:

The major result after almost four years was the 'functional requirement specifications' (FRS). Known as D80, this document encapsulates the recommended functional and performance requirements for command, control and train management systems for urban rail applications. It is fully endorsed by operators and by the entire MODURBAN consortium.

Based on many years of operating and manufacturing experience, the FRS includes a complete set of 'ready-to-use' requirements. It covers networks ranging from manually driven trains to fully driverless operation. A common system core ensures a seamless upgrade route from one level of automation to the next, right up to unattended train operation. The basic operational characteristics outlined in the FRS include:

- General requirements;
- Functional requirements;
- Grades of automation;
- Interoperability requirements;
- Principles for degraded operation;
- System performance requirements.

With regards to passenger information systems, MODURBAN has delivered an overview of this equipment and its functions, together with a comparison of the principal European products. It has also defined Passenger Information System interfaces to other MODURBAN subsystems, and provided a useful overview of regulations in the EU member states in the field of video surveillance, as well as a functional description of the system architecture.

ModUrban: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
2. Is new legislation and standardization based on findings from this research project
3. Are the results of the project implemented across Europe or only in a small number of Member States?
4. Were the results of the project implemented outside Europe before being accepted in Europe?
5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
6. Did the project increase competitiveness of railway transportation compared to other transport modes?
7. Are the results of the project taken into consideration when preparing public tenders?
8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
10. Can benefits be assessed in financial terms?
11. Applicability of results to future scenarios?
12. Usefulness of research procedures for future projects (incl. modeling)

ModUrban: Evaluation (Results)

Question	D. Otteborn	S. Dubois	A. Santiago	Y. Amsler	J. Picàs
1	Yes. Partially: radio communication	Yes	Yes	Yes	Yes
2	Yes: radio communication	Yes-example: IEC 62290	Not applicable	Yes-example: IEC 62290 Part 2	Yes indirectly
3	not known	No. but should be	Yes. But not formally	Yes. In automated line projects	Yes. But not formally
4	not known	IEC 62290 is at intl. level	No	No. European standardization process	No.
5	Yes, if implemented	Not answered	Yes, if implemented	Yes. Specially in telecommunication	Yes, if implemented
6	Yes, if implemented	Not answered	Yes	Yes. Automated lines	Yes.
7	not known, but should be	Yes. Partially	Yes. Partially	Yes. IEC 62290 are used in tenders	Yes.
8	Not applicable	Not applicable	Not applicable	Not relevant	Not applicable
9	Not applicable	Not applicable	Not applicable	Yes. Indirectly	Not applicable
10	Possibly	Not answered	Yes	Yes, specially in automated lines	Yes
11	Yes follow up research has been launched	Yes: NGTC and S²R IP2	Yes: PSD and CBTC projects	Yes: NGTC	Yes: NGTC
12	Yes follow up research has been launched	Yes: NGTC al S²R IP2	Yes	Yes: NGTC	Yes: NGTC

European Rail Research Advisory Council

ModUrban: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   Yes. Partially: radio communication
2. Is new legislation and standardization based on findings from this research project
   Yes. In the radio communication field, in IEC 62290 Part 2
3. Are the results of the project implemented across Europe or only in a small number of Member States?
   Yes. The radio communication specially In automated line projects
4. Were the results of the project implemented outside Europe before being accepted in Europe?
   No
5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
   Yes. Specially in telecommunication
6. Did the project increase competitiveness of railway transportation compared to other transport modes?
   Potentially yes (enabling automated lines)

European Rail Research Advisory Council

ModUrban: Evaluation

7. Are the results of the project taken into consideration when preparing public tenders?
   Yes because IEC 62290 is used in tenders
8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
   Not applicable
9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
   Not applicable
10. Can benefits be assessed in financial terms?
    Yes, specially in automated lines
11. Applicability of results to future scenarios?
    Yes follow up research has been launched specifically NGTC and S2R IP2
12. Usefulness of research procedures for future projects (incl. modeling)
    Yes follow up research has been launched specifically NGTC and S2R IP2

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ModUrban: Reasons for outcome (I):

- ✓ MODURBAN has gathered a critical number of operators and manufacturers as well as “end users” from the service providers and manufacturers.
- ✓ MODURBAN has been a reference for the whole community of automated metros in terms of Radio Communication System which was successfully implemented after the project.
- ✓ Radio Communication constituted only a small part of the project. For the rest, no agreement was reached due to different opinions in the supply industry.

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ModUrban: Reasons for outcome (II):

- ✓ MODURBAN could not fulfil all its expectations regarding the standardisation of the interface between on-board and wayside control-command subsystems (currently proposed most often in a combined proprietary signalling solution). It has not been possible at that time to make the manufacturers agreeing to split the two sub-systems following a common detailed architecture.

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ModUrban: Lessons learnt:

- ✓ The project shows that every player (industry, operators, institutions) must be together in order to achieve implementation.
- ✓ The industry must have a flexible and open attitude to share new solutions.

European Rail Research Advisory Council

MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- To make it more competitive
- To foster increased innovation
- To guide research efforts at the European level

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
- Ensure a strategic approach to the prioritisation of rail research

Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
- To ensure that the results of previous rail research can be taken into account for future projects
- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

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European Rail Research Advisory Council

ERRAC Project Evaluation Group

MODSafe

EVALUATION FROM OCTOBER 2015

Project acronym:	ModSafe
FP:	7
Programme acronym:	FP7-TPT - Transport - Horizontal activities for implementation of the transport programme (TPT)
Project Reference:	218606
Call identifier:	FP7-SST-2007-RTD-1
Total Cost:	€ 5,180,840
EU Contribution:	€ 3,469,161
Timescale:	September 2008- August 2012
Project Coordinator:	Peter Wigger (TÜV Rheinland InterTraffic GmbH)
Web references:	http://www.modsafe.eu/

❑ Presented by:	M. Pellot
❑ Date evaluation:	20/10/2015
❑ Market uptake:	Medium
❑ Follow ups:	SECUR-ED; 4th Railway Package; Mandate M/486
❑ Other related Projects:	UGTMS, ModUrban, NGTC.

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MODSafe

Modular Urban Transport Safety and Security Analysis

Premise:

The purpose of the MODSafe project was twofold: first, to undertake research of major steps of the Safety Life Cycle of Urban Guided Transport systems in Europe, in order to acknowledge the diversity of the rail safety landscape in urban guided transport, and to provide recommendations for some kind of convergence. Second, since security items are considered more and more as vital for the urban transport sector, the EC wanted to get advice from the sector in this domain as well.

The 22 partners were from industry, associations, R&D organizations, consultants and operators, including UITP and UNIFE.

The MODSafe project started in 2008 with state of the art evaluations and initial models. Hazard analyses, safety requirements as well as functional and object models have been developed, while a life cycle approach proposal and an approval approach were established in the process sector. For the security sector, the existing means and technologies for security systems have been analyzed, and recommendations delivered as an input for the EU project SECUR-ED.

MODSAFE proposed some generic tools to clarify how safety can be addressed, leaving Member States responsible for the allocation of responsibilities

ModSafe

Modular Urban Transport Safety and Security Analysis

Rationale:

The European Urban Guided Transport sector is characterized by a highly diversified landscape of Safety Requirements, Safety Models, Responsibilities and Roles and Safety Approval, Acceptance and Certification Schemes. While a certain convergence in architectures and systems can be observed (e.g. through other R&D projects like MODURBAN) the safety life-cycle differs from country to country and sometimes even within one country. Safety is seen as everything dealing with the methods and techniques to avoid accidents and mitigate their effects, Security is concerned with the protection of persons and the system from criminal acts and has been included in the project as it might impact Safety.

In contrast to the Mainline Railway Domain, where there is a need for interoperability between different networks across Europe, the driving factor for addressing safety management of urban rail is a better functioning of the internal market, taking advantage of existing and planned European standards (e.g.CENELEC Standards EN 50126, 50128 and 50129). Therefore a good understanding of the background is essential, and recommendations have to be shared by the relevant decision-makers.

ModSafe

Modular Urban Transport Safety and Security Analysis

Main Objectives :

MODSAFE aimed to provide for the first time a coherent and agreed overview of all related aspects of urban rail safety analysis in Europe from hazards identification to safety response measures management in all its components.

MODSAFE objective was to provide a guidance on how to deal with the diversities of European countries, in order to define find a common European approach of safety management, in order to cover all issues and to reduce the efforts and manpower needs, even for a first certification.

ModSafe

Modular Urban Transport Safety and Security Analysis

Main achievements:

MODSAFE made a thorough review of existing literature and standards, including as well R&D projects results.

MODSAFE developed an exhaustive survey of all EU countries about the methods used and allocation of responsibilities regarding safety management at all steps of the safety life cycle of the various categories of urban rail systems:

- tram/Light Rail,
- metro
- suburban/regional railways.

MODSAFE performed detailed analysis of all Safety functions and Safety models related to Urban Rail, as well as of the existing Acceptance, Approval and Certification – AAC - procedures in each European country

The consensus building process of MODSAFE has also shown the limits of standardization for technical safety functions and objects. The networks and connections created for this project (e.g. network of operators, urban rail suppliers as well as transport research institutions and other related parties like an independent safety assessor) helped to establish an on-going, target oriented discussion and therefore reveal common goals and a better understanding of different European procedures and needs.

ModSafe

Modular Urban Transport Safety and Security Analysis

Main achievements:

MODSAFE produced numerous deliverables highlighting the European situation and making detailed recommendations for the future in the form of a typical AAC process (see deliverables on next slides)

MODSAFE has been recognised by the European Commission as a sound basis to avoid applying to urban rail the legal requirements for mainline: urban rail shall be excluded from the scope of the Fourth Railway Package

ModSafe

Modular Urban Transport Safety and Security Analysis

Deliverables (1/2):

- **D1.2 "Final report - State of the art on safety responsibilities and certification"**
- **D2.1 "First List of Hazards, Preliminary Hazard Analysis (PHA)"**
- **D2.2 "Consistency Analysis and Final Hazard Analysis"**
- **D2.3 "MODSafe Risk Analysis"**
- **D3.2 "Final Hazard Control and Safety Response Measures Analysis"**
- **D4.1 "State of the Art Analysis and Compilation of Results from Previous Projects"**
- **D4.2 "Analysis of Common Safety Requirements Allocation for MODSafe continuous Safety Measures and Functions"**
- **D4.3 "Analysis of On-Demand Functions and Systematic Failures"**
- **D5.1 "Urban Guided Transport Object Safety Model"**
- **D5.2 "Functional and Combined Object/Functionl Guided Transport Model"**
- **D5.3 "Safety Attributes Allocation Matrix"**

European Rail Research Advisory Council

ModSafe

Modular Urban Transport Safety and Security Analysis

Deliverables (2/2):

- D6.1 "Survey of current safety life cycle approaches"
- D6.2 "Comparison of current safety life Cycle approaches"
- D6.3 "Proposal of common safety lify cycle approach"
- D7.1 "Review of current AAC procedures"
- D7.2 "List of elementary activity modules"
- D7.3 "Generic model of AAC processes"
- D7.4 "Acceptance, Approval, Certification - Proposal of typical optimizes AAC process"
- D10.5 "MODSafe Glossary"

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ModSafe: Main features

- FP 7
- Project Reference FP7-SST-2007-RTD-1 - 218606
- Total Cost: € 5,180,840
- EU Contribution: € 3,469,161
- Timescale: 48 months (September 2008- August 2012)
- Project Coordinator: Peter Wigger (TÚV Rheinland InterTraffic GmbH)

Partners

Alstom Transport	France	KITE Solutions	Italy
Ansaldo STS	Italy	London Underground	United Kingdom
AREVA - Société Technique pour l'Energie Atomique	France	Metro de Madrid	Spain
BME - Budapest University of Technology and Economics	Hungary	Technische Universität Dresden;	Germany
Bombardier Signal	Germany	TelSys	Germany
Dimetronic	Spain	Thales Rail Signaling Solutions	Canada
INRETS - French National Institute for Transport and Safety	France	TMB – Ferrocarril Metropolità de Barcelona	Spain

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ModSafe: Main features

Partners (Cont.)

- TÜV Rheinland Consulting — Germany
- TÜV Rheinland Intertraffic — Germany
- Rail & Bus Consultants — Germany
- RATP - Régie Autonome des Transports Parisiens — France
- UITP - International Association of Public Transport — Belgium
- UNIFE - Association of the European Railway Industry — Belgium
- Université de Valenciennes et de Hainaut-Cambrésis — France
- Université de Technologie Compiègne — France

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ModSafe: Background

Partners interviewed:

Organisation	Name of Interviewee	Country	Email
Bombardier	☑ Andreas Hardt	Germany	andreas.hardt@de.transport.bombardier.com
UNIFE	☑ Bernard Von Wullerstorff	Belgium	bernard.von.wullerstorff@unife.org
RATP	☑ Stephane Dubois	France	stephane2.dubois@ratp.fr
UITP	☑ Yves Amsler	Belgium	yves.amsler@uitp.org
TMB	☑ Jordi Picas	Spain	jpicas@tmb.cat
Thales Rail Signaling Solutions	☑ David Dimmer	Canada	David.DIMMER@thalesgroup.com

ModSafe: Background

Partners answering:

Organisation	Name of Interviewee	Country	Email
UITP	☑ Yves Amsler	Belgium	yves.amsler@uitp.org
TMB	☑ Jordi Picas	Spain	jpicas@tmb.cat

ModSafe: Background

Project description:

The purpose of the MODSAFE project is to undertake research of major steps of the safety life cycle of urban guided transport systems in Europe. Even if the rail safety landscape in urban guided transport is highly diversified, the sector will benefit from some kind of harmonisation. Furthermore, security items are considered more and more as vital for the urban transport sector. The 22 partners are from industry, associations, research and development (R&D) organisations, consultants and operators.

The MODSAFE project successfully started in 2008 with state of the art evaluations and initial models. Hazard analyses, safety requirements as well as functional and object models have been developed in the safety sector, while a life cycle approach proposal and an approval approach were established in the process sector. For the security sector, the existing means and technologies for security systems have been analysed, forming the base for a model reference under development.

European Rail Research Advisory Council

ModSafe: Background

Achievements:

MODSAFE shall have given guidance on how to deal with the diversities, to find a common European strategy. Final results focus on cross acceptance of proven and certified technologies. The application of the WPs' deliverables and outcomes shall be straight forward, in order to reduce the efforts and manpower needs, even for a first certification.

These activities help to create common safety and security methods, in order to reduce barriers within the EU. As a result, competition and common/ equal safety standards may be enabled. MODSAFE however also shows the limits of standardisation for technical safety functions and objects, as the consensus building process has shown. The networks and connections created for this project (e.g. network of operators, urban rail suppliers as well as transport research institutions and other related parties like an independent safety assessor) help to establish an on-going, target oriented discussion and therefore reveal common goals and a better understanding of different European procedures and needs.

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ModSafe: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
2. Is new legislation and standardization based on findings from this research project
3. Are the results of the project implemented across Europe or only in a small number of Member States?
4. Were the results of the project implemented outside Europe before being accepted in Europe?
5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
6. Did the project increase competitiveness of railway transportation compared to other transport modes?
7. Are the results of the project taken into consideration when preparing public tenders?
8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
10. Can benefits be assessed in financial terms?
11. Applicability of results to future scenarios?
12. Usefulness of research procedures for future projects (incl. modeling)

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ModSafe: Evaluation (Results)

Question	Y. Amsler	J. Picàs
1	Yes. Portuguese Authority	Yes
2	Yes. EC recognition for sfaty and 4th Railway Package	Yes indirectly
3	Yes. And also at Worldwide level	Yes. But not formally
4	Yes. 1st European standardization process. 2nd outside Europe	No.
5	Difficult to measure	Yes, if implemented
6	Yes. Safety improvements	Yes.
7	Yes. Should be	Yes.
8	Not relevant	Not applicable
9	Not relevant	Not applicable
10	Yes, Should be	Yes
11	Yes: Fully applicable to nay new rail system	Yes: NGTC
12	Yes: SECUR-ED	Yes: NGTC

ModSafe: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   The results have been used by the Portuguese authorities for application in their country before the end of the project. The results have been very widely disseminated in the urban rail community
2. Is new legislation and standardization based on findings from this research project
   The EC recognised the specific situation of Urban Rail with regard to Safety and the Fourth Railway Package is intending to exclude Urban Rail from the scope of the technical directives (Interoperability and Safety)
3. Are the results of the project implemented across Europe or only in a small number of Member States?
   The recommendations regarding the AAC process are valid not only in Europe but worldwide.
4. Were the results of the project implemented outside Europe before being accepted in Europe?
   It was agreed from the beginning that a consensus had to be achieved between European stakeholders for application in Europe, and that in a second step the recommendations could be disseminated for application outside Europe as well.

European Rail Research Advisory Council

ModSafe: Evaluation

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
   It is difficult to measure the effect of shared methods on the competitiveness of the European railway industry
6. Did the project increase competitiveness of railway transportation compared to other transport modes?
   The project has proved the high level of safety achieved for urban rail systems, and thus could increase the relative attractiveness of urban rail towards private car use
7. Are the results of the project taken into consideration when preparing public tenders?
   They should since they help allocating responsibilities between partners at all steps of the safety life cycle of Urban Rail systems
8. *Does the implementation of the projec*t results help facilitate cross-border operations by problem-solving in the domain of interoperability?
   Interoperability is not relevant for Urban Rail. However the AAC process could be used in case of local cross-border rail systems developments for certification on either side of the border

European Rail Research Advisory Council

ModSafe: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
   Not relevant.
   The focus is not on intermodality, but specifically on Urban Rail systems
10. Can benefits be assessed in financial terms?
    Difficult, but the proposals facilitate the certification process and reduces the time for certification through a clear allocation of responsibilities at each step of the system implementation and operations
11. Applicability of results to future scenarios?
    Fully applicable to any new urban rail system
12. Usefulness of research procedures for future projects (incl. modeling)
    Some specific security outcomes (risk assessment method, glossary) have been used as a starting point for the SECUR-ED demonstration project.
    The methods which have been defined in relation to safety are a reference for any future research or application on the subject

European Rail Research Advisory Council

ModSafe: Reasons for outcome:

- ✓Portugal, as a project-enthusiastic, implemented the results.
- ✓Large EU coverage within the project
- ✓Participation of UITP members in the detailed survey in order to collect reliable and comprehensive information in most EU countries

European Rail Research Advisory Council

ModSafe: Lessons learnt:

- ✓Even wide representation of the sector within the consortium, the results were only implemented in Portugal.
- ✓Importance of attracting the final users in the project from the beginning and to associate them in "Networks of end users"
- ✓Importance of consensus building not only between operators and manufacturers, but also with the European Commission and national authorities
- ✓Importance to achieve high quality research and high quality results, to create confidence in the proposed recommendations

European Rail Research Advisory Council

MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- To make it more competitive
- To foster increased innovation
- To guide research efforts at the European level

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
- Ensure a strategic approach to the prioritisation of rail research

Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
- To ensure that the results of previous rail research can be taken into account for future projects
- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

European Rail Research Advisory Council

ERRAC Project Evaluation Group

ERRVIN

EVALUATION FROM October 2015

Project acronym: ERRVIN
FP: 5
Programme acronym: FP5 – GROWTH
(Preparatory, accompanying and support measures)
Project Reference: G3MA-CT-2002-04039
Call identifier: 1.1.3.-3. - Key Action Land Transport and Marine Technologies
Total Cost: € 198,136 (reduced from € 396, 271)
EU Contribution: € 198,136 (reduced from € 396, 271)
Timescale: 1st January 2003 to 31st Dec 2005
Project Coordinator: Rayner MAYER (Reading University)

- Presented by: Chris Brown
- Date evaluation: 20/10/2015
- Market uptake: Strong
- Follow up projects: none
- Other related Projects: EUREKA FOOTPRINT project

Web references: http://cordis.europa.eu/project/rcn/67706_en.html
http://www.transport-research.info/web/projects/project_details.cfm?id=13956

European Rail Research Advisory Council

ERRVIN
Managing the dynamic interaction between the vehicle and the infrastructure

Premise:

This is a 100% funded Preparatory, accompanying and support measure. The project it accompanied was FOOTPRINT (a Eureka project) where the practical technical research was carried out.

ERRVIN (the European Road and Rail Vehicle-Infrastructure Network) was set up to consider the dynamic interaction of a road or rail vehicle with its infrastructure and discuss solutions that will reduce the environmental and economic impact of freight traffic. This includes the collation and analysis of characteristic data and key source documents, developing vehicle classification schemes and evolving the concept of an environmental footprint that can be used to characterise individual types of vehicle, both **road and rail**. Audible **noise**, ground borne **vibration** and **dynamic loading** by the vehicle on the infrastructure are the factors that make up this footprint.

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European Rail Research Advisory Council

ERRVIN
Managing the dynamic interaction between the vehicle and the infrastructure

Rationale:

The aim was to study the dynamic interaction of a road or rail vehicle with its infrastructure and to agree solutions that will reduce the environmental **and economic** impact of freight traffic. This involves collation and analysis of characteristic data and key source documents, running an **economic model** which transparently allocates the costs amongst road or rail freight users and developing **environmental acceptability criteria** for different classes of vehicles and infrastructures.

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ERRVIN
Managing the dynamic interaction between the vehicle and the infrastructure

Main Objectives:

The overall objective of the ERRVIN project is to reduce the environmental impact of road and rail transport through a more thorough understanding of the dynamic interactions of a vehicle with its infrastructure. In particular, the project set out to:

- Assist the E.C. & Member States with information and advice to implement existing Directives such as Intermodality (EC 92/106) and Interoperability (EC 01/016)
- Develop concepts of environmentally friendly road & rail vehicles and infrastructures
- Compare the enviro-economic cost of road and rail freight
- Examine the sensitivity of various cost drivers associated with infrastructure usage.

ERRAC *European Rail Research Advisory Council*

ERRVIN: Background

Details

- FP 5
- Project Reference ERRVIN
- Total Cost: € 198,136 (reduced from € 396, 271)
- EU Contribution: € 198,136 (reduced from € 396, 271)
- Timescale: 1st January 2003 – September 2004
- Project Coordinator: Rayner MAYER SCIOTECH PROJECTS Ltd (University of Reading)

Partners

- SCIOTECH PROJECTS LIMITED (University of Reading) UK
- FORUM OF EUROPEAN NATIONAL HIGHWAY RESEARCH LABORATORIES Belgium
- NS RAILINFRABEHEER B.V. Netherlands
- PROCEDIS LTD United Kingdom
- TRL LIMITED United Kingdom
- WHEEL RAIL INTERFACE SYSTEM AUTHORITY LTD United Kingdom

ERRVIN

Partners interviewed:

Organisation	Name of interviewee	Country
U. Reading	☑ Rayner MAYER	UK
[RSSB	Paul Gray	UK]
[Network Rail	Amanda Hall (or Andy Doherty)	UK]
PRORAIL	R Mayer to provide contact	NL
[ORR UK Regulator	Peter Doran	UK]

ERRVIN: Background

Project description:

The overall objective of the ERRVIN project is to reduce the environmental impact of road and rail transport through a more thorough understanding of the dynamic interactions of a vehicle with its infrastructure.

Note the sister Project FOOTPRINT carried out the technical R&D.

European Rail Research Advisory Council

ERRVIN: Background

Achievements:

A stakeholder network was established to develop a widely accepted and sustainable consensus. It included network managers, infrastructure maintainers, vehicle operators, manufacturers, Member State representatives and the Commission.

- The project has identified six principal issues, associated with the legislation that has been agreed by the EU to reduce the environmental impact of transport.
- The key principle is that the user rather than society should pay the marginal socio-environmental cost. Issues include methods of vehicle classification and measurement of the environmental impact due to traffic by road and rail vehicles. It is important to measure the footprint in-service.
- A proposed methodology for rail vehicle classification based on gross vehicle mass and the number and grouping of axles. **(This is being followed up by Eureka project Eco-vehicle.)**
- A proposal to formalise the measurement methods being developed by Footprint and other groups in the form of a CEN Workshop Agreement in order to provide a legal basis for such measurements has been submitted for consideration. (This resulted eventually in a new product “Gotcha” a fibre optic method to measure the impact of trains on track .)

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European Rail Research Advisory Council

ERRVIN: Background

Achievements (continued):

- **The main market uptake from ERRVIN and FOOTPRINT was the commercial product “Gotcha”,**

- **Gotcha is an open wayside monitoring platform to measure the quality of various aspects of trains. The most common modules used are Wheel Defect Detection to monitor the quality of the wheels and the Weighing in Motion to determine the load of a passing vehicle. A variety of sensor types can be added to the platform to determine the state of different aspects of trains.**
  http://www.gotchamonitoringsystems.com/ **Gotcha Monitoring Systems® is a joint development of Lloyd's Register Rail and SST-Nederland Research and Development.**
- **Over 50 systems in use in Network Rail today. Often used at tunnel entrances.**
- **Also sold in Norway, Sweden, Switzerland, France, Netherlands.**
- **It detects track force from passing trains, said to reduce broken rails.**

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European Rail Research Advisory Council

ERRVIN: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   – Yes (the Gotcha monitoring system) – with project FOOTPRINT
2. Is new legislation and standardization based on findings from this research project
   – Not directly, but the technology provides safe to operate assurance made use of in safety regulation
3. Are the results of the project implemented across Europe or only in a small number of Member States?
   – Yes
4. Were the results of the project implemented outside Europe before being accepted in Europe?
   – No, in Europe first**.**

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European Rail Research Advisory Council

ERRVIN: Evaluation

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
   – Yes The technology helped increase safety assurance through early warning of need for maintenance and preventing unnecessary maintenance
6. Did the project increase competitiveness of railway transportation compared to other transport modes?
   –Yes it helped rail catch up with road
7. Are the results of the project taken into consideration when preparing public tenders?
   No.
8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
   Yes e.g. Channel tunnel has these sensors at each end to detect defective trains entering

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ERRVIN: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
   No

10. Can benefits be assessed in financial terms?
    Yes they could be (reduction in broken rails and subsequent passenger disruption, more effective train maintenance , reduced track access charges?)

11. Applicability of results to future scenarios?
    –Possible future application via ECO-VEHICLE (e.g. on road diesel testing/charging)

12. Usefulness of research procedures for future projects (incl. modeling)
    Two linked projects FOOTPRINT and ECO-VEHICLE .

ERRVIN: Reasons for outcome

✓ Close tie-in with technical project (FOOTPRINT)

✓ ERRVIN helped establish positive links between road and rail (technical, commercial and safety).

✓ Roads participants gained less than rail, but were still willing to participate

ERRVIN: Lessons learnt

- ✓ A series of connected projects (rather than a single project) is often needed to make progress.
- ✓ Rail can learn from roads (legislation around road vehicle suspension and its damage to roads was adapted for rail).
- ✓ Productive to work closely with infrastructure managers where they are the ones seeing the damage.
- ✓ Time extensions to promising project should be allowed.

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MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- **To make it more competitive**
- **To foster increased innovation**
- **To guide research efforts at the European level**

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- **Determine the market impact of previous rail research to improve use of research funding**
- **Ensure a strategic approach to the prioritisation of rail research**

Project Evaluation

- **Individual projects are evaluated after they have been completed to ensure successful dissemination of project results**
- **To ensure that the results of previous rail research can be taken into account for future projects**
- **To avoid weak market uptake of results by learning the lessons of previous research**
- **The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes**

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ERRAC Project Evaluation Group

European Driver's Desk Advanced Concept Implementation – Contribution To Foster Interoperability

EVALUATION FROM OCTOBER 2015

Project acronym: EUDD
FP: 5
Programme acronym: FP5 - GROWTH - KA3 - Land transport and marine technologies
Project Reference: G3RD-CT-2000-00457
Call identifier: 1.1.3.-3. - Key Action Land Transport and Marine Technologies
Total Cost: €4,515,486
EU Contribution: € 2,747,262
Timescale: 2001-2003
Project Coordinator: Wolfgang Steinicke (Forschungs- und Anwendungsverbund Verkehrssystemtechnik Berlin)
Web references:

- ❑ **Presented by:** A. Gougelet and D. Schut
- ❑ **Date evaluation:** October 2015
- ❑ **Market uptake: STRONG**
- ❑ **Follow up projects:** EUCAB (MODTRAIN/MODLINK), EUDDPlus
- ❑ **Other related Projects:** none

EUDDPlus

European Driver's Desk Plus

Premise

In conformity with the EU policy the project aims at the improvement of interoperability in cross-border railway traffic by development, construction and evaluation of a new driver's desk that will be the core of modular train for application throughout Europe. Optimisation of human-vehicle interaction regarding working conditions, traffic safety and implementation of extended future-oriented monitoring/control capabilities are envisaged. Main project objectives are measurable improvements relating to man-machine-interface (e.g. reduction in reaction time), the supply industry (e.g. reductions in manufacturing costs, reduced time-to-market) and the Railways (e.g. reduced Life-Cycle costs). A multidisciplinary specification process will ensure the application of latest scientific knowledge's. The evaluated specifications of desk concept (realised and evaluated as hardware mock-up) will serve as input document for future EU standard.

EUDDPlus

European Driver's Desk Plus

Rationale

The international state-of-the-art with regard to the **man-machine-interface (MMI)** to control trains is still characterised by a **lot of different national and operator-specific solutions** impeding the interoperability of the rail system in Europe. This situation **hinders seamless rail traffic across Europe** and thus reduces the efficiency of international rail operation. The great variety of train driver's desk layouts does not only concern the Train Operating Companies (TOCs) but also the suppliers who had to develop dedicated driver's desk solutions for each of their customers and are therefore not able to profit from "economies of scale". The lack of harmonisation in train driver's workplaces finally **impacts the competitiveness of the rail system** towards other modes of transport.

European Rail Research Advisory Council

Objectives of the project

- Harmonisation of different national conditions and requirements for High Speed,
- Freight Locomotive and Regional Transit
- Define the basic areas of man-machine interface
- Proposals to minimize control elements and service processes
- Reduce production cost, life-cycle cost and servicing costs with regards to all components in the area of MMI
- Reduce cost for education of drivers
- Improvement of drivers working conditions
- Improvement of safety for drivers and passengers

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European Rail Research Advisory Council

Background

Details

- FP 5
- Total Cost: : €4,515,486
- EU Contribution: € 2,747,262
- Timescale and duration: 01/01/2001 – 31/12/2003 - 36 Months
- Coordinator: Wolfgang Steinicke (Forschungs- und Anwendungsverbund Verkehrssystemtechnik Berlin)

Partners

• Forschungs- und Anwendungsverbund Verkehrssystemtechnik Berlin	GERMANY
• Alstom Transport A.A.	FRANCE
• Ansaldobreda S.P.A.	ITALY
• Bombardier Transportation GMBh	GERMANY
• Deuta-Werke GMBh	GERMANY
• Faiveley Transport SA	FRANCE
• IAS- Institut für Arbeits- und Sozialhygiene Stiftung	GERMANY
• Quintus-design	GERMANY
• SGW Werder GMBh	GERMANY
• Siemens AG	GERMANY
• Stichting European Rail Research Institute	NETHERLANDS
• Trafo (industrial design)	ITALY
• Universitat Politecnica de Catalunya	SPAIN
• Vienna University of Technology	AUSTRIA

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Background

The project European Driver‟s Desk (EUDD), which was funded in FP5 by the European Commission and was developed by several major rail suppliers, was to support cross-border rail transport in Europe. Barriers between the EU Member States are reduced by a uniform technology and interoperability. At the same time a realisation of scale in the production of driving cabs was sought. Further economies of scale in maintenance, in lifecycle and training costs and other costs were expected. The determination of these savings and the resulting application potentials were target of the investigation.

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EUDD: Background

Partners interviewed (EUDD & EUDD Plus):

Organisation	Name of interviewee	Country
Alstom	☑ Denis Miglianico	France
DB Schenker Rail AG	☑ Steffen Leipner	Germany

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EUDD: Structure (1)

WP 1 Definition of functional specifications: this WP was covering the analysis of existing railway practices and drivers working conditions, preparing a state-of-the art and future trends case taking into account developments in automotive and aeronautics sectors. With the inclusion of identified customers requirements, this WP prepared an ergonomic and economic impacts study as well as assessment criteria and design guidelines.

WP 2 Design concepts: this WP produced initial driver's desk concept which were them augmented with high flexibility components to allow a full modularisation for interoperability.

WP 3 Operational components software development and functional realisation: WP3 proceeded to a specification of electrical components followed by software and hardware development of these components. A hardware mock-up was designed, based on definitions/development of a test simulation interface done earlier.

EUDD: Structure (2)

WP 4 Definition and development of a test simulation interface for mock-up: WP4 was dedicated to the industrial design mock-up test, virtual-reality lab tests and functional mock-up test.

WP 5 Verification and Recommendation for Harmonisation: WP5 extracted the conclusions from previous work packages and prepared an input document for European standardisation.

Achievements

- Base concepts for interoperable driver's desk, further extended by EUCAB and implemented on full-scale test through EUDDPlus

Evaluation:

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?

   Yes, the results achieved by the follow-up EUDDPlus
2. Is new legislation and standardization based on findings from this research project?

   Yes after EUDDPlus: EN 16186, UIC 612
3. Are the results of the project implemented across Europe or only in a small number of Member States?

   N/A, however EUDDPlus results have been implemented across Europe in different locomotives and EMU/DMU. For example inside Alstom more than 50 locomotives compliant with this new standards have been sold.
4. Are the results of the project implemented outside Europe before being accepted in Europe?

   No

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Evaluation:

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?

   Yes, through the results of EUDDPlus

6. Did the project increase competitiveness of the railway transportation compared to other transport modes?

   Yes, through the results of EUDDPlus

7. Are the results of the project taken into consideration when preparing public tenders?

   Yes, through the results of EUDDPlus

8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?

   Yes, through the results of EUDDPlus

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Evaluation:

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?

   Yes, through the results of EUDDPlus

10. Can benefits be assessed in financial terms?

    No

11. Applicability of results to future scenarios?

    Yes, EUDDPlus was the follow-up

12. Usefulness of research procedures for future projects (incl. modeling)?

    Yes, EUDDPlus was the follow-up

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Reasons for outcome

- ✓ Strong motivation and involvement of partners, as a result of a precise market need and commercial goal
- ✓ The consortium included partners with all capabilities needed to achieve the objectives
- ✓ Commitment and good organisation to continue the work in the follow-up project EUDDPlus

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MARKET IMPACT EVALUATION

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ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
- Ensure a strategic approach to the prioritisation of rail research

Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
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- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

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ERRAC Project Evaluation Group

European Driver's Desk Plus : Advanced Concept Implementation – Contribution To Foster Interoperability

EVALUATION FROM OCTOBER 2015

Project acronym: EUDDPlus
FP: 6
Programme acronym: SUSTAINABLE DEVELOPMENT
Project Reference: 031555
Call identifier: SUSTDEV-2005-3.3.1.3.2
Total Cost: 3,23 M€
EU Contribution: 1,799M€
Timescale: 2006-2010
Project Coordinator: FAV
Web references: http://www.modtrain.com/

- Presented by: A. Gougelet and D. Schut
- Date evaluation: 20/10/2015
- Market uptake: Strong
- Follow up projects: none
- Other related Projects: EUDD, EUCAB (MODTRAIN/MODLINK)

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EUDDPlus

European Driver's Desk Plus

Premise

The project EUDDplus aims at the **development, in-field testing and validation of the interoperable, harmonised and modularised train driver's desk**. It represents the logical and necessary link between the successful FP 5 project European Driver's Desk (EUDD) and the large-scale exploitation of that driver's desk concept´, advanced in ergonomics, safety and life cycle costs (LCC). Simultaneously, the EUDDplus shall use the findings of the FP 6 Integrated Project MODTRAIN, in which the EUCAB working area elaborates the harmonised driver's cab system requirements specs (SyRS) of the future.

EUDDPlus

European Driver's Desk Plus

Rationale

The international state-of-the-art with regard to the **man-machine-interface (MMI)** to control trains is still characterised by a **lot of different national and operator-specific solutions** impeding the interoperability of the rail system in Europe. This situation **hinders seamless rail traffic across Europe** and thus reduces the efficiency of international rail operation. The great variety of train driver's desk layouts does not only concern the Train Operating Companies (TOCs) but also the suppliers who had to develop dedicated driver's desk solutions for each of their customers and are therefore not able to profit from "economies of scale". The lack of harmonisation in train driver's workplaces finally **impacts the competitiveness of the rail system** towards other modes of transport.

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Objectives of the project

The objective of the project EUDDplus is to enhance a **Europe wide standardisation and harmonisation of a loco driver's desk functional arrangement and layout**, including the testing and verification of the ergonomic advantages, sub system performance and the potential economic benefits (LCC). A UIC 612 conform European drivers desk will be implemented and tested (usability testing) at vehicle technology platforms (locomotives) under cross-border operation.

Targets

- To achieve a reduction of the Life Cycle Costs (LCC) of the system driver's desk of at least 15 % compared to the reference case (given by the test locomotive with conventional desk).
- To justify the ergonomic advantages of the EUDD desk layout during in-field tests
- To prove the technical and operational feasibility of the EUDD concept and MODTRAIN ORS (Operational requirements specification) 612 implementation
- To facilitate the future series homologation procedure of the EUDDplus desk layout for all European networks by involving the ERA (European Rail Agency) and the national authorities for the entire project duration via a user platform.

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Background

Details

- FP 6
- Total Cost: : 3,23 M€
- EU Contribution: 1,799M€
- Start and duration: 07/2006 - 43 Months
- Scientific Coordinator: Steering board

Partners

- See chart to the right

Beneficiary name	Beneficiary short name	Country
TSB Innovationsagentur GmbH / Forschungs- und Anwendungsverbund Verkehrssystemtechnik Berlin	FAV	Germany
Siemens Aktiengesellschaft	SIE	Germany
Bombardier Transportation GmbH	BT	Germany
ÖBB Traktion GmbH	OEBB	Austria
MAV-GÉPÉSZET Zrt	MAV	Hungary
Ceske drahy a.s.	CD	Czech Republic
AustriaTech – Gesellschaft des Bundes für technologiepolitische Maßnahmen GmbH	ATE	Austria
IAS Institut für Arbeits- und Sozialhygiene Stiftung	IAS	Germany
Technische Universität Wien / Vienna University of Technology	VUT	Austria
Fundació Politècnica de Catalunya - Universitat Politècnica de Catalunya	FPC-UPC	Spain
Union Internationale des Chemins de fer	UIC	France
Union of European Railway Industries	UNIFE	Belgium
Deuta Werke GmbH	DEUTA	Germany
SKODA TRANSPORTATION s.r.o.	ST	Czech Republic
ALSTOM Transport S.A.	ALS	France
EAO Lumitas GmbH	EAO	Germany
W. Gessmann GmbH	GES	Germany

Background

The project European Driver‟s Desk (EUDD), which was funded in FP5 by the European Commission initiated the first development of European-wide operate-able driver‟s desk. The functionality was tested with several drivers in a simulation environment. To continue these efforts one step closer to a unified European driver‟s desk to make efficient cross-boarder operations possible the project European Driver‟s Desk Plus (EUDDplus) was born as multisystem, three phases approach. It bases and takes advantage on the just finished IP MODTRAIN (working area EUCAB of MODLINK sub project). In EUDDplus a multi-system locomotive (PRIMA II) will be equipped with an advanced version of the European Driver‟s desks based on latest perception for locomotive application following the EUCAB results (ORS and FRS/SyRS/FIS). In a field test at the Wildenrath test ring with drivers from different EU member states the usability of the European Driver‟s desk as part of an innovative vehicle concept will be proofed and cognitions for the serial implementation collected. This will be supported by reference test trails with a second multi-system locomotive (109E/ class 380 CD) in the Czech Republic in 2009.

EUDDPlus: Background

Partners interviewed:

Organisation	Name of interviewee	Country
Alstom	☑ Denis Miglianico	France
DB Schenker Rail AG	☑ Steffen Leipner	Germany

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EUDDPlus: Structure (1)

WP 1 Project Management: WP 1 was dedicated to perform the *project management tasks*. It comprised the technical as well as the administrative coordination.

WP 2 EUDD*plus* User Platform: this WP was focussed on *identifying the interested operators and suppliers that should compose the core of the EUDDplus user platform* and *organising seminars* to gather inputs and preparing the implementation of the solution.

WP 3 Homologation Support: this WP was to *prove that the EUDDplus specifications meet the essential requirements* defined in the Interoperability Directive 2008/57/EC and specified in the Conventional Rail Technical Specification for Interoperability Locomotive and Passenger Rolling Stock (CR TSI Loc&Pas RST) It also targeted integration of the EUDDplus specifications in a spreadsheet which contains a detailed list of parameters and their link to the requirements of certification authorities and network operators of several European countries.

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EUDDPlus: Structure (2)

WP 4 EUDDplus Concept Precision and Specification: *Precision and specification of the desk concept* for implementation with regards to MODTRAIN specifications. *Elaboration of the EUDDplus desk configuration* according to EUCAB and former EUDD results. *Comparison* of the Alstom PRIMA II desk design with the UIC 612. *Adaption of the design for the tests*, elaboration of *different drawings of the desk and specification* of the 4 display screens (TRD, ETD, CCD, TDD2). *Specification of hardware and software* for set point values of speed, dynamic braking and automatic braking and for the travel direction selector**.**

WP 5 System Engineering: *specification of mechanical, electrical, pneumatic and TCMS interfaces* according to the concept requirements, the development and adaption of hardware desk components including the electrical traction brake controller, the automatic brake, the automatic speed control and the auxiliary desk, and the development and testing of software for the 4 displays/terminals.

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EUDDPlus: Structure (3)

WP 6 Construction and Desk Integration: *Functional tests on PRIMA II locomotive included the implementation and evaluation of the EUDDplus demonstrator* desk according to the specifications given by WP 4 and WP 5 into the PRIMA II locomotive test platform. *Construction of the desk* including the cabling, the mounting of equipment, the testing before vehicle integrating into the locomotive and the vehicle integration of the prototype desk according to the specification. Followed by *extensive functional static and dynamic testing of the PRIMA II locomotive on Wildenrath test ring*. A desk for the training simulator was also built.

WP 7 In-field Test Programme and Evaluation: *testing according to different scenarios* (different speed, tracks, signalling, climatic conditions etc.) The test scenarios had been designed in a way that made the drivers able to use all the driving equipment at least one time, including different operational modes (normal operation, degraded modes, shunting). *Further specifications of all hard- and software criteria* to be tested were made. This WP also included the use of au useful *additional measuring method: measurement of the driver's eye movements* with the help of an eye tracking system.

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EUDDPlus: Structure (3)

WP 8 Conclusions for Broad Scale Exploitation: *input from the user platforms* from the TOCs, the System, Subsystem and Component Suppliers, and from Authorities, Notified Bodies and Standardisation Bodies (not. ERA). *Preparation of an exploitation and market penetration scenario of the EUDD/EUCAB layout* based on the in-field testing results as well as on the updated LCC considerations, taking into account international cross-acceptance and standardisation.

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Achievements

Alternative proposal (80 % compliant to UIC 612) to Driver's desk defined in UIC leaflet 612.

Requirements and recommendations have been defined regarding the design, the **hardware components and the visibility and legibility of the displays**.

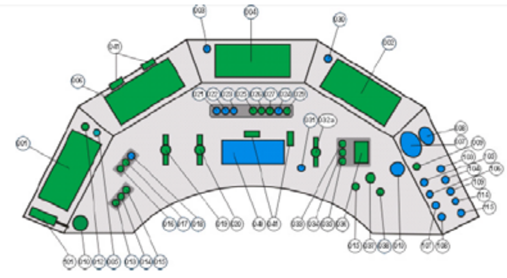

Fig. 4: Driver's desk according UIC 612

EUDD*plus* desk - Displays

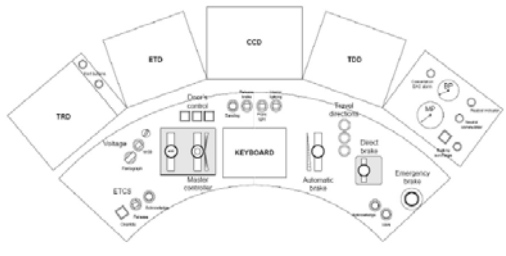

Fig. 5: EUDD*plus* desk concept integrated into PRIMA II locomotive prototype

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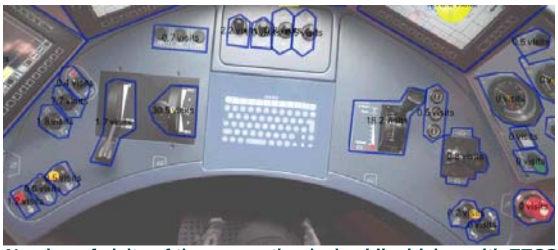
Achievements

Development of a **training simulator** for train drivers.

Recommendation for a **wider use of eye-movement detection metering** as additional measurement system.

EUDD*plus* training simulator



Number of visits of the eye on the desk while driving with ETCS

Density Distribution during the drive with ETCS

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Achievements

Nota bene: Feedback from use

When actually being used, the EUDD locomotives from some manufacturers showed some **problems with the river unit's software leading to a situation where it was not possible to carry out movements to push (when coupling or decoupling) without additional support**. Within the affected series of rolling stock, the brake and traction performance are mutually interlocked by the software so that it is not possible to change gears when braking, something which is often necessary in order to (de-)couple and to compress the buffer.

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Achievements

Numerous dissemination activities between 2007 and 2010, including:

- 1 Press release in Dec. 2009
- 2 Media briefings (2009 & 2010)
- 7 conferences between 2007 and 2010
- 1 website: www.euddplus.eu (*now defunct*)
- Flyers/brochures in 2010
- 7 direct emailings to a wide range of rail sector stakeholders from 2008 to 2010
- 1 video of in-track testing made in June 2010: www.youtube.com/watch?v=fWYeGho5hzc
- 10 publications (trade press articles, European websites, UIC eNews, etc.)
- Exhibition at Innotrans 2010
- 1 poster at Innotrans 2010

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Evaluation:

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?

   Yes : EMU/DMU, Loco and High speed train, new DB loco BR 147/187 TRAXX 3 from Bombardier Transportation

2. Is new legislation and standardization based on findings from this research project?

   Yes : EN 16186, UIC 612

3. Are the results of the project implemented across Europe or only in a small number of Member States?

   They have been implemented across Europe in different locomotives and EMU/DMU. For example inside Alstom more than 50 locomotives compliant with this new standards have been sold.

4. Are the results of the project implemented outside Europe before being accepted in Europe?

   No

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Evaluation:

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?

   Yes, by providing a standard that is also used in US

6. Did the project increase competitiveness of the railway transportation compared to other transport modes?

   Yes, by providing a common base for driver's desk

7. Are the results of the project taken into consideration when preparing public tenders?

   Yes, for example new loco BR 147/187

8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?

   Yes

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Evaluation:

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?

    Yes

10. Can benefits be assessed in financial terms?

    Yes, confirmed in different by partners

11. Applicability of results to future scenarios?

    Possible, not clear how

12. Usefulness of research procedures for future projects (incl. modeling)?

    Possible

European Rail Research Advisory Council

Reasons for outcome

- ✓ Strong involvement of partners especially FAV, Alstom transport and Siemens, Operators (ÖBB, SNCF, etc.)
- ✓ Availibility of a locomotive and a ring for testing
- ✓ Good preparation : Tests done in a simulator to prepare the in-fields tests (in the MODTRAIN project)
- ✓ Large number of motivated drivers from EU who were available for testing the locomotive
- ✓ Availibility of a training simulator
- ✓ Human factors and ergonomics taken into account all along the project

Market uptake and lessons learnt

Quality of Market Uptake: high market up-take.

The goal of EUDDPlus, based on EUDD and EUCAB, was to do a multisystem demonstration and field test verification in vehicle platform of the two previous projects results. Tests were conclusive and dissemination activity managed to reach a fair number of transport stakeholders. EUDDPlus results influenced two different norms: EN 16186 and UIC 612. At least 50 locomotives incorporating EUDDPlus specifications have been sold, indicating a high market-uptake of the solution.

Lessons learnt

- ✓ Commitment for the availability of testing equipment should be done at the beginning of the project (issue with the 1st loco)
- ✓ Availability of ERTMS technology on test ring is a key success factor
- ✓ Fruitful cooperation between Universities and Industries

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- Determine the market impact of previous rail research to improve use of research funding
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- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

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ERRAC Project Evaluation Group

URBANTRACK

EVALUATION FROM DECEMBER 2015

Project acronym:	URBANTRACK
FP:	6
Programme acronym:	INFRASTR-6
Project Reference:	TIP5-CT-2006-031312
Call identifier:	FP6-2005-TRANSPORT-4
Total Cost:	€18,590,475
EU Contribution:	€9,998,350
Timescale:	September 2006 - August 2010
Project Coordinator:	Patrick VANHONACKER (D2S Dynamics, Structures & Systems International, Belgium)
Web references:	http://www.urbantrack.eu/ http://www.transport-research.info/web/projects/project_details.cfm?id=35176 http://cordis.europa.eu/project/rcn/84718_en.html

- ❑ **Presented by:** **C. Ulianov**
- ❑ **Date evaluation:** **09/12/2015**
- ❑ **Market uptake:** Medium
- ❑ **Follow up projects:** **none**
- ❑ **Other related projects: none**

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URBAN TRACK | Urban Rail Infrastructure

Premise:

The strategic aim of *call 3B "Development of cost-effective infrastructure for light rail systems"* was to support projects for light and heavy rail which consider cost effective innovative track products to fit in a harmonised European market. The products should be developed according to the ERRAC 2020 vision: low life cycle cost, high performance, modular, safe, low noise and vibration.

The 'Urban rail infrastructure' (Urban Track) project was established by a team of international researchers to develop innovative new track infrastructure products and techniques as positive drivers in modular and interoperable rail systems. The ambition was to develop and build an integrated family of "maintenance-free" modular track infrastructure solutions which can be adapted to specific circumstances and have the benefit of standardised components.

URBAN TRACK | Urban Rail Infrastructure

Rationale:

New urban rail systems (LRT, tram, metro) face opposition to the installation of new tracks from residents living nearby. The arguments concern noise and vibration disturbance during construction and exploitation, reduced revenues for businesses during construction, and general quality of life.

Besides these human factors, technical issues increase the project costs and thus require improvement. The cost of classical urban track construction is very high, especially for embedded tram tracks; track renewal methods are cumbersome, time consuming and often need complete closure of a section.

There is almost no standardisation within the same network, there is no uniformity of functional requirements between networks, making it hard to transfer rolling stock from one network to another.

Other internal challenges relate to investment and maintenance costs, which are generally covered by different authorities that may have opposing interests, and prevent LCC-based (life-cycle cost) decisions.

European Rail Research Advisory Council

URBAN TRACK | Urban Rail Infrastructure

General Objective:

To deliver an integrated series of modular track infrastructure solutions at low cost, with no or little maintenance, high availability, constant comfort and ensuring great punctuality, all this in an environmentally friendly and safe manner. In order to reach these objectives, quality and attractiveness of the tracks have to be increased and new technologies and standardisation (harmonisation) have to be introduced in the process.

Specific objectives: five innovative new products in the urban track sector:

1. Prefabricated track modules [product/solution 1]
2. Green LRT/tram tracks [product/solution 2]
3. Embedded metro tracks [product/solution 3]
4. Alternative low cost tracks for floating slab in tunnel and at grade [product/solution 4]
5. Maintenance free interface between rail and street pavement for embedded tracks [product/solution 5]

European Rail Research Advisory Council

URBAN TRACK | Urban Rail Infrastructure

Specific objectives: six innovative analysis methods:

1. Innovative track installation methods (new tracks) [method 1]
2. Automated track installation [method 2]
3. Fast renewal and refurbishment methods (LRT/tram) [method 3]
4. Cost/benefit analysis method for urban rail infra works (LRT/tram) [method 4]
5. Preventive and predictive maintenance for metro tracks [method 5]
6. Techniques for reducing wear in curves and turnouts (LRT/tram) [method 6]

Specific objectives: three innovative reference documents:

1. Harmonised standard for 'Rail Transit Track Inspection and Maintenance' (metro) [standard 1]
2. Harmonised LCC calculation method [standard 2]
3. Harmonised functional performance specifications [standard 3]

URBAN TRACK: Background

Details

- **FP6**
- **Project Reference** TIP5-CT-2006-031312
- **Total Cost:** € 18,590,475
- **EU Contribution:** € 9,998,350
- **Timescale:** September 2006 - August 2010
- **Project Coordinator:** Patrick VANHONACKER

(D2S Dynamics, Structures & Systems International, Belgium)

URBAN TRACK: Background

Partners

Dynamics, Structures & Systems International	D2S	Belgium
Société des Transports Intercommunaux de Bruxelles	STIB	Belgium
Alstom Transport Systems	ALSTOM	France
Bremen Strassenbahn AG	BSAG	Germany
Composite Damping Materials	CDM	Belgium
Die Ingenieurswerkstatt	DI	Germany
Institut für Agrar- und Stadtökologische Projekte an der Humboldt	ASP	Germany
Tecnologia e Investigacion Ferriaria	INECO-TIFSA	Spain
Institut National de Recherche sur les Transports & leur Sécurité	INRETS	France
Institut National des Sciences Appliquées de Lyon	INSA-CNRS	France
Ferrocarriles Andaluces	FA-DGT	Spain
Alfa Products & Technologies	APT	Belgium
Autre Porte Technique Global	GLOBAL	Philippines
Politecnico di Milano	POLIMI	Italy
Régie Autonome des Transports Parisiens	RATP	France
Studiengesellschaft für Unterirdische Verkehrsanlagen	STUVA	Germany
Stellenbosch University	SU	South Africa

Transport for London	LONDON TRAMS	United Kingdom
Ferrocarril Metropolita de Barcelona	TMB	Spain
Transport Technology Consult Karlsruhe	TTK	Germany
Université Catholique de Louvain	UCL	Belgium
Universiteit Hasselt	UHASSELT	Belgium
International Association of Public Transport	UITP	Belgium
Union of European Railway Industries	UNIFE	Belgium
Verkehrsbetriebe Karlsruhe	VBK	Germany
Fritsch Chiari & Partner	FCP	Austria
Metro de Madrid	MDM	Spain
Frateur de Pourcq	FDP	Belgium

European Rail Research Advisory Council

URBAN TRACK: Evaluation

Partners interviewed:

Organisation	Name of interviewee	Country
UITP	☑ Yves Amsler	France
TMB	☑ Javier Gómez	Spain
MDM (by FFE)	☑ Antonio de Santiago	Spain

European Rail Research Advisory Council

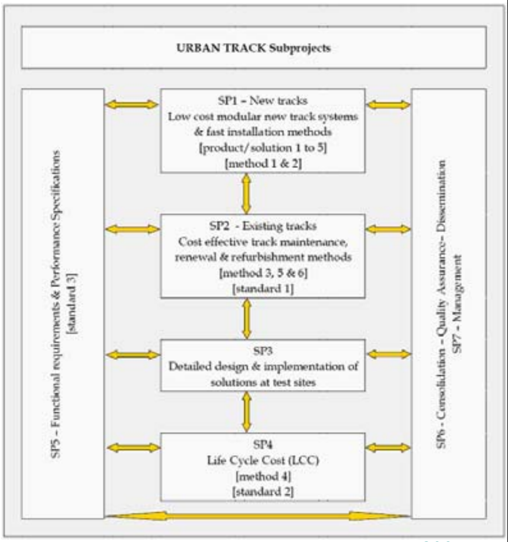
URBAN TRACK: Background

Project description

SP1 Low Cost Modular New Track Systems & Fast Installation Methods

SP1 focused on LRT, tram and metro tracks for new lines and extensions of existing lines. This SP aimed at researching, developing and designing ballastless track solutions at "system" level at lowest cost based upon the results of the LCC analysis. These solutions integrate:

- *innovative new low cost track concepts, e.g. prefabricated track modules;*
- *ecological concepts, e.g. "green" tracks;*
- *maintenance and operational strategies;*
- *and took into account all required specific interfaces (e.g. presence of road pavement, drainage, etc.).*



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URBAN TRACK: Background

Project description *(cont.)*

SP2 Cost Effective Track Maintenance, Renewal & Refurbishment Methods [Existing Lines]

SP2 considered tracks in tunnels, as well as tracks at grade (tram and metro). This SP aimed at researching, developing and designing innovative track renewal and refurbishment methods, including automated renewal methods and techniques for extending the life of existing tracks (link with maintenance). Consideration have been given to costs, environmental aspects (dust, noise), speed of execution and continuous availability of the tracks. Special attention was given to refurbishment methods for turnouts and rails in curves.

SP3 Design & Implementation of Solutions at Test Sites

Considering the results obtained in the other SPs, this SP was to design solutions for specific topics. These had to be validated in the networks of ten end-users.

SP4 Life Cycle Cost (LCC) Calculation

SP4 was to result in a controlled methodology to assess the life cycle cost benefits of innovative technological solutions and facilitate joint development between network operators/infrastructure managers and the supply industry.

ERRAC *European Rail Research Advisory Council*

URBAN TRACK: Background

Project description *(cont.)*

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European Rail Research Advisory Council

URBAN TRACK: Background

Project description *(cont.)*

SP5 Functional Requirements

SP1 and SP2 focused on a specific area: either new track construction, track renewal or maintenance. The purpose of SP5 was to identify where the axes are for improvement and for further development of track components, construction methodology and system design. Another objective was to set the basis for further evaluation of these improvements and development that would result from SP1 and SP2.

SP6 Consolidation & Dissemination

All project results (deliverables) were to be consolidated by the project co-ordinator in close collaboration with UITP and a group of network operators (not partners in the project). Dissemination would mainly be ensured by UITP (infra managers), UNIFE (industry) and the partners themselves.

SP7 Management & Project Coordination

The project management was ensured by D2S International, assisted by APT for the administrative management of the project.

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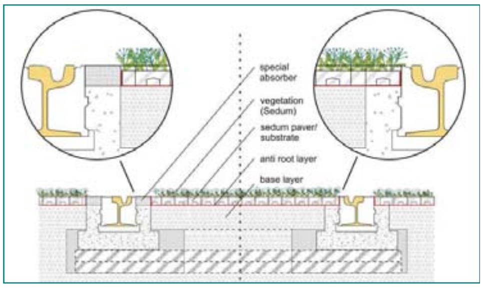
URBAN TRACK: Background

Results and achievements

1. Green Tram Tracks – Implementation of Vegetation Systems In Tram Tracks



Installation on test site Brussels
(left – artificial grass for comparison, right – concrete drain)

Track design

- *Noise reduction*
- *Waterbalance*
- *Optic, habitat*
- *LCC reduction*

Sedum track

- *Left: Berlin, Prenzlauer Allee, 2009*
- *Right: Chemnitz, Goetheplatz*

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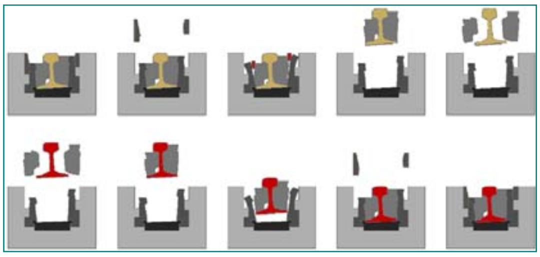
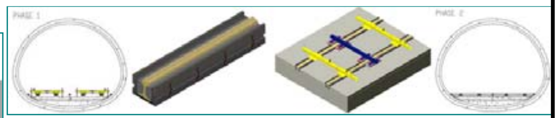
URBAN TRACK: Background

Results and achievements (cont.)

2. REMS: Removable Embedded Rail System for Metro in Tunnel



REMS rail replacement concept using keys



REMS top down installation concept using gauge frames

REMS installation in a tunnel of the Madrid metro network

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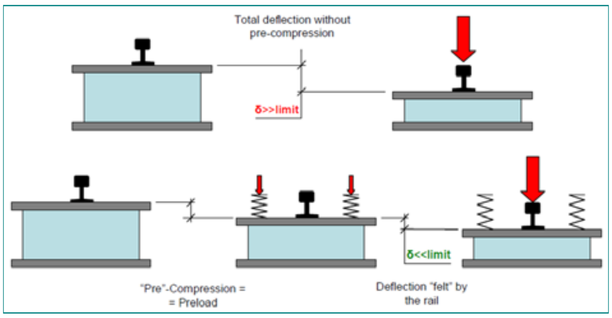
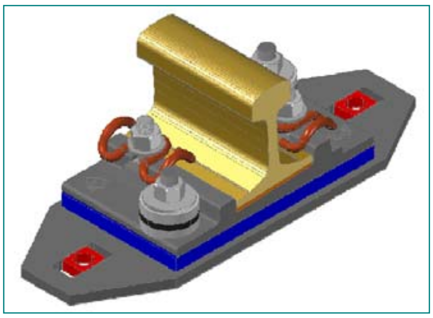
URBAN TRACK: Background

Results and achievements (cont.)

3. CDM-Elastiplus: Resilient Fastener as an Alternative to Floating Slab Systems and as a Solution to Excessive Rail Corrugation



CDM-Elastiplus working principle



CDM-Elastiplus device

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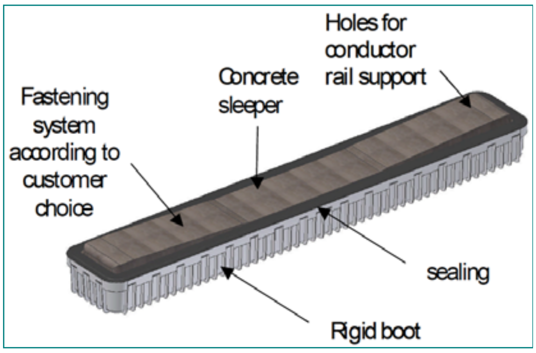
URBAN TRACK: Background

Results and achievements (cont.)

4. Alternative to Floating Track Slab With High Attenuation Sleeper



3D-view of the monobloc sleeper

Validation on site
(construction phase after concreting of foundation)

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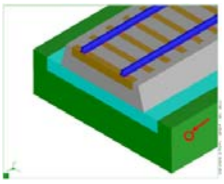
URBAN TRACK: Background

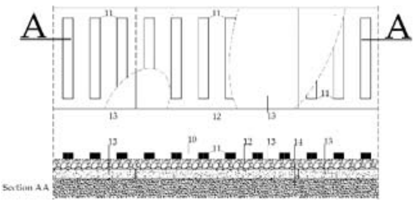
Results and achievements (cont.)

5. APT-FST: Alternatives for Floating Slab at Grade

Schematic view:



a. Integration of the load distribution plates in the track structure



b. Installation of the slabs under ballasted track

Installation of the demonstrator (location: „Rue du Chateau d'Or" in Brusselss)

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URBAN TRACK: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation

UITP [YA] / general	MDM [FFE] / re. REMS	MTB [FFE] / re. CDM-Elastiplus
YES (details in the table on slide 23)	NO	NO

2. Is new legislation and standardization based on findings from this research project

UITP [YA] / general	MDM [FFE] / re. REMS	MTB [FFE] / re. CDM-Elastiplus
YES, contribution to: EN 13146-1 to -9 in coordination with EN 13848-1 to -6, EN 13230-1 to -5, EN 13231-1 to -3, EN 13232-1 to -9, EN 13481-1 to -8, EN 13803-1 & -2, EN 14587-1 to -3, EN 14730-1 & 2, EN 14811, EN 15594	NO	NO

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URBAN TRACK: Evaluation

3. Are the results of the project implemented across Europe or only in a small number of Member States

UITP [YA] / general	MDM [FFE] / re. REMS	MTB [FFE] / re. CDM-Elastiplus
YES (details in the table on slide 23)	NO, the REMS pilot was implemented in Madrid only	NO, the Elastiplus fastener was not implemented.

4. Are the results of the project implemented outside Europe before being accepted in Europe

UITP [YA] / general	MDM [FFE] / re. REMS	MTB [FFE] / re. CDM-Elastiplus
YES (details in the table on slide 23) ???	NO	NO

5. Did the project increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design

UITP [YA] / general	MDM [FFE] / re. REMS	MTB [FFE] / re. CDM-Elastiplus
One can hope so…	YES, due to its novel features and satisfactory results.	We don’t have information on this.

European Rail Research Advisory Council

URBAN TRACK: Evaluation

6. Did the project increase competitiveness of the railway transportation compared to other transport modes

UITP [YA] / general	MDM [FFE] / re. REMS	MTB [FFE] / re. CDM-Elastiplus
One can hope so…	It helps to improve maintenance, but NOT enough to have a real impact on competiveness.	We don't know. It seems that the developments related to trams and light rail may be interesting, but TMB was not directly involved in those parts of the project.

7. Are the results of the project taken into consideration when preparing public tenders

UITP [YA] / general	MDM [FFE] / re. REMS	MTB [FFE] / re. CDM-Elastiplus
One can hope so…	NO	NO

8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability

UITP [YA] / general	MDM [FFE] / re. REMS	MTB [FFE] / re. CDM-Elastiplus
N/A (urban rail)	NO, it is a standard system independent of interoperability problems.	N/A (urban rail)

European Rail Research Advisory Council

URBAN TRACK: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality

UITP [YA] / general	MDM [FFE] / re. REMS	MTB [FFE] / re. CDM-Elastiplus
N/A	NO, it is not relevant to intermodality problems.	NO

10. Can benefits be assessed in financial terms

UITP [YA] / general	MDM [FFE] / re. REMS	MTB [FFE] / re. CDM-Elastiplus
One can hope so…	Perhaps in relation to maintenance costs	NO

European Rail Research Advisory Council

URBAN TRACK: Evaluation

11. Applicability of results to future scenarios

UITP [YA] / general	MDM [FFE] / re. REMS	MTB [FFE] / re. CDM-Elastiplus
YES	YES	It is always possible to learn something. Solution number 3 (fastener) didn't function, but the work undertaken was useful to detect what was not functioning and learn from it. Without being directly involved in the activities related to trams and light rail during the project, it seems that part of the developments related to them may be interesting. In future renovations of TMB tram infrastructure, URBANTRACK information will be used as an input.

12. Usefulness of research procedures for future projects (incl. modelling)

UITP [YA] / general	MDM [FFE] / re. REMS	MTB [FFE] / re. CDM-Elastiplus
YES (see LCC model)	YES	

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URBAN TRACK: Evaluation (summary from UITP / YAs)

Product	Validation	Results of Validation
Track installation and renewal	25 % LCC reduction	Achieved with few exceptions
LCC Model	On the various project track systems	A generally accepted LCC model
	Comparison with INNOTRACK	
On-line LCC Calculation Tool		Fully operational
Socio Econmomic CBFA Model	On the various installation sites	A generally accepted LCC model
Socio Economic cost calculation tool integrated into LCC tool		Fully operational
REMS	Validated at MDM	MDM considers it their development
Thin foundation plates	Validated at STIB	Plate resonance frequency must be tuned to vehicle track frequency
Frictionless booted sleeper	Validated in Manilla	Constant track modulus and reduced impact on viaducts
CDM-Elastiplus	Homologated under heavy rail conditions	Ready for commercial installation in Spain
Appitrack	Automated installtion of metro track on plinths - tangent & curved	Installation successful
Prefabricated FST	Proven constructability	Optimisation with softer mat defined
Tram track replacement	Validation in Bremen	Double what was previously possible
Tram track replacement	Validation Karlsruhe	Complete track and street available after one long weekend
Track standards manual	Discussed with operators	Available on website of UITP
Track maintenance manual	Discussed with operators	Available on website of UITP
Predictive maintenance	Test case at RATP	Implemented at RATP
Methodology to evaluate lubrication	Test case at RATP	Implemented at RATP
Low cost monitoring system	Validated in Manilla	Commercially available

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European Rail Research Advisory Council

MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- To make it more competitive
- To foster increased innovation
- To guide research efforts at the European level

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
- Ensure a strategic approach to the prioritisation of rail research

Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
- To ensure that the results of previous rail research can be taken into account for future projects
- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

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European Rail Research Advisory Council

ERRAC Project Evaluation Group

MODTRAIN

EVALUATION FROM 10th March 2016

Project acronym: MODTRAIN
FP: FP6
Programme acronym: SUSTDEV
Project Reference: 506652
Call identifier: FP6-2002-TRANSPORT-1
Total Cost: € 30,310,182
EU Contribution: € 16,860,000
Timescale: February 2004- April 2008
Project Coordinator: Antoine LORAILLÈRE (UNIFE)

Web references: http://www.modtrain.com/

- ❑ Presented by: Cristian Ulianov
- ❑ Date evaluation: 10/03/2016
- ❑ Market uptake: STRONG
- ❑ Follow up projects: MODBRAKE
- ❑ Other related Projects:

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European Rail Research Advisory Council

MODTRAIN
Innovative modular vehicle concepts for an integrated European railway system

Premise:

One of the policies proposed by the European Commission in its 2001 White Paper 'European Transport Policy for 2010: time to decide' was to shift the balance between modes of transport by 2010 by revitalising the railways. For railways, the goal for 2010 was to maintain the modal share of rail transport at the same level as that in 1998. Rail transport was thus expected to grow significantly as the total transport demand in 2010 was expected to be 40% higher than in 1998. In its White Paper, the Commission also announced its intention to table a set of new proposals to improve access to the railway network for freight transport and to amend existing directives on the interoperability of conventional rail systems and high-speed rail systems, as well as a proposal to create a European Railway Safety and Interoperability Agency.
To meet these objectives, ***affordable and attractive interoperable rolling stock*** must become the norm for use on European networks.

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European Rail Research Advisory Council

MODTRAIN
Innovative modular vehicle concepts for an integrated European railway system

Rationale:

•To avoid the risk of each new train being the subject of independent interpretations of the requirements and built from unproven prototype sub-assemblies **interoperable constituents** must be defined, validated and promoted at European industry level. That's why, the main European railways systems manufacturers (ANSALDOBREDA, ALSTOM, SIEMENS and BOMBARDIER), sub-systems suppliers (KNORR-BREMSE, DEUTA WERKE, LUCCHINI, etc.) railways operators (SNCF, DB, FS) and Professional associations as UNIFE, UIC, VBD, FIF, ANIE and RIA have decided to join their efforts with high skilled research centres to reach this objective.

•Initially, the MODTRAIN studies should have concentrated on fixed formation passenger trains and Universal Locomotives capable of 200 km/h and more, but as work advanced it was hoped to extend this scope to embrace all rolling stock likely to operate over the high speed and conventional interoperable networks.

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European Rail Research Advisory Council

MODTRAIN
Innovative modular vehicle concepts for an integrated European railway system

Rationale:

•As a starting point the MODTRAIN Integrated Project was to define and prove the necessary functional, electrical and mechanical interfaces, and validation procedures necessary to deliver the range of interchangeable modules that will make the next generation of inter-city trains and universal locomotives possible.

•The principal elements to be defined in the MODTRAIN Integrated Project using end-users requirements and validation (via the MODUSER platform) were:

- the running gear (MODBOGIE)
- the train control architecture (MODCONTROL)
- the on-board power systems (MODPOWER)
- the man-machine and train-to-train Interfaces (MODLINK).

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European Rail Research Advisory Council

MODTRAIN
Innovative modular vehicle concepts for an integrated European railway system

Main Objectives:

To fulfil the objectives defined in the ERRAC agenda and in the two European railways packages, the MODTRAIN consortium proposed to carry out the R&D activities to help achieve the following targets:

1) **A reduction of up to 10% in average cost per passenger per km (pkm) /tons per km (tkm)**

2) **30% increase in the productivity of the new rolling stock and an increase of the percentage of service proven components built into 40-50% closer to the 80-90% found in the aerospace and automotive industries.**

3) **A marked reduction in bidding costs (estimated at up to 25% at the end of the process) due to increased modularisation of train architecture.**

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European Rail Research Advisory Council

MODTRAIN
Innovative modular vehicle concepts for an integrated European railway system

Main Objectives (continued):

4) Foster platform-based production patterns to be combined with a decrease (estimated at 10%) in manufacturing costs and a reduction in the time-to-market (estimated at 30%).

5) Improving the reliability may by up to 25% and maintenance costs be reduced by up to 30%.

6) Increased daily utilisation factors for the rolling stock up to 99%. These are cost reductions that can tip the competitive balance decisively in favour of rail-based systems and deliver first class time-to-market services.

7) Enable the passenger to choose and have confidence in travelling by rail in a stress free environment. That's why the passenger needs will be integrated at design stage of the new systems.

European Rail Research Advisory Council

MODTRAIN
Innovative modular vehicle concepts for an integrated European railway system

Specific Objectives:

❖ **MODBOGIE**

- ✓ Reduction of manufacturing cost and economies of scale (standardisation and harmonisation process)
- ✓ Reduction of environmental impact and maintenance costs
- ✓ Improvement of existing standards
- ✓ Improvement in the approach for bogie verification and design
- ✓ Improvement of Rolling Stock performances

MODTRAIN
Innovative modular vehicle concepts for an integrated European railway system

Specific Objectives:

- **MODCONTROL**
  - ✓ To achieve true interoperability while reducing vehicle system complexity, subsystem interfaces with the TCMS must be radically redesigned and standardised, focussing on independence from technology dependant low-level interfaces.
  - ✓ To elaborate 'Functional Requirements Specification' and 'System Requirements Specification' for the Train Control and Monitoring System (TCMS) for High Speed and conventional Rolling Stock products.
  - ✓ To design a core TCMS that meets the above requirements in order to demonstrate its feasibility.

MODTRAIN
Innovative modular vehicle concepts for an integrated European railway system

Specific Objectives:

- **MODPOWER**
  - ✓ To define which characteristics and specific components of the product can be common to the overall application field, saving main design parameters and interfaces and which others must be specifically designed for a single application.
  - ✓ To select specific applications to develop and demonstrate fully functional power supplies, based on harmonised requirements and optimised on a 'Virtual On-Board Power Network' simulator specially developed for this project.
  - ✓ Improvement of system performance & Simplification of system integration
  - ✓ Increase of system availability and reliability & Reduction purchase and operational cost

European Rail Research Advisory Council

MODTRAIN
Innovative modular vehicle concepts for an integrated European railway system

Specific Objectives:

- **MODLINK**
  - ✓ To select specific applications to develop fully functional cabs, door assemblies and train crew panels to encourage the development of advanced technological solutions
  - ✓ To demonstrate the successful interoperation of locomotives and/or multiple unit stock relying on innovative electromechanical, radio-magnetic or optical links (some of them being developed under EU (EDIP) or national programmes (FEBIS/ELIS) combined with well tried and tested physical couplers.
  - ✓ To define standard test plans for acceptance and validation of the project and the product, selecting the most appropriate hardware and software tools.

European Rail Research Advisory Council

MODTRAIN
Innovative modular vehicle concepts for an integrated European railway system

Specific Objectives:

- **MODBRAKE**
  - ✓ Specification of the brake system modules, considering modularisation at different levels of the rolling stock architecture
  - ✓ Elaboration of functional concepts for brake modules, including their interfaces with other subsystems Specification of validation/assessment and maintenance processes in accordance with inspection/test criteria for safety and reliability
  - ✓ Development/improvement of a tool for the evaluation of brake modules' life-cycle costs Submission of proposals to standardisation bodies concerning brake requirements for future standardisation or standards to be updated
  - ✓ Exemplary implementation of specification results for brake control and bogie equipment, application of the test specifications.

European Rail Research Advisory Council

MODTRAIN: Background

Details

- FP FB6
- Project Reference 506652
- Total Cost: € 30,310,180
- EU Contribution: € 16,860,000
- Timescale: February 2004 to April 2008
- Project Coordinator: Antoine LORAILLÈRE (UNIFE)

European Rail Research Advisory Council

MODTRAIN: Background

Partners

- ALSTOM TRANSPORT SA France;
- BOMBARDIER TRANSPORTATION (HOLDINGS) GERMANY GMBH Germany ;
- SIEMENS AG TRANSPORTATION SYSTEMS Germany ;
- UNION INTERNATIONALE DES CHEMINS DE FER France;
- ABB SCHWEIZ AG Switzerland;
- FRA SYSTEM SPA Italy;
- FRENSISTEMI SR Italy;
- KMT-GROUP OY Finland;
- KNORR-BREMSE SYSTEME FUR SCHIENENFAHRZEUGE GMBH Germany;
- DYNAMICS, STRUCTURES & SYSTEMS Int. Belgium;
- LUCCHINI SIDERMECCANICA SPA Italy;
- POLITECNICO DI MILANO Italy;
- UNIVERSITA DEGLI STUDI DI FIRENZE Italy;
- TECHNISCHER UBERWACHUNGS-VEREIN NORD E.V. Germany;
- FRAUNHOFER GESELLSCHAFT ZUR FORDERUNG
- UNIVERSITY OF NEWCASTLE UK;
- TECHNICAL UNIVERSITY OF BERLIN Germany;
- INSTITUT FUR ARBEITS-UND SOZIALHYGIENE SIFTUNG Germany;
- VIENNA UNIVERSITY OF TECHNOLOGY Austria;
- UNIVERSITAT POLITECNICA DE CATALUNYA Spain;
- RAILWAY INDUSTRY ASSOCIATION UK;
- FEDERATION DES INDUSTRIES FERROVIAIRES France;
- ASSOCIATION OF RAILROAD INDUSTRY IN GERMANY Germany;
- ANIE FEDERATION Italy;
- GEIE France;
- INSTITUTO SUPERIOR TECNICO Portugal;
- KNORR BREMSE GMBH Austria;
- LUMIKKO OY Finland;
- DEUTSCHE BAHN AG Germany,
- TRENITALIA S.P.A. Italy;
- SOCIETE NATIONALE DES CHEMINS DE FER France;
- ALMA CONSULTING GROUP SA France;
- ANSALDOBREDA S.P.A. Italy;
- D'APPOLONIA SPA Italy;

European Rail Research Advisory Council

MODTRAIN: Background

Partners interviewed:

Organisation	Name of interviewee	Country
UNIFE	☑ Eric FONTANEL	Belgium
Bombardier / FAV	☑ Dan OTTEBORN	Germany
UNEW	☑ Mark ROBINSON	

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European Rail Research Advisory Council

MODTRAIN: Background

Project description:

- MODTRAIN was a large Integrated Project (IP) aimed at defining the necessary functional, electrical and mechanical interfaces and validation procedures to deliver the range of interchangeable modules, which will form the basis for the next generation of intercity trains and universal locomotives.
- The concept of modularity aimed to create economic advantages both for railway suppliers and operators, such as reduced manufacturing cost and economies of scale, increased productivity of new rolling stock as well as increased reliability founded on a rise in proportion of service-proven components in new rolling stock designs.
- Together with the technical solutions, these fulfilled the objectives of increased railway competitiveness and interoperability defined in the agenda for the European Rail Research Advisory Council (ERRAC) and in the First and Second Railway Packages enacted by European Union legislation.
- As a starting point, MODTRAIN concentrated on fixed-formation passenger trains and universal locomotives capable of 200 km/h or more.
  The main outputs of the MODTRAIN project are related to standardisation.

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European Rail Research Advisory Council

MODTRAIN: Background

Project description:

- MOD The principal elements to be defined in the MODTRAIN Integrated Project using end-users requirements and validation (via the *MODUSER platform*) are:
  - *(MODBOGIE)*
  - *(MODCONTROL)*
  - *(MODPOWER)*
  - *(MODLINK)*

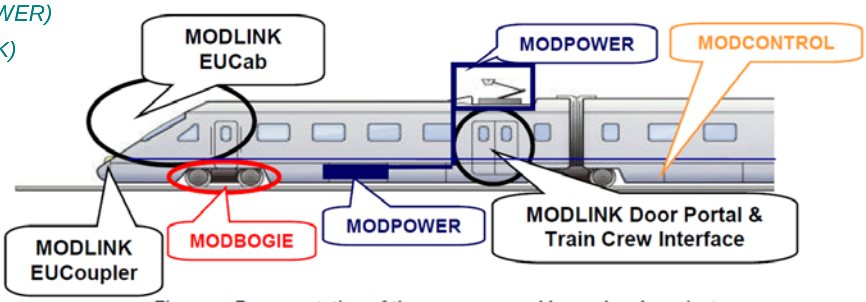

Figure : Representation of the areas covered by each sub-project

European Rail Research Advisory Council

MODTRAIN: Background

Project description:

MODTRAIN scope

The scientific and technical objectives for each sub-project are:

MOD BOGIE

- Development of a "VIRTUAL" motorised bogie and its demonstration to prove effective standardisation of functional modules and their interfaces

MOD CONTROL

- Elaboration of a generic Functional and System Requirements Specification for a new generation of on-board Train Control
- Standardisation of functional interfaces between TCMS communication networks and key vehicle modules.
- Design, simulation and validation of a generic core TCMS system ,with integration of the simulated system on a test-bench simulating the other subsystems.
- Requirements Specification for next generation on-board train communication system..

ERRAC *European Rail Research Advisory Council*

MODTRAIN: Background

Project description:

MOD POWER

- Standardisation of HV, LV and auxiliary power supply systems for high-speed railways.
- Identification and proof of the main design parameters and interfaces to develop fully functional power supply assemblies

MOD LINK

MODLINK 1	MODLINK 2	MODLINK 3
EUCAB	Passenger interfaces	EUCOUPLER

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MODTRAIN: Background

Project description:

- MOD LINK

EUCAB

- Develop and demonstrate the "future European cab“
- Develop and demonstrate of new and improved MMI technologies for the driver
- Develop new methods for vigilance control) and train crew (door activation and passenger information)

Passenger interfaces

- Investigate, develop and demonstrate/test harmonised door modules for passenger trains, passenger information interfaces, access for handicapped passengers, fire protection and evacuation systems

EUCOUPLER

- Investigate, develop, demonstrate/test of new electromechanical and train to train data coupling technologies (Structural, power/service communication).

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Follow-up MODTRAIN: Background

Project description:

MODBRAKE

- ✓ The European MODBRAKE project was set up as an extension of the MODTRAIN project in order to consider as an entire sub-system the brake system of high speed trains and universal locomotives with speeds of over 190km/h.
- ✓ MODBRAKE investigates the potential for standardisation of braking system modules at all levels of the vehicle architecture.
- ✓ MODBRAKE aims to derive frameworks and drafts for future standards, functional specifications, interface definitions and test specifications.
- ✓ MODBRAKE thus contributes to a common understanding of brake-related requirements and will complement standardisation activities in the rail sphere

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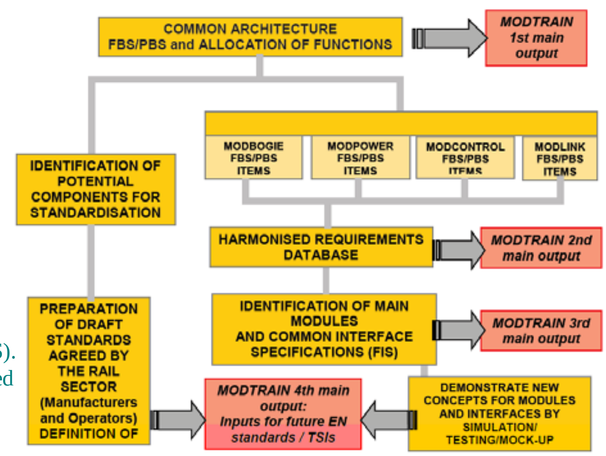
MODTRAIN: Background

Achievements:

MODTRAIN GENERAL ACHIEVMENTS

- The project started by compiling the requirements ensuing from either European legislation (Technical Specifications for Interoperability – TSI), European standards (ENs) or operator standards (Operational Requirements Specifications – UIC Leaflet 612).
- A complete set of Functional & System Requirement Specifications were then developed based on a set of standardised Functional Requirement Specifications (FRS).
- Finally, the main interfaces to be standardised were identified and the related standards drafted.



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MODTRAIN: Background

Achievements:

MODTRAIN GENERAL ACHIEVMENTS

- The commitment of the various partners over the last four years ensured that MODTRAIN successfully achieved its main goal. Some of the project deliverables are now being processed by the European standardisation organisations (CEN / CENELEC) on their way to becoming future European standards (ENs).
- MODTRAIN also paves the way for a new type of cooperation between the various players in the sector. Above and beyond the mandatory requirements defined in European regulations, MODTRAIN proves that voluntary harmonisation is both feasible and contributes to the objectives of greener, safer and faster trains for Europe.

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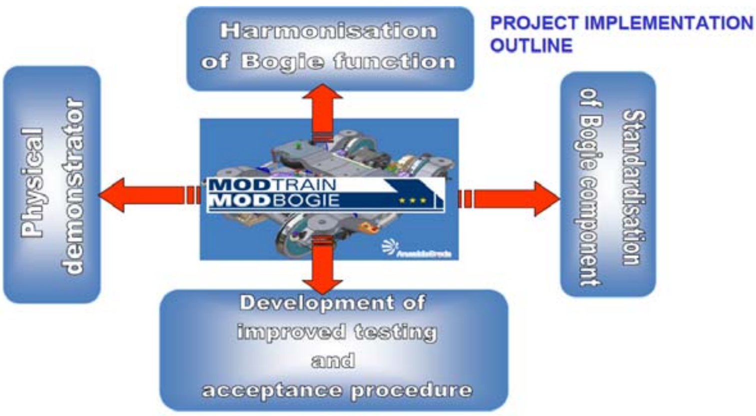
MODTRAIN: Background

Achievements:

- MODBOGIE



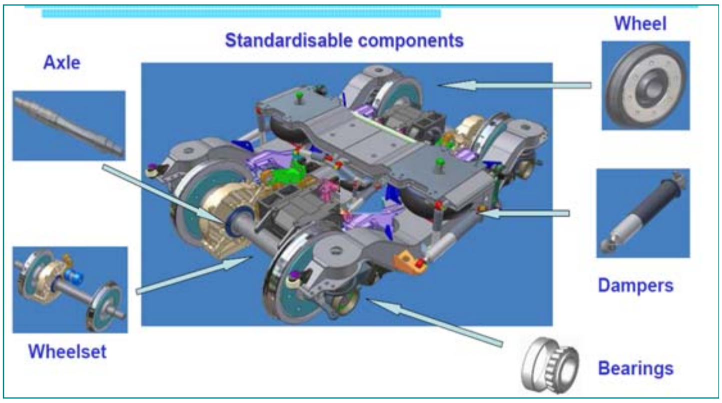
European Rail Research Advisory Council

MODTRAIN: Background

Achievements:

❖ **MODBOGIE**

1) **Producing a standardisation and acceptance procedure for the shown components**



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European Rail Research Advisory Council

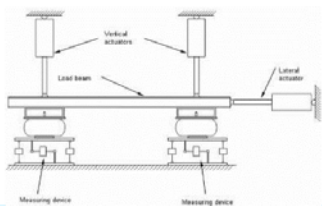
MODTRAIN: Background

Achievements:

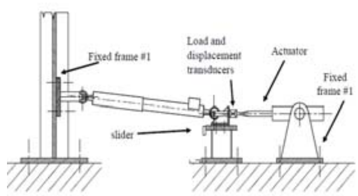
❖ **MODBOGIE**

2) Performing lab tests and demonstration for :

a) Secondary air springs



b) Hydraulic dampers



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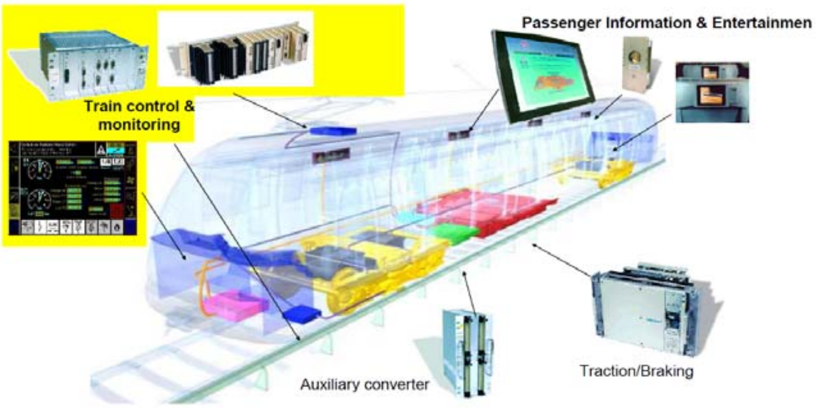
ERRAC European Rail Research Advisory Council

MODTRAIN: Background

Achievements:

- MODCONTROL



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MODTRAIN: Background

Achievements:

- MODCONTROL

STEP 1	MODTRAIN FUNCTIONAL AND HARDWARE ARCHITECTURES FBS/PBS	prEN 15380-4
STEP 2	HARMONISED REQUIREMENTS COLLECTION FUNCTIONS STANDARDISATION (FRS/ORS/SyRS) SAFETY REQUIREMENTS ELABORATION	Common Requirements Database
STEP 3	TCMS SPECIFICATION STANDARDISATION	TCMS Generic specification
STEP 4	DEFINITION OF STANDARDISED INTERFACES FOR THE TRAIN SUB-SYSTEMS	FIS CENELEC TS

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MODTRAIN: Background

Achievements:
❖MODCONTROL

❖MODCONTROL Harmonised requirements
- Harmonisation of requirements was finally achieved after a thorough review process involving industrial partners and Railways Operators.
- Presently, about 5000 requirements are stored in a database, using the powerful Requisite Pro tool. This valuable database is now to be maintained by UNIFE & UIC.

❖ MODCONTROL FRSs
- Provide Diagnostics
- Provide Trainwide Communication
- Manage Train Modes
- Provide operational communication and data transmission to the ground
- Supervise ability of the driver

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MODTRAIN: Background

Achievements:
❖MODCONTROL

❖ **Standardisation of the interfaces with the TCMS for the subsystems of the train**
- Doors (under CENELEC TS approval)
- HVAC (heating, Ventilation and Air Conditioning)
- PIS (Passenger Information System)
- Diagnostics
- Auxiliary
- Battery
- Pantograph (under CENELEC TS approval)
- Bogie
- Traction
- Train modes

❖ **Fault Tree Analysis have been performed for thirty three identified hazards :**

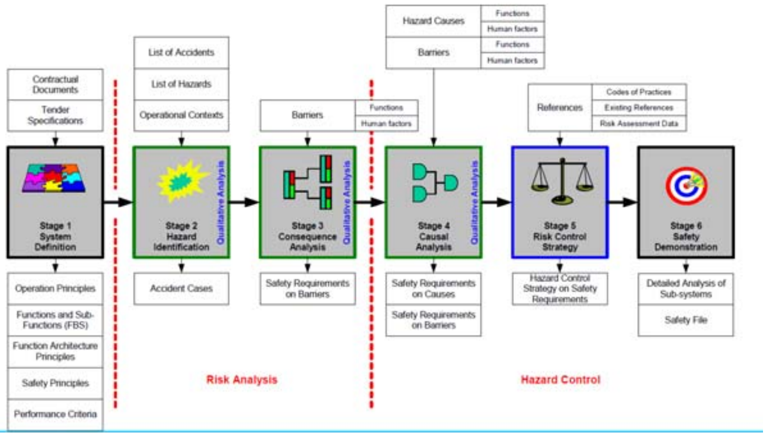
- Unintentional train motion
- Wrong travel direction
- Excessive speed
- Impaired braking
- Excessive jerk

European Rail Research Advisory Council

MODTRAIN: Background

Achievements:
❖MODCONTROL

❖ **Provide safety contribution as follow**



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MODTRAIN: Background

Achievements:
❖MODPOWER




On-board energy supply systems of ***modern reference vehicles*** were analyzed in order to identify ***best practice solutions***.




ERRAC *European Rail Research Advisory Council*

MODTRAIN: Background

Achievements:

❖**MODPOWER**

✓ Target system architectures for power supply systems were developed defining future power train line voltage, shore supply, battery voltage etc.

✓ Developed generic system architectures are based on FRSs and on results from an analysis of realized systems on modern trains and locomotives.

✓ Target system architectures were developed for locomotive-hauled passenger trains and EMUs with distributed as well as concentrated power.

✓ A central VVVF power supply for HVAC units were invented enabling energy cost savings without a significant increase of purchase costs. The supply concept is subject for verification by system simulation as well as launched vehicle test on a modern regional train (SNCF: Z-TER).

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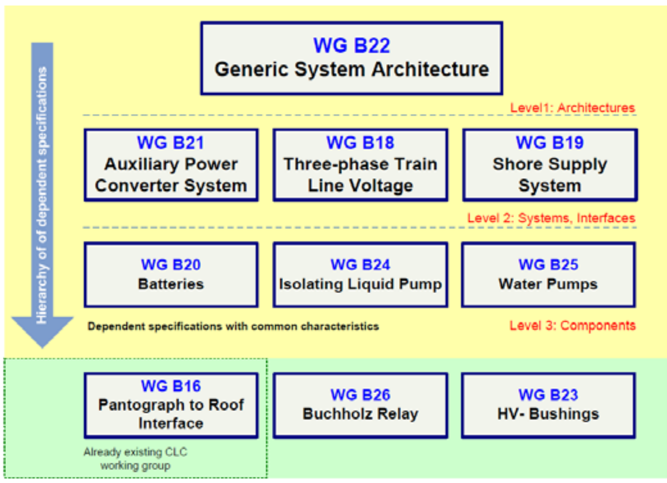
MODTRAIN: Background

Achievements:

❖**MODPOWER**

✓ **Component Standardization have been provided**



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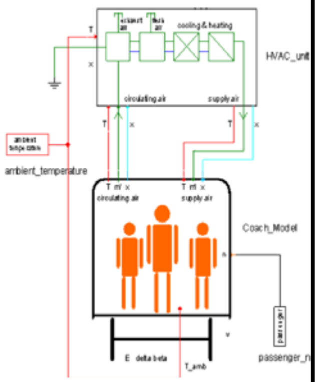
MODTRAIN: Background

Achievements:

MODPOWER

- ✓ **MODPOWER introduced a new simulation method, which allows to simulate complex systems on an operational, behavioural level. This method is based on a standardized modelling language (VHDL-AMS) making verification of requirements in an early project phase possible.**



- ✓ **A library was developed including models for all main functions and components for on board energy supply systems and connected loads:**
  - High voltage components (e.g. Pantograph, MCB, transducers)
  - Line side converter and traction transformer
  - Auxiliary converter and battery system
  - Distribution facility and loads
  - HVAC unit including the electric and thermal operation
  - Thermal coach model

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MODTRAIN: Background

Achievements:

MODPOWER

- ✓ An innovative central variable frequency supply for air-conditioning of coaches was developed and will be tested on a French train (Z-TER)

Examples of installed sensors

Pyranometer, solar radiation

Humidity sensor

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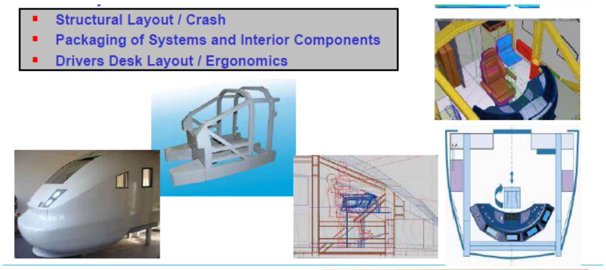
MODTRAIN: Background

Achievements:

❖MODLINK

1) EUCAB



- ✓ Optimised MMI by applying latest knowledge in ergonomics
- ✓ Enhanced functional modularisation
- ✓ Shift of functionalities: from controls to displays
- ✓ Min 15% cut of Life Cycle Costs

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MODTRAIN: Background

Achievements:

❖MODLINK

1) EUCAB

Tests with PRM and reference people
- Elderly people
- Wheelchair users
- Blind and visually impaired people
- Deaf persons
- Parents with small children
- Reference persons without mobility impairments

Scientific evaluation by IAS
- Statistical analysis

Results feed back to
- EN 14752 "Railway applications – body side entrance systems"
- TSI PRM - "Persons with reduced mobility"

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MODTRAIN: Background

Achievements:

❖ **MODLINK**

2) Passenger interface

Overall Goals:

- Standardised solutions
- Ergonomically optimised
- Cost efficiency considered

MODTRAIN: Background

Achievements:

❖ **MODLINK (summary)**

- **Requirements analyses with respect to the Human-machine-Inteface successfully performed for**
  - Drivers Cabin
  - Passenger Entrance region and Vestibule
- **Full scale prototyping of Cab as well as Entrance area and part of Passenger Compartment**
  - Manufacture of tangible Hardware
- **Validation and Testing performed for**
  - Whole Cab (Entering, putting into service, etc)
  - 4 Driver desk variants at Simufer, all “passed”!
  - Entrance area and Passenger Compartment with respect to TSI PRM
- **Follow-up R&D activities envisaged**
  - To consolidate EUPAX results for future TSI PRM upgrade
- **Handing over of results to standardisation bodies**
  - TSI - EN - UIC

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MODTRAIN: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   – Partially (some sub-projects). Where sub-projects managed to arrive at common standards, later design solutions have been based on those. Generally: The more IT related, the poorer the results

2. Is new legislation and standardization based on findings from this research project
   – A number of TSI and EN requirements are based on findings of MODTRAIN

3. Are the results of the project implemented across Europe or only in a small number of Member States?
   – via TSI and ENs they are implemented across Europe

4. Were the results of the project implemented outside Europe before being accepted in Europe?
   – No. There was some benchmarking with other industrial sectors rather than with other regions than Europe.

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MODTRAIN: Evaluation

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
   – Slightly. Projects in Russia and China resulted in transfer of EU products and standards to those regions. However, there is still big reluctance in EU railway industry to standardise on global scale.
6. Did the project increase competitiveness of railway transportation compared to other transport modes?
   – No, as the scope was limited to High-Speed and the degree of standardisation in aviation has never been achieved in the railway sector. Aviation is for high-speed the main competitor and has significantly reduced costs during the last decade.
7. Are the results of the project taken into consideration when preparing public tenders?
   – As far as standards derived from MODTRAIN are concerned, those standards are referred to in a number of tenders.
8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
   – Definitely yes. The project helped to grow mutual understanding and to find common language for specifications. This was a precondition for common standards.

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MODTRAIN: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?

   – Though intensive benchmarking with other industries, the project results hardly contribute to inter-modality. This is because the inter-modality in high-speed is more on infrastructure side (connecting air-ports with railways) and less on rolling stock.

10. Can benefits be assessed in financial terms?

    – Difficult to say. Economies of scale have not been significantly driven by MODTRAIN. Standards on interiors and cab design may foster accessibility and reduce training time for staff.

11. Applicability of results to future scenarios?

    – Definitely yes for the common requirements database. It was a pity that ERA and especially the EU standardisation organisations (CEN/ CENELEC) had not been ready for cooperation. Managing public technical requirements in a common database is a real booster for innovation and standardisation. It would follow the Wikipedia principle or could even become part of it. Protectionism of administrations is still blocking it.

12. Usefulness of research procedures for future projects (incl. modeling)

    - The above example is extremely useful for fostering sharing and just culture, especially on quality (coherence, 3rd party assessment) of functional requirements

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MODTRAIN: Reasons for outcome

- ✓ Structured process for finding agreements: Partners have been clustered according to common business needs. E.g., railway operators have formed a common operators group and have been obliged to come up with pre-agreed requirements. This accelerated the efficient analysis of requirements and their consolidation. It prevented disturbances and delays.
- ✓ Common requirements database had been the reference tool for all specification processes.

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MODTRAIN: Lessons learnt

- ✓ Integration of MODTRAIN in the railway sector was not sufficient: ERA and EU standardisation organisations acted as consumers of MODTRAIN deliverables but did not take up the innovations in the working methods: resulting in no IT, no public sharing, no management of requirements (still today's situation)
- ✓ Key to success is clear scope and targets **before** starting the project. Due to very diverse expectations from project partners, discussion on way forward consumed nearly one year before technical work started

European Rail Research Advisory Council

MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- To make it more competitive
- To foster increased innovation
- To guide research efforts at the European level

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
- Ensure a strategic approach to the prioritisation of rail research

Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
- To ensure that the results of previous rail research can be taken into account for future projects
- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

ERRAC Project Evaluation Group

LOCOPROL

EVALUATION FROM March 2015

Project acronym:	LOCOPROL
FP:	FP5
Programme acronym:	IST
Project Reference:	IST-2000-28103
Call identifier:	GROWTH - KA3
Total Cost:	€ 7,957,244
EU Contribution:	€ 4,047,467
Timescale:	August 2001- July 2004
Project Coordinator:	Jean Pierre FRANCKART (ALSTOM BELGIUM SA)
Web references:	http//:www......

- ❑ Presented by: Cristian Ulianov
- ❑ Date evaluation: 10/03/2016
- ❑ Market uptake: WEAK
- ❑ Follow up projects: none
- ❑ Other related Projects: SATLOC, SPARTACUS

LOCOPROL

Low Cost Satellite Based Train Location System for Signalling and Train Protection for Low Density Railway Lines

Premise:

•To respond to the demand of the mobility of persons and goods which is constantly growing thorough the world, the guide systems has an important role to play. In Europe, the commission in its white paper "European transport policy for 2010: time to decide" has set up objectives to the railway transport 2020 a doubling of the number of passengers and a tripling of freight volume.

•To reach those ambitious goals, the development and the implementation of innovation is a must not only at the technical level but also at the organizational level. The last years have seen the development of the European signalling system : European Railway Traffic Management System (ERTMS) allowing full interoperability between countries.

•The implementation of ERTMS is starting on trunk lines for which the investment is justified. However, for other lines with less traffic, other cost effective solutions have to be developed to provide the same level of safety for train operations.

•LOCOPROL provides an ideal solution filling the gap between the very low cost traditional solutions characterised by a very poor level of functionality and safety, and the very expensive ETCS based solution adapted for the main lines.

ERRAC European Rail Research Advisory Council

LOCOPROL

Low Cost Satellite Based Train Location System for Signalling and Train Protection for Low Density Railway Lines

Rationale:

•The classical signalling system is based on train detection by the infrastructure complemented, if necessary, by on board equipment and wayside systems. The ERTMS signalling system of control, command and management of trains, allows the interoperability of trains across the borders. ERTMS relies on a digital radio link between the wayside and trains which allow a decrease of on-board equipment and a reduction of the time interval between trains while the communication links uses GSM-R (RAILWAY).

•The LOCOPROL system is based on the adaptation of the most advanced positioning algorithms to the railway needs allowing positioning (CENELEC SIL-4 standard) using the signals provided by the constellation of GPS satellites, GLONASS (Russian equivalent) and EGNOS. The location information are used for safety purposes and train positive detection.

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LOCOPROL

Low Cost Satellite Based Train Location System for Signalling and Train Protection for Low Density Railway Lines

Rationale:

•For these purposes Alstom-transport with its partners has developed LOCOPROL project supported by the European commission developing an innovative low cost signalling system , responding to the functional operational needs and meeting the safety regulations of the medium size railway lines

•LOCOPROL provides an ideal solution filling the gap between the very low cost traditional solutions characterised by a very poor level of functionality and safety, and the very expensive ETCS based solution adapted for the main lines.

•The proposed approach in LOCOPROL is totally different from the recently emerged train-aided satellite location systems. in LOCOPROL the safe location is directly based on satellite signals GPS, EGNOS and future GALILEO on which no specific integrity requirements are imposed. LOCOPROL has shown that there is no necessity to have important investments in GSM-R infrastructure

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LOCOPROL

Low Cost Satellite Based Train Location System for Signalling and Train Protection for Low Density Railway Lines

Main Objectives:

- to define a new multi-technology location system based on satellite positioning combined with fail-safe on-board track mapping and interlocking;
- to study and prove its application to ERTMS/ETCS;
- to study and prove its short term applicability in Low Density Traffic Lines;
- to study its applicability in order to increase track side workers protection;
- to prove that a satellite positioning device may be included or associated with ERTMS equipment taking into account the hardware architecture aspects and the functional compatibility.

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LOCOPROL: Background

Details

- FP FP5
- Project Reference IST-2000-28103
- Total Cost: € 7,957,244
- EU Contribution: € 4,047,467
- Timescale: August 2001- July 2004
- Project Coordinator: Jean Pierre FRANCKART (ALSTOM BELGIUM SA)

Partners

- SOCIETE EXPLOITATION CFTA France;
- RESEAU FERRE DE FRANCE France;
- DR. ING. XIWEN ZHANG, BERATUNG UND PLANUNG IM VERKEHRSWESEN Germany;
- ALSTOM TRANSPORT SPA Italy;
- HONEYWELL REGELSYSTEME GMBH Germany;
- NORTHERN JIAOTONG UNIVERSITY China;
- SOCIETE NATIONALE DES CHEMINS DE FER BELGES – NATIONALE MAATSCHAPPIJ DER BELGISCHE SPOORWEGEN Belgium;
- SEPTENTRIO NV Belgium;
- TRASYS SA Belgium;
- INSTITUT NATIONAL DE RECHERCHE SUR LES TRANSPORTS ET LEUR SECURITE France;
- EUROPEAN ROAD TRANSPORT TELEMATICS IMPLEMENTATION COORDINATION ORGANISATION S.C.R.L. Belgium;

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LOCOPROL: Background

Partners interviewed:

Organisation	Name of interviewee	Country
Bombardier/chair UNISIG	☑ Dan Otteborn	Sweden

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LOCOPROL: Background

Project description:

- The development process for the LOCOPROL project was slightly different from a pure top down approach. The reasons to do so were the following:
  - ✓ the main objective of the project focused on the development of new sub-systems with reference
  - ✓ to a complete signalling system o the aim of the project was to validate the system principle as well as the application engineering guidelines from a safety point of view but not to validate the sub-systems or components.
  - ✓ o the project reused existing sub systems or modules already developed e.g. ERTMS components o this procedure shortens the duration of the whole process.

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LOCOPROL: Background

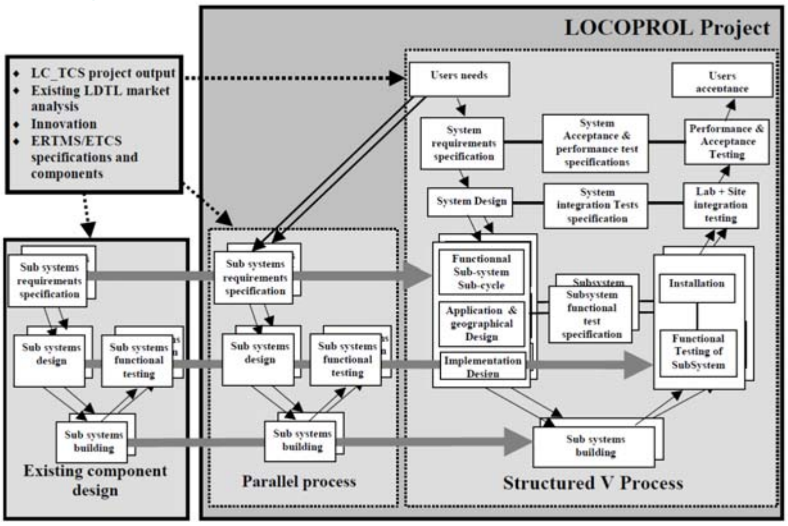
Project description:

- The already existing processes, performed in the frame of former projects. It is applicable to the component that do already exist and that has been used in our "new" system.
- The parallel process, performed in the frame of the project. It is applicable to sub systems for which the development work may start at an earlier time of the project with minimum risks, without waiting for the time were it should start according to a pure top down approach. The main aim for having this kind of process is to shorten the duration of the project. It is usually possible to do it with a minimum of risk on the basis of the company experience in the domain of application or on the basis of preliminary (not formal) studies already performed.
- The third process, also performed in the frame of the project, is the "well known" formal top down process that has to be performed in any case to be compliant with CENELEC standards. During this last process, all the work performed using one of the two other processes has to be validated based on the results of the top-down system formal approach. Discrepancies that are detected during this check point process are fed through to all lower level design phases that have already been performed. When there are such divergences, corrective actions have to be performed to put in conformity all the outputs of the two "early" processes.

![ERRAC] *European Rail Research Advisory Council*

LOCOPROL: Background

Project description:



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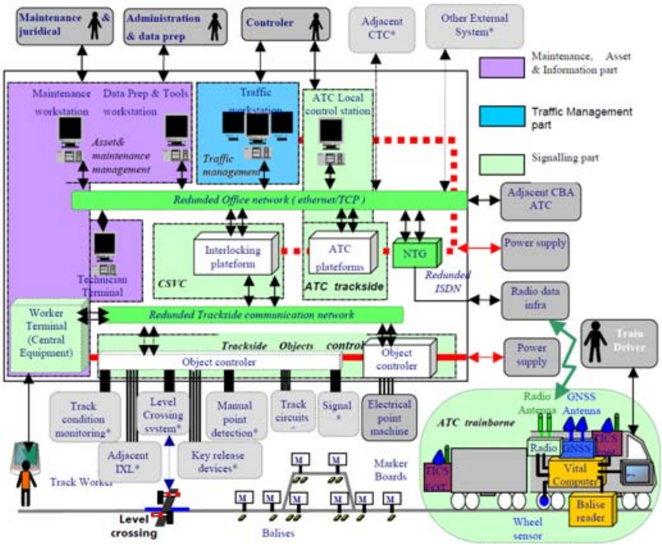
LOCOPROL: Background

Project description:

The LOCOPROL system (maximum concept) is presented in the Figure



LOCOPROL: Background

Project description:

WP1

Objectives:

- to provide sound internal project management with an efficient interface to Commission services
- to ensure that the project was capable of reaching its objectives.
- to deliver the day-to-day management was undertaken by a Project Co-ordinator who was assisted by the Project Management Group
- formulating of recommendations about the project as necessary. Taking into account the complexity of the project

WP2

Objectives:

- to set up to define and investigate the system functionality, performances (including the RAMS aspects), degraded situation from an operational point of view, end user interface and other users specific constraints based on a user point of view.
- to provided the LOCOPROL project with a unique set of user preferences and needs ensuring the end user a wanted service.
- to define the state of the art in the domain world-wide and in particular an overview of the results of previous and current EU R&D projects related to the LOCOPROL work.

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LOCOPROL: Background

Project description:

WP3

Objectives:

- To determine specification of LOCOPROL system aspects. The system work performed in the frame of this Work package aimed to verify that the requirement for the components.
- to be developed in the frame of the project, working together in a system configuration, will allow this
- to define system to meet the users requirements in terms of performances, degraded situation, end user interface, users functions and other users specific constraints as resulting from the work done in WP2.
- to assure a maximum level of interoperability between the LOCOPROL system components and ERTMS/ETCS equipped vehicles. The “Internal Interfaces specification” ensured that all the interfaces between the different parts and modules of the LOCOPROL system were clearly identified and defined.

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LOCOPROL: Background

Project description:

WP4

Objectives:

- to build/ adapt System modules by using laboratory tests included also tests necessary for verifying the correct integration of the different modules in a full system.
- to prepare the data and the application engineering. The tools necessary for system component tests were developed in such a way that they were reusable for the overall system integration tests.
- to Implement the integrated pilot System. the components developed and tested were implemented in three test sites in order to allow performance, integration and validation testing. Each test site tested and validated different subsets of the LOCOPROL functions and consequently different configurations of LOCOPROL components.

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LOCOPROL: Background

Project description:

WP5

Objective :
to check if:

- The system meets its intended purpose and it conforms to the required standards,
- The safety requirements (safety functions and integrity levels) are set, correct, complete and traceable to hazard and risk analysis
- The system architecture which apportions safety functions between the different sub-systems is adequate,
- The system is required to safety the requirement of SIL 4 and this has been derived from the system safety requirements and system architecture,

WP6

Objectives:

- To evaluate the performance of the different parts of the system and in a later stage the overall system in the different test sites.
- To validate within the context of this project refers primarily to the validation of the system, e.g. the verification of successfully fulfilling the user requirements as expressed in the WP2.
- To determine references and extensive correlation laid between the User Needs, the Validation Requirements, the trial results and the LOCOPROL specifications in order to help prove that the user requirements and associated benefits can be realised in a near-operational environment.

LOCOPROL: Background

Project description:

WP7

Objective :

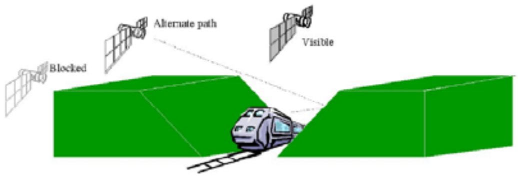
- Dissemination activities played an important role within LOCOPROL and started at an early stage within the project. The dissemination activities involved all partners contributing to the project and include:
  - ✓ to present project results at relevant events (e.g. Concertation Meetings, Conferences, etc.). o to ensure a wide dissemination of the Projects' results through the Web, newsletter, ITS magazines.
  - ✓ to provide a brochure of the Project for a non-technical audience.
  - ✓ to participate in relevant meetings that could help in getting a wider acceptance of the Project results.

LOCOPROL: Background

Achievements:

- **Development of innovative positioning algorithm called "1D Algorithm"**
  - ✓ The positioning algorithm developed in the frame of the LOCOPROL project is based on a principle radically different from the classical GPS location algorithm that is running in anybody's car or PDA. To meet the safety requirements of the railways sector, a new principle has been developed to add redundancy in the measurements and to improve the integrity level of the computed position.
  - ✓ it uses one of the particular characteristics of the rail transport: its one degree of freedom movement. As the track equation is fixed and can be known by the system, the positioning is brought back to a 1D problem.

The algorithm uses several combinations of pairs of satellites, one pair of satellites being able to determine a position locus in the form of a hyperboloid in the space (see figures above). The intersection of this hyperboloid with the track equation can determine a position interval on the track.



States of satellite reception

European Rail Research Advisory Council

LOCOPROL: Background

Achievements:

The LOCOPROL system

After a test period of more than 6 months during which:

- the system components (CSVC, TPC, mini-ATS) mock-ups have been successfully tested
- the complete system has been successfully integrated in laboratory
- the system has been tested and evaluated on site through a significant amount of scenarios
- an evaluation of the system has been performed by the CFTA users
- a live public demonstration of the system has been held,

We can conclude that the objectives of the LOCOPROL project have been largely reached. The principles of the LOCOPROL system i.e.:

- the integration of the satellite based positioning
- the positive train detection,
- the token based interlocking,

The LOCOPROL subsystem

Tests have been performed in 2 phases:

- The first phase dedicated to the debugging of the new algorithms and the preliminary test of complete ETCS train borne equipment integrating this new odometry in the so called ETCS level 0. This first phase demonstrated that a failsafe GNSS based positioning subsystem could be integrated into an ETCS equipment without impacting the existing applicative software.

- The second phase confirms the first phase conclusions and extends these positive results to the ETCS level 2 application tested in the CFTA line. The added value of this new odometry has been demonstrated in both test tracks (RFF and CFTA), demonstrating therefore that is possible to locate the train in safety in line sections without the need of balises.

European Rail Research Advisory Council

LOCOPROL: Background

Achievements:

- **A new multi- technology fail safe satellite based train location system based on satellite positioning combined with fail-safe on board track mapping and interlocking**
  - ✓ Safe digital mapping of possible trajectories
  - ✓ Fail-safe positioning using redundant and independent satellite pairs
  - ✓ No integrity requirements are required as the train location is determined by GPS,EGNOS and future GALILEO

- **A new control & command system including a token-based simplified interlocking system and positive train detection**
  - ✓ Establish different ways to transmit the data between moving trains
  - ✓ Reducing the equipment cost as well as the operational cost
  - ✓ For typical LDTL lines it was shown that important investment in GSM-R infrastructure is not necessary

European Rail Research Advisory Council

LOCOPROL: Background

Achievements:

- **Development of an innovative system with high interoperability with ERTMS and integration of satellite based odometry in ERTMS/ETCS on board architecture**
  - ✓ The project has proven that it is possible to integrate LOCOPROL satellite based location and speed calculation module into ERTMS/ETCS on board
  - ✓ Substitution of high cost classical odometry by much cheaper LOCOPROL satellite based module even on high density lines

- **Performing on site experimentation**
  - ✓ It was shown that for sites with low traffic, it is possible to reduce the level of availability and accuracy, without reducing the level of safety, and so work with less costly technologies meeting the general aim of LOCOPROL project for reduction of total cost
  - ✓ 3 track test has been performed to test the functionality of the developed systems namely in:
    1) Belgian test track
    2) RFF test track
    3) CFTA test track

European Rail Research Advisory Council

LOCOPROL: Background

Achievements:

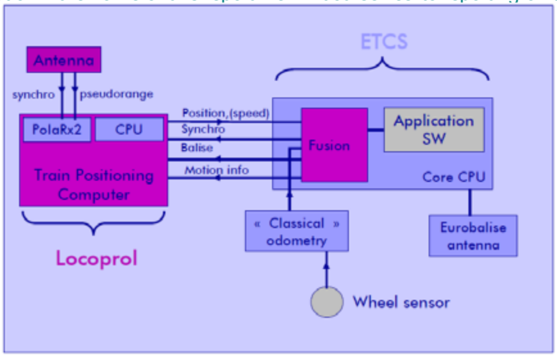
- **Improving the safety assessments**
  - ✓ The safety level targeted with the overall LOCOPROL system is 10^-9/h (wrong side failure per hour) and the one for the positioning sub system is about 6.10^11/h.
  - ✓ The safety evaluation team came to the conclusion that the safety objectives as set in the preliminary safety case for the overall tolerable hazard rate (10-9/h) and the one for positioning (6.10-11/h) are consistent with the French GAME (overall at least equivalent) principle in use in French railways (official proof still to be provided).
  - ✓ According to the hazard identification performed and the proposed mitigation to reduce failure risks, the preliminary safety case gives good hope that the satellite measurement process for train positioning using 6 satellites (3 independent pairs) or using 4 satellites (6 dependent pairs) will achieve the 6.10-11/h objective and the SIL4 requirements.
  - ✓ The LOCOPROL safety evaluation team also validated the fact that the use of at least passive eurobalises is necessary to mitigate the risk during train position initialisation, but also at singular locations such as points or in the vicinity of stations in order to counter the lack of accuracy of the satellite train positioning.

European Rail Research Advisory Council

LOCOPROL: Background

Achievements:

- **Testing and validation of the use of satellite positioning in an ERTMS architecture**
  - ✓ The validation of Train borne architecture by A large number of test that have been done on separate modules as well as on the integrated system. These tests included laboratory tests as well as simulations, dynamic as well as static. In the frame of this report we limit ourselves to reporting on the dynamic overall results.



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European Rail Research Advisory Council

LOCOPROL: Background

Achievements:

- **A new sensor configuration has been implemented and successfully tested in test tracks**
  - ✓ This new train borne sensor configuration point out the added value of the introduction of the satellite based positioning.
  - ✓ This new sensor allows a reduction of the amount of sensors compared to what is classically used today, and particularly the very expensive one in terms of Life cycle cost.
  - ✓ It has been demonstrated that the combination of wheel sensors and GNSS sensor associated to the 1D algorithm developed in the frame of the project allows a level of performance at least compatible with LDTL requirements at a significantly reduced Life Cycle Cost.

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ERRAC *European Rail Research Advisory Council*

LOCOPROL: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   – Not to my knowledge, I have been deeply involved in the development and commercialisation of ERTMS during 20 years and no attempt to officially include LOCOPROL technologies have been made. (DO)
2. Is new legislation and standardization based on findings from this research project
   – No legislation or standard originates from this project (DO)
3. Are the results of the project implemented across Europe or only in a small number of Member States?
   - No implementation in Europe known (DO)
4. Were the results of the project implemented outside Europe before being accepted in Europe?
   – It is possible that some implementation has occurred outside Europe (DO)

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ERRAC *European Rail Research Advisory Council*

LOCOPROL: Evaluation

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
   - No if anything it is only benefitting Alstom no other manufacturer has adopted this technology (DO)
6. Did the project increase competitiveness of railway transportation compared to other transport modes?
   - No (DO)
7. Are the results of the project taken into consideration when preparing public tenders?
   - No (DO)
8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
   - No as no other supplier offers this technology – it would be against the interoperability concept (DO)

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ERRAC *European Rail Research Advisory Council*

LOCOPROL: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
   - No (DO)
10. Can benefits be assessed in financial terms?
    - No (DO)
11. Applicability of results to future scenarios?
    - Possibly, as known the ongoing satellite – project are struggling with the issue of satellite applications in the rail field
12. Usefulness of research procedures for future projects (incl. modeling)
    - Possibly , see above

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ERRAC *European Rail Research Advisory Council*

LOCOPROL: Reasons for outcome

✓ A single source, supply, system could not be accepted and integrated in the much larger ERTMS world.

✓ Same technical problem with satellite navigation in railway still remains as seen in other projects.

✓ There were no common system requirements in the rail community.

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LOCOPROL: Lessons learnt

- ✓ The project was initiated in a period where several manufacturers were trying to grab an initiative and advantages over other suppliers. This probably explain why no other supplier was involved. However as the standard ERTMS evolved as the European standard system by law private isolated initiative could not make their way

- ✓ The real possibility to put forward a single source system was overestimated.

ERRAC European Rail Research Advisory Council

ERRAC *European Rail Research Advisory Council*

MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- To make it more competitive
- To foster increased innovation
- To guide research efforts at the European level

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
- Ensure a strategic approach to the prioritisation of rail research

Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
- To ensure that the results of previous rail research can be taken into account for future projects
- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

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ERRAC *European Rail Research Advisory Council*

ERRAC Project Evaluation Group

(WIDEM)

EVALUATION FROM March 2016

Project acronym: WIDEM
FP: FP6
Programme acronym: SUSTDEV
Project Reference: 516196
Call identifier: FP6-2003-TRANSPORT-3
Total Cost: € 3,766,500
EU Contribution: € 1,949,900
Timescale: January 2005- June 2008
Project Coordinator: Steven Cervello (LUCCHINI SIDERMECCANICA SPA)

Web references: http://www.widem.org/

- ❑ **Presented by:** **Cristian Ulianov**
- ❑ **Date evaluation: 10/03/2016**
- ❑ **Market uptake:** STRONG
- ❑ **Follow up projects: EURAXLES**
- ❑ **Other related Projects: Deufraco**

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WIDEM (Wheelset Integrated Design and Effective Maintenance)

Premise:

The economic efficiency and competitiveness of the rail transportation mode depends on safety, availability and maintenance of its individual highly loaded structure components such as railway wheelsets.

The WIDEM project aimed to improve efficiency and competitiveness through a fundamental re-examination of wheelset design, which in turn will facilitate improved maintenance practices. Combining inputs from reliable service measurement of wheel-rail forces carried out by means of an innovative instrumented wheelset and extensive assessment of actual material properties, an original endurance strength design concept was developed and validated through a comprehensive testing programme on full scale wheelset prototypes.

WIDEM (Wheelset Integrated Design and Effective Maintenance)

Rationale:

The idea of starting this project was stimulated by the application of the new European design standards. As the verification of full-scale fatigue limits of wheels and axles becomes mandatory, testing methods and interpretation methods of the results were either not defined or not generally consistent throughout European laboratories.

The technical information that can be found in the new European standards comes from the previous UIC norms: for example, in the case of axles, it is based on the so-called A1N steel grade, which was extensively tested in the 1970s by SNCF laboratories. Over the past years, these norms were proven to be safe when using this kind of steel grade. In the last 20 years, many new vehicles were put into service achieving higher and higher speeds, and vehicle weight reduction became necessary for the majority of European train manufacturers.

European Rail Research Advisory Council

WIDEM
(Wheelset Integrated Design and Effective Maintenance)

Rationale:

In Italy, during the 1980s, the former Fiat Ferroviaria, together with Lucchini, started to use an alloy steel grade (30NiCrMoV12) for the new axle of the first Italian tilting train. In this case, design methods based on the manufacturer's internal experience were used to handle this material and the applied design was proven to be safe by years of service.

The new European standards enable the use of materials different from E1N, but not much of the recently gained experience, and knowledge in using new materials and in designing new advanced vehicles, were considered when writing these norms. For the reasons mentioned above, it becomes difficult for today's designers to define more precise load spectra and material characteristics, which can be accepted by an authority responsible for approving the qualification of a new component.

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European Rail Research Advisory Council

WIDEM
(Wheelset Integrated Design and Effective Maintenance)

Main Objectives:

1. Creation and validation of an innovative and rigorous methodology to design wheelsets
2. Endurance strength design approach for wheels and axles which will lead to an optimisation of wheelset geometry, a reduction of un-sprung masses and an extension of maintenance intervals while meeting increasing safety and service requirements
3. A new wheelset maintenance strategy based on more accurately defined inspection periods through the use of new NDT devices for railway (Compensated Resonance System)
4. Optimise the design and maintenance of wheelsets, to reduce Life Cycle Cost. Wheelset loads will be measured and used to develop design guides for new axles and optimise testing regimes for existing axles
5. The ultimate goal is to increase the competitiveness, capacity and availability of European railway products in the wheelsets area

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European Rail Research Advisory Council

WIDEM: Background

Details

- FP FP6
- Project Reference 516196
- Total Cost: € 3,766,500
- EU Contribution: € 1,949,900
- Timescale: January 2005 - December 2007
- Project Coordinator: Steven Cervello (LUCCHINI SIDERMECCANICA SPA)

Partners

- LUCCHINI SIDERMECCANICA SPA Italy;
- UNION OF EUROPEAN RAILWAY INDUSTRIES Belgium ;
- ALSTOM FERROVIARIA SPA Italy;
- DYNAMIC, STRUCTURE, SYSTEMS INTERNATIONAL Belgium;
- FRAUNHOFER-GESELLSCHAFT ZUR FORDERUNG DER ANGEWANDTEN FORSCHUNG E.V Germany;
- MICROSYSTEMS SRL Italy;
- MALMTRAFIK I KIRUNA AB Sweden;
- POLITECNICO DI MILANO Italy;
- TWI LIMITED United Kingdom;
- CZECH RAILWAYS - RAILWAY RESEARCH INSTITUTE Czech Republic;

European Rail Research Advisory Council

WIDEM: Background

Partners interviewed:

Organisation	Name of interviewee	Country
LUCCHINI	☑ Steven Cervello	Italy
UNIFE	☑ Bernard von Wullerstorff	Belgium

WIDEM: Background

Project description:

The WIDEM project is in principle a re-examination of the basic information necessary to design and validate a railway wheelset and to manage the maintenance parameters that in some way are related its design criteria.

The idea of starting this project was stimulated by:

- ✓ The application of the new European design Standards.
- ✓ The verification of full scale fatigue limits of wheels and axles
- ✓ Testing methods and interpretation methods throughout the European Laboratories.

The technical information that can be found in the new European Standards comes from the previous UIC norms; for example, in the case of axles, is based on the so called A1N steel grade extensively tested in the past 70's by SNCF laboratories. Over the past years these norms were surely proven to be safe when using this kind of steel grade. In the last 20 years many new vehicles were put into service with higher and higher speeds.

WIDEM: Background

Project description:

Vehicle weight reduction, become a must for the majority of the European train manufacturers. Already in the 80's in Italy, the former Fiat Ferroviaria (now part of Alstom Transport) started together with Lucchini to use an alloy steel grade (30NiCrMoV12) for the new axle of the first Italian Tilting Train.

In this case design methods based on the manufacturers' internal experience were used to handle this material. Also in this case the applied design was proven to be safe by years of service. The new European Standards enable the use of materials different from E1N, but not so much of the latest experience and knowledge in using new material and in designing new advanced vehicles was considered when writing these norms.

***For the above mentioned reasons, today, from a formal point of view, it becomes difficult for the designer to define more precise load spectra and material characteristics that can be accepted by an authority responsible to approve the qualification of a new component*.**

European Rail Research Advisory Council

WIDEM: Background

Project description:

- The WIDEM project has developed an innovative measuring wheelset using up-to-date wireless data processing and transmission technology. A dynamic calibration is being carried out by using a unique roller rig on which a running condition near to reality can be performed.
- Test campaign measuring loads on two different kind of vehicles – the high-speed tilting train (the Czech Pendolino from Alstom) and the 30 axle-tonne freight vehicles from MTAB travelling across Sweden.
- Definition of a rigorous methodology to test the fatigue resistance of full-scale axles and wheels.
- Research on fretting fatigue phenomena, which takes place under axle seats, by taking into account seats and section transition geometry, press fi t pressure and axle/hub slip.
- Creation and validation of an innovative methodology to design and validate wheelsets. This methodology is based on load spectra and S-N curve for the material in the fullscale condition.

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European Rail Research Advisory Council

WIDEM: Background

Achievements:

Task 1: The accuracy in measuring the wheel-rail dynamic loads

- Development of an innovative measuring wheelset mad of up to date wireless data processing and transmission technology
- Lucchini and Polimi have developed a new real time measurement methodology of wheel-rail contact forces based on the acquisition of the axle deformations with bandwidth of 70Hz
- Preparing two different instrumented wheelsets calibrated on the Lucchini roller rig BU300. The first wheelset is Alstom Pendolino ETR480 and the second one in a 30ton freight wheelset.

Task 2: Wheel-rail load tests and data collection

- The first instrumented wheelset has been used on Czech Pandolino vehicle and a set of measures have been taken on VUZ railway circuit
- The second instrumented wheelset has been used in Sweden by MTAB heavy haul vehicles from Kiruna to Narwik and the corresponding data set has been taken
- Development of a specific software capable of extracting the data from the measured strains on the axle and calculate the contact forces on the wheel

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European Rail Research Advisory Council

WIDEM: Background

Achievements:

Task 3: Improving flexible multibody models to understand the vehicle track interaction

- Polimi developed a flexible multibody model taking into account the deformability of the wheelset, bogies and car bodies
- Validation of the developed model through the measurements performed in the two test campaigns

Task 4: Assessment of material properties

- Defining precise procedure to perform full scale fatigue tests on wheels and axles
- Full scale test were brought in Lucchini test rigs to find fatigue limit at 10 million cycles for different diameter ratio(D/d). The work was performed on A!N and A4T and 30NiCrMoV12 steel grades.
- Further material characterization has been performed to determine Wohler curves to enable the application of typical endurance design methods based on Miner counting methods.

European Rail Research Advisory Council

WIDEM: Background

Achievements:

Task 5: Development and validation of new design method for wheelset

- New design procedure has been defined based on the optimisation of the wheelset geometry
- FEM models of the wheelset have been used with the application of the load spectra for each running conditions. The models have defined the relationship between the single unit loads applied on the wheel tread and the stresses at various wheel nodes
- The analysis showed that it is possible to reduce the wheel weight by 10% by the application of the new design procedure.

Task 6: The probability of detecting cracks in the wheelsets

- Performing the crack detection procedure with different inspection methods and evaluating possible new techniques to be used like the compensated resonance method.
- Performing inspection tests on both fatigue tested axles and real in-service cracked axles

European Rail Research Advisory Council

WIDEM: Background

Achievements:

Task 7: The periodicity for the in-service NDT inspection

- Determination of the optimal periodicity for the NDT inspection of axles and wheels by putting together all the information that are necessary to perform the evaluation including the load spectra and the material crack propagation properties.
- Determination of the material parameters that are used by NASGROW software that has been used for the crack propagation detection.
- Adaptation of the crack propagation model to take into account the rotating bending that increases the crack propagation
- Finite element analysis has been conducted to aid selection of appropriate stress intensity factors and crack shape development including complex effects such as the presence of the seats in the axle.

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European Rail Research Advisory Council

WIDEM: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   – Yes, the new method for design is applied in the calculation and design of new wheelsets, and new inspection and testing method for wheelsets qualification is applied by LRS.

2. Is new legislation and standardization based on findings from this research project
   – No, but it influenced the future revision of the standards. This happens now, after the completion of the follow-up Euraxles project; CEN considers the results.

3. Are the results of the project implemented across Europe or only in a small number of Member States?
   – The outcomes are known and applied by other EU wheel manufacturers, e.g., Germany, Spain, France (along with Italy)

4. Were the results of the project implemented outside Europe before being accepted in Europe?
   – No.

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European Rail Research Advisory Council

WIDEM: Evaluation

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
   – The outcomes may increase the competitiveness of EU manufacturers abroad (e.g., Lucchini products more competitive on Chinese market vs the local ones)

6. Did the project increase competitiveness of railway transportation compared to other transport modes?
   – Its results contribute to increasing the reliability of RS and reduce costs and maintenance.

7. Are the results of the project taken into consideration when preparing public tenders?
   - No

8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
   – No

European Rail Research Advisory Council

WIDEM: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
   – No

10. Can benefits be assessed in financial terms?
– It could be done, but it seems to be very difficult, and the results may be not enough relevant. The changes in terms of inspection, improvement of reliability and maintenance costs are difficult to assess.

11. Applicability of results to future scenarios?
   – Perhaps, but not clear how

12. Usefulness of research procedures for future projects (incl. modeling)
   - Yes, Euraxles.

WIDEM: Reasons for outcome

- ✓ The coordinator was motivated, being the actual end-user
- ✓ Small and focused consortium
- ✓ The project came on time, when it was a real need to solve critical issues related to wheelsets

WIDEM: Lessons learnt

- ✓ Smaller but more focused projects may be more efficient than large ones, without too many unclear goals.
- ✓ Solving real needs is key to success.

European Rail Research Advisory Council

MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- To make it more competitive
- To foster increased innovation
- To guide research efforts at the European level

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
- Ensure a strategic approach to the prioritisation of rail research

Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
- To ensure that the results of previous rail research can be taken into account for future projects
- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

European Rail Research Advisory Council

ERRAC Project Evaluation Group

ISTU

EVALUATION FROM APRIL 2016

Project acronym:	ISTU
FP:	6
Programme acronym:	SUSTDEV
Project Reference:	506243
Call identifier:	FP6-2002-TRANSPORT-1
Total Cost:	€ 1,458,207
EU Contribution:	€ 896,000
Timescale:	November 2003 – September 2006
Project Coordinator:	Johan Charles Bendien (Innovative Trade and Product Strategies GmbH)
Web references:	http://www.istu.info

- ❑ Presented by: Dan Otteborn
- ❑ Date evaluation: 2016-04-08
- ❑ Market uptake: Weak
- ❑ Follow up projects: none
- ❑ Other related Projects: none

European Rail Research Advisory Council

ISTU

INTEGRATED STANDARD TRANSPORTATION UNIT for self-guided freight container transportation systems on rail

Premise:

There has been an increase in the transport of shipped containers from modern harbour infrastructures, which have eco-efficient, clean and fast logistic systems, to discharge ships that send the cargo urgently to interim logistic centres where it can than be selected for final destination.

More and more automatic guided vehicles (AGVs) are under consideration as an analysis in the last ten years has shown their effectiveness and cost advantages. Today only a few ports have been equipped with AGVs; most still work with a manual-driven operation. Such systems are expensive and the pollution aspects with diesel-driven vehicles are high, increasing the energy cost further for operators. Since the signing of the Kyoto Protocol, these diesel engines operating around the clock in harbours that are mostly located in the centre of cities are seen in a bad light due to their polluting features.

ISTU concentrated on the design and specification of a two-container wagon for terminal applications based on a speed of up to 50 km/h with a diesel-electric power supply unit to provide an autonomous integrated electrical propulsion system. The chosen technology can be extended to all major future eco-efficient systems.

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European Rail Research Advisory Council

ISTU

INTEGRATED STANDARD TRANSPORTATION UNIT for self-guided freight container transportation systems on rail

Rationale:

- The increasing transport of shipped containers request from modern harbour infrastructures eco-efficient, clean and quick logistic systems to discharge ships and send the cargo urgently to interim logistic centres where they can than be selected for final destination. More and more Automatic Guided Vehicles (AGVs) are under consideration as analysis of the last 10 years have shown their effectiveness and cost advantages.

- A major challenge was to design and/or specify on base of a practical driving cycle for two-container wagons such platform for terminal applications based on a speed of 12kM/H and a maximum speed up to 50 km/h. The project has optimised and designed the complete vehicle system, i.e. all electro-mechanical components, including a Diesel- electric power supply unit to provide an autonomous integrated electrical propulsion system.

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European Rail Research Advisory Council

ISTU

INTEGRATED STANDARD TRANSPORTATION UNIT for self-guided freight container transportation systems on rail

Rationale:

- The ISTU STREP project has investigated developed and has demonstrated a cost effective integrated propulsion unit for individual self-driven two-container rail platform wagons for freight container transport between ports and cargo distribution centres. As a major component an integrated motor with all major propulsion features is a key investigation of the project.
- The project analysed the needs and application scenarios in harbours with related logistic centres. With the basic assumptions the targets for the drive requirements were set and the according engineering process started. To avoid critical interferences of the different involved partners and their tasks, we used to couple the drive with the wheels of the platform via a standard cardan although not standard in rail.
- The design of the vehicle and the propulsion could be done individually, optimizing the design on the different partners in the project.

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European Rail Research Advisory Council

ISTU

INTEGRATED STANDARD TRANSPORTATION UNIT for self-guided freight container transportation systems on rail

Main Objectives:

1. Developing an electrical integrated low-cost: propulsion and cooling systems, control and power electronic components, simple producible rail transportation motor.
2. To design and/or specify on base of a practical driving cycle for two-container wagons such platform for terminal applications based on a speed of 12kM/H and a maximum speed up to 50 km/h.
3. Demonstrating the proposed low-cost propulsion system-designing and specifying all requirements for a direct freight logistic application, i.e. a container wagon.
4. Defining interfaces and showing implementation of such propulsion units and its interfaces for a self-guided self-propelled application.

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ERRAC *European Rail Research Advisory Council*

ISTU: Background

Details

- FP 6
- Project Reference 506243
- Total Cost: € 1,458,207
- EU Contribution: € 896,000
- Timescale: November 2003- September 2006
- Project Coordinator: Johan Charles Bendien (Innovative Trade and Product Strategies GmbH)

Partners

- INNOVATIVE TRADE AND PRODUCT STRATEGIES GMBH Germany;
- RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN Germany;
- POLITECNICO DI TORINO Italy;
- APS ENERGIA SP Z O O Poland;
- SKODA ELECTRIC S.R.O. Czech Republic;
- EURETITALIA S.R.L. Italy;
- THE RAIL VEHICLES INSTITUTE TABOR Poland.

ERRAC *European Rail Research Advisory Council*

ISTU: Background

Partners interviewed:

Organisation	Name of interviewee	Country
THE RAIL VEHICLES INSTITUTE TABOR	☑ Ryszard SZERBART	Poland

European Rail Research Advisory Council

ISTU: Background

Project description:

- In 2003, the Innovative Trade and Product Strategies (ITAPS) company developed a new automatic guided vehicle (AGV) concept for road and rail applications, which also has potential for use at container terminals. Called the 'integrated standard transportation unit' (ISTU), the vehicle offers an alternative to current locomotive-pulled freight for rail applications and container transport between cargo distribution centres and port container yards. ITAPS also developed an integrated motor concept (IPMOT) similar to that used in hybrid cars, but with high overloading capabilities.
- The 'Integrated standard transportation unit for self-guided freight container transportation systems on rail' (ISTU) project built on such advances to develop and demonstrate a cost-effective integrated propulsion unit and an individual self-driven two-container, cost-improved rail platform wagon. The new motor concepts, targeting freight container transport, integrate all major propulsion features for a key technology especially suited to the ISTU.

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European Rail Research Advisory Council

ISTU: Background

Project description:

Methodology:

- The project analysed the needs and application scenarios in harbours with related logistic centres. sing basic assumptions, the targets for the drive requirements were set and the according engineering process started. To avoid critical interference from the different involved partners and their tasks, we coupled the drive with the wheels of the platform via a cardan shaft although not a standard in today's rail technology. Via this approach we could proceed to simultaneous engineering while the cost targets were reached. The design of the vehicle and the propulsion could be done individually.
- A first prototype of the Integrated Propulsion Motor Unit called 'IPMOT' confirmed the technical features and revealed some improvement possibilities with regard to the overloading characteristics of such a motor. In a redesigned and completed product, we integrated these features by smaller changes in the winding layout. In parallel, the full vehicle was designed with a proper diesel-electric power supply unit and all components integrated in the vehicle structure.
- As an extension from this technology, a road driven vehicle was additionally analysed.

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European Rail Research Advisory Council

ISTU: Background

Achievements:

- A first prototype of the Integrated Propulsion Motor Unit called "IPMOT" confirmed the technical features and revealed some improvement possibilities with regard to the overloading characteristics of such motor
- The overload capabilities has been increased considerably within redesigning process to allow the integrated motor to be the main component within future hybrid drives.
- A brake system has been added on the shaft of the motor.
- The Engineering for a rail vehicle is actually validated in a test belt although the simulated results are demonstrating the targeted values already

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European Rail Research Advisory Council

ISTU: Background

Achievements: **IPMOT - Integrated Propulsion Motor Unit**

- The developed vehicle is called the 'Integrated standard transportation unit' (ISTU) and is designed as an alternative to conventional locomotive-pulled freight for rail applications on rail, for drayage between cargo distribution centres and in port container yards as an AGV.
- ITAPS has developed an integrated motor concept (IPMOT) that is similar to the once used in the latest hybrid cars but with high overloading capabilities. With this technology it is expected to reduce the pollution in modern harbours. With our future hybrid concept and this motor, AGVs will overcome the inertia of a heavy load even with nearly half the power of today diesel engines.
- The new electric propulsion concept has been developed based on switched reluctance motor technology - an AC motor with no windings or permanent magnets on the rotor which gives a high reliability to the product. With a 80-100 kW engine a low-speed rail application, where the load on a two-axle ISTU is limited by the 22.5 t axle load, can be realised. Within partnerships between ITAPS and companies from Poland and the Czech Republic the ISTUs and AGVs will be produced.

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European Rail Research Advisory Council

ISTU: Background

Achievements: **IPMOT - Integrated Propulsion Motor Unit**

IPMOT- is a first **“plug and play drive”** for traction application developed for rail and road application, automatic guided vehicles. The technology integrates the propulsion, power controllers, cooling and brake systems.

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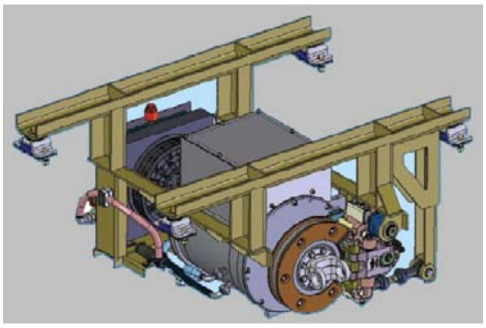
European Rail Research Advisory Council

ISTU: Background

Achievements: **IPMOT - Integrated Propulsion Motor Unit**

IPMOT means:

- Integration of electro-mechanical, cooling and control system
- Compact mechanical construction
- 5 pole supply system (2 electrical power supply, 2 cooling supply channels, 1 control signal)
- Efficiency up to 91%,
- Availability > 98%
- Reduction of: complexity, cost, interference liability



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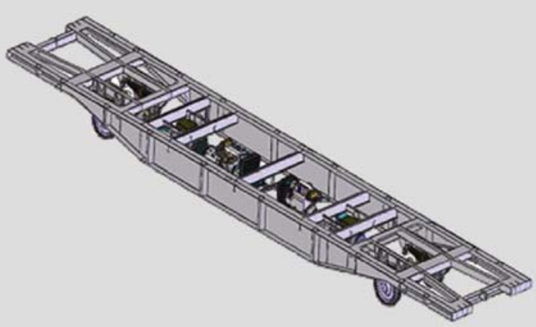
ISTU: Background

Achievements: ISTU - Integrated Standard Transportation Unit



ISTU-technical specification

- Self-guided vehicle
- Total length 16400 mm
- Width 2737 mm
- Weight ca. 11,0 t
- Axle load 22,5 t
- Height of loading surface up 1020 mm
- Max loading 34,0 t
- Standard gauge of 1435 mm
- Wheel diameter 760 mm
- Loading and unloading by a typical loading equipment
- Max. speed 50 km/h
- Average speed with loading ca. 10 km/h
- Diesel-Generator set 2
- IPMOT drive 2

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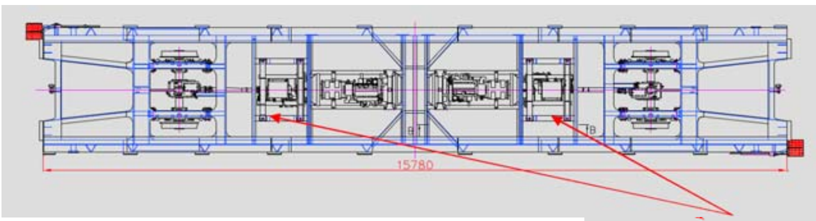
ISTU: Background

Achievements: ISTU - Integrated Standard Transportation Unit



ISTU-load specification

- 1 container class A, B or C, of a gross weight of 34 t or
- 1 swap body class A, of a gross weight of 34 t or
- 1 swap body class C of a gross weight of 16 t or
- 2 swap bodies class C each of a gross weight of 16 t.

IPMOT
Integrated Propulsion Motor Unit fully integrated PLUG and PLAY drive solution

European Rail Research Advisory Council

ISTU: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   – No, no evidence of any commercial application exist.
2. Is new legislation and standardization based on findings from this research project
   – No
3. Are the results of the project implemented across Europe or only in a small number of Member States?
   – No, no implementation found.
4. Were the results of the project implemented outside Europe before being accepted in Europe?
   –No

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ISTU: Evaluation

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
   – No
6. Did the project increase competitiveness of railway transportation compared to other transport modes?
   – No
7. Are the results of the project taken into consideration when preparing public tenders?
   – No
8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
   - No, this was not within the project objectives

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ISTU: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
   – It could have helped if being implemented, but it was not.

10. Can benefits be assessed in financial terms?
    - No

11. Applicability of results to future scenarios?
    – No

12. Usefulness of research procedures for future projects (incl. modeling)
    - No

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ISTU: Reasons for outcome

- ✓ ISTU was a pure academic research project no industrial implementer or potential end customer was present, consequently no follow up or push for market implementation existed.
- ✓ The prototype was never fully implementable, the AGV functionality was never implemented.
- ✓ Despite the intention to keep the cost down the ISTU turned out to be far too expensive for commercial application.

ISTU: Lessons learnt

- ✓ Projects which are not really scientific, i.e. ground research ones, should not be carried out by just research institutes and universities involved. Projects aiming for commercial implementation must have real end-customer and companies in the consortia, who can drive the industrial implementation on board.
- ✓ A business case showing the commercial feasibility is essential in order to understand the necessary cost structure needed in order to make the research commercially applicable.

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MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- **To make it more competitive**
- **To foster increased innovation**
- **To guide research efforts at the European level**

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- **Determine the market impact of previous rail research to improve use of research funding**
- **Ensure a strategic approach to the prioritisation of rail research**

Project Evaluation

- **Individual projects are evaluated after they have been completed to ensure successful dissemination of project results**
- **To ensure that the results of previous rail research can be taken into account for future projects**
- **To avoid weak market uptake of results by learning the lessons of previous research**
- **The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes**

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ERRAC Project Evaluation Group

EMSET

EVALUATION FROM APRIL 2016

Project acronym:	**EMSET**
FP:	**4**
Programme acronym:	**CSC - Cost-sharing contracts**
Project Reference:	**RA-95-SC.0120**
Call identifier:	**FP4-TRANSPORT**
Total Cost:	**€ 6,298,960**
EU Contribution:	**€ 3,149,474**
Timescale:	**October 1996- June 1999**
Project Coordinator:	**Jaime TAMARIT (**CENTRO DE ESTUDIOS Y EXPERIMENTACION DE OBRAS PUBLICAS**)**
Web references:	http://cordis.europa.eu/project/rcn/34444_en.html

- **Presented by: Dan Otteborn**
- **Date evaluation: April 2016**
- **Market uptake: Strong**
- **Follow up projects: none**
- **Other related Projects: none**

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EMSET

FUNCTIONAL EUROCAB COMPONENT VALIDATION ON THE MADRID-SEVILLA LINE

Premise:

•The unified European Signalling System, i.e. **ERTMS** (European Rail Traffic Management System), is a Traffic Management System. The lower layers or system kernel enclose the Train protection and control functions (ATP / ATC functions). This interoperable control kernel is recognised as **ETCS** (European Train Control System).

•The specification of the new Railways Traffic Management System with its ATP / ATC kernel (ERTMS / ETCS) is the basis for the definition of a new European Directive whose application is going to be mandatory for the railway lines integrated in the Trans-European Network (TEN).

•According to the Interoperability Directive 96/48 EC, the Member States, through the Regulatory Committee foreseen in the Article 21 of the Directive, approved the designation of AEIF *(Association Européenne pour l'Interopérabilité Ferroviaire)* as the "joint representative body" in charge of preparing all the Technical Specifications for Interoperability (TSI) and, in particular, this related to the Control-command and signalling ERTMS. According to the mandate given by the Commission, AEIF will include in this TSI all the necessary specifications developed during the ERTMS Project.

EMSET

FUNCTIONAL EUROCAB COMPONENT VALIDATION ON THE MADRID-SEVILLA LINE

Rationale:

The main objective of the "Master Plan for Development and Pilot Installations of the European Rail Traffic Management System (ERTMS)" was to consolidate the long term development of the ERTMS activities. This global strategy should delineate the path from development towards the validation and market penetration - set against a range of political, operational and research initiatives that significantly impact the backcloth for the subsequent development of the project.

An overall strategic framework entailing a two - phase approach has been structured as follows:

- *A development phase: aiming at the completion of the user and technical system specifications, the establishment of a coherent test framework (including test specifications and the development of a set of common system / sub-system test tools), and the prototyping of the system.*
- *A validation phase: whose objective is the full scale experimentation of prototype ERTMS complete configurations under real operating conditions.*

EMSET

FUNCTIONAL EUROCAB COMPONENT VALIDATION ON THE MADRID-SEVILLA LINE

Rationale:

•With the exception of the system prototyping which was carried out by individual companies on the basis of their own sources, the work included in the development phase was primarily covered within the framework of Community funded RTD activities.

•The research contribution also covers some preliminary customisation activities for the system installation in the different pilot sites, aiming a pre-feasibility assessment of the ERTMS concept. The pilot tests will be co-financed by the Trans-European Networks, within the allocation foreseen for feasibility studies of projects of common interest.

•The objective of the EMSET project was to perform a first step towards the functional validation of the on-board ERTMS sub-system, including the interoperability - via several STM (Specific Transmission Modules) - with some main existing systems used on the European High Speed lines and Trans European Network.

ERRAC European Rail Research Advisory Council

EMSET

FUNCTIONAL EUROCAB COMPONENT VALIDATION ON THE MADRID-SEVILLA LINE

Main Objectives:

1. To define the test requirements and the scenarios to be performed in EMSET and to discuss among the partners the method used for testing, the tests conditions and he tests to apply, on the basis of ERTMS-EUROSIG documents.
2. To specify the common EuroCab tools used on site and to develop them for the laboratory and on-site tests.
3. To perform the conformity tests of EuroBalise and EuroRadio FFFIS in the industry premises, and to verify that the balise, antenna and BTM of each company are compliant with the Eurobalise FFFIS.
4. To perform the interoperability tests of EuroBalise and EuroRadio sub-systems in the CEDEX laboratory.

European Rail Research Advisory Council

EMSET
FUNCTIONAL EUROCAB COMPONENT VALIDATION ON THE MADRID-SEVILLA LINE

Main Objectives:

5. To perform the functional tests of the on-board equipment in the CEDEX laboratory and on-site.
6. To consolidate the long term development of the ERTMS activities.
7. To establish the test configuration for laboratory and on site tests in MADRID CEDEX laboratories and on site in a portion of the track of MADRID SEVILLA LINE onboard the train (locomotive and Lab. Car), customised by RENFE.
8. Co-ordination with the other EMSET contracts supported by the TEN-T funds from 1995 to 1999, whose activities are strictly related to the activities of RA-95-SC-120. In particular EMSET RESEARCH CONTRACT FOURTH FRAMEWORK is the complement of the ERTMS EUROSIG contract dealing with the ERTMS technical specifications and the other EMSET contracts supported by TEN-T funds.

European Rail Research Advisory Council

EMSET
FUNCTIONAL EUROCAB COMPONENT VALIDATION ON THE MADRID-SEVILLA LINE

Main Objectives:

9. To develop at least one sample of the tools for EMSET EUROCAB laboratory and on site tests, only for functional tests.
10. To finalise the test configuration for EUROBALISE and EURORADIO subsystem tests defined by the ERTMS EUROSIG contract.

ERRAC *European Rail Research Advisory Council*

EMSET : Background

Details

- FP 4
- Project Reference RA-95-SC.0120
- Total Cost: € 6,298,960
- EU Contribution: € 3,149,474
- Timescale: October 1996-June 1999
- Project Coordinator: Jaime TAMARIT (CENTRO DE ESTUDIOS Y EXPERIMENTACION DE OBRAS PUBLICAS)

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EMSET : Background

Partners

- CENTRO DE ESTUDIOS Y EXPERIMENTACION DE OBRAS PUBLICAS Spain;
- ABB DAIMLER-BENZ TRANSPORTATION SIGNAL AB Sweden ;
- ALCATEL SEL SEÑALIZACION S.A Spain;
- ANSALDO TRANSPORT S.P.A Italy;
- CS TRANSPORT France;
- DIMETRONIC S.A. Spain;
- GEC ALSTHOM ACEC TRANSPORT S.A. Belgium;
- RED NACIONAL DE LOS FERROCARRILES ESPAÑOLES Spain;
- SASIB RAILWAY S.P.A. Italy;
- SIEMENS AG Germany.

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EMSET : Background

Partners interviewed:

Organisation	Name of interviewee	Country
CENTRO DE ESTUDIOS Y EXPERIMENTACION DE OBRAS PUBLICAS	☑ Jaime Tamarit	Spain
GEC ALSTHOM ACEC TRANSPORT S.A.	☑ Pierre MERTENS	Belgium
ADTRANZ	☑ Lars Larsson	Sweden

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ALCATEL SEL	GE	Mr. Helmut Uebel	10, Lorenz Strasse. D-70435-Stuttgart, Germany	+49 7 11 821 44 92	+49 7 11 821 38 67
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ISDEFE	ES	Mr. Carlos Drescher	Edison, 4. 28006-Madrid, Spain	+34-91-411.50.11	+34-91-411.47.03
SCIRO ELECTRA	IT	Mr. Paolo Cesario	Via Fieschi, 25-6ª. 16121-Genoa, Italy	+39-010-570.26.52	+39-010-570.27.03
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European Rail Research Advisory Council

EMSET : Background

Project description:

- EMSET was the first step towards the functional validation of the essential functions of the on-board European Rail Traffic Management System (ERTMS) subsystem, including the interoperability with some main existing systems used on the European High Speed lines and Trans European Network. It dealt with all the activities related to the tests that were carried out first in Laboratory and later on the Madrid- Seville line.

- The project was divided into different contracts, corresponding to several phases dealing with the planning and specification of the tests, preparation of the line and rolling stock, development of test tools, test of Eurocab prototypes and test of STMs for interoperability with existing national systems.

- The EMSET contract N. RA-96-SC.120 covered the period from 01/10/96 to 30/06/99, which includes the prolongation of the amendment and the additional extension agreed by the European Commission.

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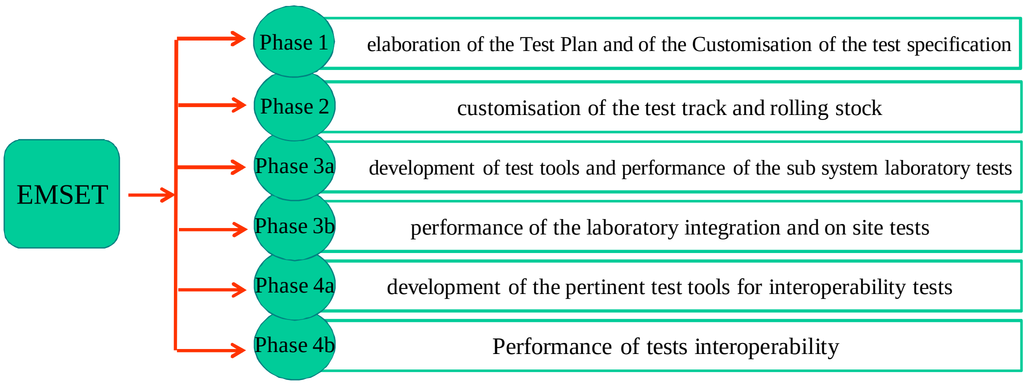
European Rail Research Advisory Council

EMSET : Background

Project description:

The EMSET project was split into six phases or steps, corresponding to different sources of financing and, accordingly, with different contractual situations. These steps are:



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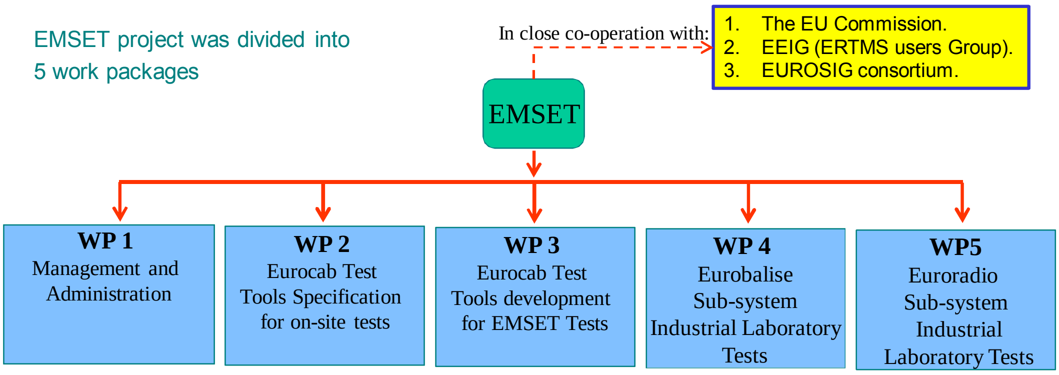
European Rail Research Advisory Council

EMSET : Background

Project description:

EMSET project was divided into
5 work packages



WP 1 was intended to manage the project (technical, organisational and financial aspects) and its quality, as well as the different subcontracts. It also provided communication between the EC and the Railways and with other projects (ERTMS-EEIG, ERTMS-EUROSIG, MORANE and ETCSVB).

European Rail Research Advisory Council

EMSET : Background

Project description:

WP 2 completed the specifications of the Eurocab tests and relating tools for the site tests. This work has become the basis for the development (done within the WP 5.21.2) and duplication of the relevant tools (work covered by a TEN contract). During this period, the specification of the Eurocab tools for the on site tests has been completed.

WP 3 developed the Eurocab tools for the EMSET Laboratory and On-site tests. This was done successfully. Development of Eurocab simulators were subcontracted to ERRI/ERS, the EMSET industrial companies were involved in the follow-up of the tools developed by ERRI. The development of the first version of the tools has been completed, on one hand by ERRI under the
follow-up of the EMSET partners, and on the other hand by the industrial partners of the EMSET consortium. Successful acceptance tests have been performed and the tools are now being used in the Laboratory tests. These WPs were involved in co-ordination between ERTMS EUROSIG extension contract and EMSET contracts.

WP 4 had the objective of executing FFFIS conformity tests of the EUROBALISE subsystem in the laboratories of the industrial partners. This was performed successfully by the companies that have developed Eurobalise equipment, on the basis of a commonly agreed set of test cases

WP 5 had the same objective than WP 5.22.1.a for the EURORADIO subsystem. Tests were also performed successfully according to the relevant specifications

European Rail Research Advisory Council

EMSET : Background

Project description:

Technical means

1- EUROBALISE & EURORADIO Laboratories of the Industrial partners of EMSET

The four companies providing of Eurobalise constituents (ADTRANZ, ALSTOM, ANSALDO & SIEMENS) have laboratories in their premises to check the FFFIS compliance of their components.

SIEMENS (Berlin): equipment for the test of the physical channel

GSM-traffic channel simulator. SIEMENS (Berlin)

ADTRANZ EUROBALISE test bench In Stockholm

SIEMENS EUROBALISE test bench In Braunschweig

European Rail Research Advisory Council

EMSET : Background

Project description:

Technical means

2- High Speed Infrastructure

- The test segment chosen to run the main line test is between La Sagra and Mora stations (track I). A lateral track going from La Sagra station to La Sagra workshops (track P) has been customised to fit equipment and perform simple scenarios.

- The length of the test track segment on the main line is around 36 km. The maximum speed in this segment is 270 km/h; the maximum speed during the tests is conditioned by the test train. The length of the lateral is around 3 km. The maximum speed in this segment is 60 km/h.

It has been agreed to divide the segment into three areas:

- An area to be used as unfitted. This area extends over the first 11.5 km starting at La Sagra.
- An area to test ERTMS - level 1. This section can be also used as an ERTMS – level 2 area. This area has 15 km and is next to the national systems area.
- An area to test ERTMS - level 2. This area extends over the last 9.5 km ending at Mora station.

The lateral track is about 3 km long and will be equipped to carry out level 1 and level 2 tests and transitions from ERTMS to unfitted area. The speed during the tests will be limited to 60 km/h. Lateral track

ERRAC *European Rail Research Advisory Council*

EMSET : Background

Project description:

Technical means

3- Rolling stock

To test the Eurocab prototypes on site and for ERTMS levels of application 1 & 2, the following specifications from the rolling stock are required:

- The test train will consist of a 252 SIEMENS high speed locomotive and an ALSTOM
- Laboratory Car. (This Laboratory is used by RENFE for line maintenance).
- The train will be driven from a prototype of the man-machine interface installed in the cabin of the locomotive.
- The communication train-track with Eurobalises will be real. This communication will be based on switchable Eurobalises (for level 1) and fixed Eurobalises (for level 2) installed on the track.
- The prototype under test will be connected to the real service brake of the locomotive. To avoid damage produced by abrupt application of the maximum brake effort, the connection of the prototype to the emergency brake will be simulated.
- Due to the low weight of the test train and, consequently, the low maximum braking effort, the test speed was limited to 160 Km/h.

ERRAC *European Rail Research Advisory Council*

EMSET : Background

Project description:

Partners contribution and work load

REF.		ADT	ACEC	SEL	ANS	CSEE	GAT	SAS	SIE	DIM	ERRI
	Scenario Generators										
CT4.1	Laboratory Scenario Generator	**									××
CT4.2	Laboratory Scenario Controller		**								××
CT5	On-Board Scenario Controller			××							
CT6	Trackside Scenario Controller									××	
	Simulators										
CS3	ETCS level 1 Trackside System Simulator						**				××
CS8	ETCS level 2 Trackside System Simulator					**		**			××
	Recorders										
CT1.1	Laboratory Test Data Logging Unit								××		
CT1.2	Display Device for Laboratory									**	××
CT1.3	Evaluation for Lab							××			
CT2.1	Site Test Data Logging Unit								××		
CT2.2	Display Device for Site									××	
CT2.3	Evaluation for Site							××			
	EMSET Specific Train Interface										
CB3	Speed Sensor Simulator for lab.					**					××
CB4	Train Motion Simulator for lab.					**					××
CB7	Reference Odometer/Time Adapter for SITE				××						
	EMSET Trackside Customisation										
CS6	Traffic Simulator for level 1									××	
B 14	Field Bus			××						××	

EMSET : Background

Project description:

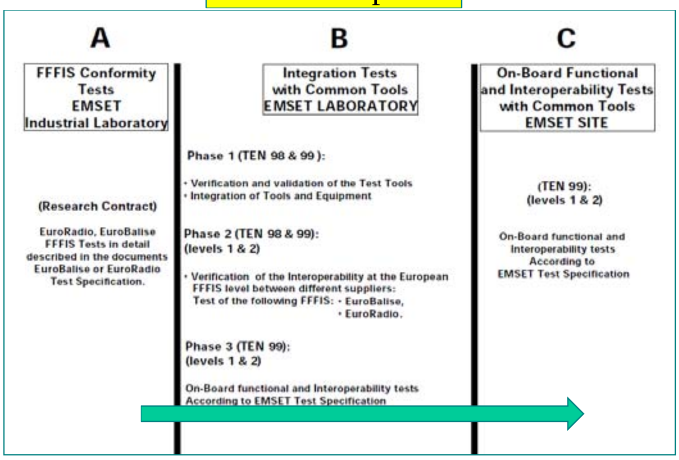
Partners contribution and work load

REF.		ADT	ACEC	SEL	ANS	CSEE	GAT	SAS	SIE	DIM	ERRI
	EuroBalise										
B1	Off-line Telegram Generator		××								
B1.1	Off-line Telegram Generator for lab. and site		××								
B2	Reference Loop	××									
B2.1	Reference Loop for lab. (including balloon)										
B3	Reference Signal Generator Interface C						××				
B4	Reference Signal Generator Interface A						××				
B4.1	Reference Signal Generator Interface A for lab.						××				
B5	Antenna Positioning Tool for LAB				××						
B6	Test Management System				××						
B7	Reference Antennas	××									
B8	Reference Units for Debris, M.M. and Cables				××						
B9	Reference Odometer / Time for LAB				××						
B10	Reference Receiver				××						
B11	Power Meter/RF accessories				××						
B12	Signal Generator for Interface A (tele-powering)						××				
B13	LEU Emulator for line (2 signals/6 balises)			××						××	
	EuroRadio										
CS10	EuroRadio Messages Generator (UDSA)								××		
	EuroRadio Messages Generator (ERSA)				××	××		××			
CS10.1	EuroRadio Message Generator for lab.					××					
CS10.2	EuroRadio Message Generator for site							××			

EMSET : Background

Project description:

EMSET test phases



European Rail Research Advisory Council

EMSET : Background

Project description:

EMSET test types

STEP A:
INDUSTRIAL SUBSYSTEM TESTS
- Private industrial FFFIS verification tests:
- Industrial Euroradio protocol FFFIS verification tests.

STEP B2:
COMMON SUBSYSTEM TESTS
- Common Eurobalise FFFIS verification tests
- common Eurobalise FFFIS interoperability verification tests
- Common Euroradio protocol FFFIS interoperability verification tests

STEP B3 & C:
COMMON FUNCTIONAL TESTS
- Functional interoperability tests specification
- Common Eurocab Laboratory functional interoperability verification tests
- Common Eurocab On-site functional interoperability verification tests

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European Rail Research Advisory Council

EMSET : Background

Achievements:

Key Results:

EMSET has achieved:

- the elaboration of a test specification for the on-board subsystem (Eurocab) creating the basis for its assessment from both a functional and interoperability point of view;
- the development of a range of reference test tools for laboratory and site tests to support such a test process;
- the performance of laboratory and field tests - the latter using the Madrid-Seville high-speed line - for the functional and interoperability validation of several ERTMS/ETCS components/sub-systems, notably:
  - **Eurobalise** using balises supplied by Adtranz, Ansaldo, Alstom and Siemens; this included, in particular, the assessment of the interoperability of track-side components and of transmission using the on-board equipment of different suppliers,
  - **Euroradio** communications sub-system, using equipment from Alstom, Adtranz, Ansaldo (with CSEE Transport), Alcatel and Dimetronic; the tests covered the validation of the Euroradio protocol as implemented in company proprietary data receivers using an uniform message generator, and
  - **Eurobab** equipment from Alstom, Ansaldo (with CSEE Transport), Alcatel and Dimetronic.

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European Rail Research Advisory Council

EMSET : Background

Achievements:

EMSET test results

EUROBALISE test results

- *EUROBALISE INDUSTRIAL LABORATORY TESTS OF EMSET PHASE A. COMMON TESTS LISTS*
- *ADTRANZ EUROBALISE TEST RESULTS*
- *ALSTOM EUROBALISE TEST RESULTS*
- *ANSALDO EUROBALISE TEST RESULTS*
- *SIEMENS EUROBALISE TEST RESULTS*

EURORADIO test results

- *Adtranz Signal GmbH Euroradio Laboratory Test Report (Phase A)*
- *ALSTOM Euroradio Laboratory Test Report (Phase A)*
- *CSEE Transport and ANSALDO Euroradio Laboratory Test Report (Phase A)*
- *Euroradio Industrial Laboratory Tests. DIMETRONIC Test Report*
- *EURORADIO Industrial Laboratory Tests. Siemens Test Report*

European Rail Research Advisory Council

EMSET : Background

Achievements:

One of the most fruitful result of EMSET has been the production of a whole **set of tools** upgraded to SRS Class P, useful to check the interoperability of the communication channels of Eurobalise and Euroradio so as the functional interoperability of the Eurocab boarded system with different infrastructure implementations.

A set of 40 tools have been specified, developed and validated by an Independent Assessor (***Institute of Applied Magnetism***). These tools have been integrated into four laboratories:

EMSET set of tools

1.- Eurobalise interoperability verification Laboratory.

In the CEDEX premises in Madrid. This Laboratory is constituted by the following set of tools:

- B1 Off-line Telegram Generator
- B1.1 Off-line Telegram Generator for lab. and site
- B2 Reference Loop
- B2.1 Reference Loop for lab. (including balloon)
- B3 Reference Signal Generator Interface C
- B4 Reference Signal Generator Interface A
- B4.1 Reference Signal Generator Interface A for lab.
- B5 Antenna Positioning Tool for LAB
- B6 Test Management System
- B7 Reference Antennas
- B8 Reference Units for Debris, M.M. and Cables
- B9 Reference Odometer / Time for LAB
- B10 Reference Receiver
- B11 Power Meter/RF accessories
- B12 Signal Generator for Interface A (tele-powering)
- B13 LEU Emulator for line (2 signals/6 balises)

European Rail Research Advisory Council

EMSET : Background

Achievements:

EMSET set of tools

2.- Eurocab functional interoperability verification On-Site.

This set of tools has been installed on the test track between the Stations of "La Sagra" and "Mora"
in the Madrid – Seville High speed line. This set of tools is constituted by the following tools:

- CT5 On-Board Scenario Controller
- CT6 Trackside Scenario Controller
- CT2.1 Site Test Data Logging Unit
- CT2.2 Display Device for Site
- CT2.3 Evaluation for Sit
- CB7 Reference Odometer/Time Adapter for SITE
- CS6 Traffic Simulator for level 1
- B 14 Field Bus
- CS10.2 EuroRadio Message Generator for site
- EMSET Specific Train Interface
- EMSET Trackside Customisation

3.- Eurocab functional interoperability verification Lab.

In the CEDEX premises in Madrid. This Laboratory is duplicated and is constituted by the following set of tools:

- CT4.1 Laboratory Scenario Generator
- CT4.2 Laboratory Scenario Controller
- CS3 ETCS level 1 Trackside System Simulator
- CS8 ETCS level 2 Trackside System Simulator
- CT1.1 Laboratory Test Data Logging Unit
- CT1.2 Display Device for Laboratory
- CT1.3 Evaluation for Lab
- CB3 Speed Sensor Simulator for lab.
- CB4 Train Motion Simulator for lab.
- B2.1: Reference Loop (x 3)
- B4.1: Reference Signal Generator Interface A for lab.
- CS10.1: EuroRadio Message Generator for laboratory
- Attenuators for Laboratory

European Rail Research Advisory Council

EMSET : Background

Achievements:

EMSET set of tools

4.- Euroradio interoperability verification Laboratory.

In the CEDEX premises in Madrid. This Laboratory is constituted by the following set of tools:

- CS8: ETCS Level 2 Trackside System Simulator
- CT4: Test Data Logging Unit
- CS10: EuroRadio Messages Generator (UDSA)
- CS10: EuroRadio Messages Generator (ERSA)
- Primary Channel for radio transmission in laboratory

ERRAC *European Rail Research Advisory Council*

EMSET : Background

Achievements:

Test and Tools specifications

- In EMSET, the specification activity begun with the test specification at functional level, starting from the scenarios document produced by the ERTMS Users Group. Starting from the description of the tests at functional level a technical test specification was prepared. The technical test specification defines at user level all EUROBALISE and EURORADIO telegrams, identified all actions expected by the driver and described the normal behaviour expected from the Boarded Prototype, according to the specification.
- EMSET test and tools specification has been upgraded according to the Class P SRS (Class P is a kernel of Class 1 functionality being tested in EMSET). This upgrading process has been accomplished within the TEN framework. At present the industrial partners of EMSET are passing the functional tests in Laboratory according the test specification updated to SRS Class P with the tools upgraded accordingly.

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ERRAC *European Rail Research Advisory Council*

EMSET : Background

Achievements:

Test and Tools specifications

- Integration process of the first Eurocab prototype with the common boarded tools for the Eurocab On-site Functional tests, specified in agreement with Class P SRS.

On the left: the tools mounted on the RENFE Auscultation Car;
On the right: the 252 SIEMENS locomotive adapted to EMSET tests.

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European Rail Research Advisory Council

EMSET : Background

Achievements: Subsystem tests in industrial laboratories

- EMSET compliance tests of EUROBALISE and EURORADIO subsystems with SRS specifications was envisaged to be performed only in the laboratories of the industrial partners.
- The tests of Euroradio revealed some undefined aspects that needed clarification. In addition, the tests performed between companies of the same group established in different countries revealed that an important amount of work was required to reach interoperability between two implementations of the same Group.
- The situation with the Eurobalises could be similar given that interoperability verification tests between Eurobalise components (Antenna/BTM & Eurobalise) provided by different suppliers were never performed.
- The interoperability verification tests of Eurobalise with common tools has been finished with success and the interoperability between components of different providers has been assured after testing all combinations Antenna/BTM – Eurobalise. The integration of private equipment with common tools has required an important amount of work.

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European Rail Research Advisory Council

EMSET : Background

Achievements: Subsystem tests in industrial laboratories

- Some differences were also detected at GSM specification level for data transmission between different countries. After two series of tests with common tools the EMSET Project has created two reference tools and the interoperability between implementations of different suppliers has been assured.
- The next figure shows the interoperability tests of the ALSTOM Antenna/BTM with SIEMENS Eurobalises (Left side) and the interoperability verification tests of the ANSALDO Antenna/BTM with ALSTOM Eurobalises (Right side)


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European Rail Research Advisory Council

EMSET: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   – Partially. The project defined the test tools, the test process and the test specifications. The test of individual companies product against this common standard test led to many redesigns and modifications of products.

2. Is new legislation and standardization based on findings from this research project
   – A number of TSI and EN requirements are partly based on findings of EMSET.

3. Are the results of the project implemented across Europe or only in a small number of Member States?
   – via TSI and ENs they are implemented across Europe.

4. Were the results of the project implemented outside Europe before being accepted in Europe?
   – Yes the installation of ERTMS were at least done in parallel with European installation and sometime even ahead of Europe.

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European Rail Research Advisory Council

EMSET: Evaluation

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
   – Yes as the project paved the way for the development of the ERTMS which today is almost a world standard.

6. Did the project increase competitiveness of railway transportation compared to other transport modes?
   – Yes as the ERTMS is one of the key component in interoperability it did increase the competitiveness of the European railways.

7. Are the results of the project taken into consideration when preparing public tenders?
   –Yes ERTMS TSI have to be respected in European public tenders. Outside Europe it is used on a voluntarily base.

8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
   – Definitely yes. The project laid the foundation to the fact that today a large number of different suppliers products can work together in a interoperable way.

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European Rail Research Advisory Council

EMSET: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
   – No, this was not the aim of the project.

10. Can benefits be assessed in financial terms?
    – Difficult to say. In a long term perspective, when the entire European railway is truly interoperable, it will demonstrate a financial benefit.

11. Applicability of results to future scenarios?
    – Definitely yes The philosophy of independent public test of interoperable and interchangeable products and components are used in all modifications of ERTMS.

12. Usefulness of research procedures for future projects (incl. modeling)
    - The standardisation of the 28 odd European signaling system was a unique undertaking lasting about 20 years. It is unlikely that a similar endeavor ever will be undertaken.

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EMSET: Reasons for outcome

✓ It become evident that individual test of component was not going to produce interoperable components from a number of different suppliers. All stakeholders were therefore in favour of common and open test and prepared to accept the consequences of these tests on their own product development.

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EMSET: Lessons learnt

- ✓ Key to success is clear scope and targets before starting the project. A clear and generally accepted need for the project and an acceptance to adapt to the out come of the project.
- ✓ Openness and transparency is fundamental to success.

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European Rail Research Advisory Council

MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- To make it more competitive
- To foster increased innovation
- To guide research efforts at the European level

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
- Ensure a strategic approach to the prioritisation of rail research

Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
- To ensure that the results of previous rail research can be taken into account for future projects
- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

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European Rail Research Advisory Council

ERRAC Project Evaluation Group

HYCOTRANS

EVALUATION FROM APRIL 2016

Project acronym: HYCOTRANS
FP: 4
Programme acronym: BRITE/EURAM 3
Project Reference: BRPR960257
Call identifier: CSC - Cost-sharing contracts
Total Cost: € ……….
EU Contribution: € ……….
Timescale: December 1996- November 1999
Project Coordinator: Prof. Mark Robinson (UNIVERSITY OF SHEFFIELD)

Web references: N/A

- ❑ Presented by: Cristian Ulianov
- ❑ Date evaluation: April 2016
- ❑ Market uptake: Medium
- ❑ Follow up projects: HYCOPROD
- ❑ Other related Projects: none

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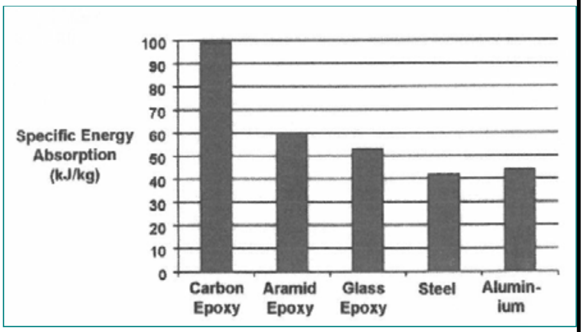
European Rail Research Advisory Council

HYCOTRANS

Hybrid composite structures for crash worthy bodyshells, containers and safe transportation structures

Premise:

The objective of any crashworthy vehicle design is to ensure that, in the event of a collision, the kinetic energy of the impacting masses is dissipated safely as to minimise the risk of injury to the vehicle's occupants. Research into the use of composite materials for crashworthy structures has demonstrated that they can be designed to provide energy absorption capabilities superior to those of metals when compared to weight-to-weight basis as shown by the figure.



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European Rail Research Advisory Council

HYCOTRANS

Hybrid composite structures for crash worthy bodyshells, containers and safe transportation structures

Premise:

- The focus on composite materials in the multitude of interested industries is with good reason. The performance and geometric design of composite materials offer tremendous advantages in that they are lightweight and cheaper to produce. However, their impact resistance is not viable as composites are generally brittle in nature.

- It has been found that Fibre Reinforced Plastics **(FRPs)** don't exhibit the ductile failure process associated with metals. Instead, the brittle nature of fibres and thermosetting polymers tend to generate a brittle mode of failure. Provided that the crushing mechanism of the FRP can be controlled in a stable, progressive manner, very high energy absorption levels can be obtained.

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European Rail Research Advisory Council

HYCOTRANS

Hybrid composite structures for crash worthy bodyshells, containers and safe transportation structures

Rationale:

- The structural sandwich concept involves combining two thin and stiff fibre-reinforced plastic (FRP) faces with a thick and relatively weak foam or honeycomb core. Such structures can be designed to achieve the necessary strength and stiffness for use in load-bearing applications. However, their use in safety critical areas has been severely restricted. Composites are generally brittle in nature, failing in an unpredictable and often catastrophic manner.
- A consortium of railway industries and research institutions initiated research into the impact absorbent properties of composite materials to provide greater safety features for passengers in railway cars. Since composite materials do not possess the same high impact or crash resistant properties of steels, but provide excellent performance features in other areas, the consortium undertook research in geometric designs for composite materials that would provide the required standards of impact resistance.

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European Rail Research Advisory Council

HYCOTRANS

Hybrid composite structures for crash worthy bodyshells, containers and safe transportation structures

Main Objectives:

1. To develop an energy absorbing composite structural system applicable to a wide range of materials;
2. To produce standard procedures for determining the properties of a structure by scaling without the need of expensive full scale testing;
3. To develop a predictive tool for designing the energy absorbing composite structure;
4. To construct a full-size prototype crash worthy body shell to be tested for the demonstration of the project results.

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European Rail Research Advisory Council

HYCOTRANS: Background

Details

- FP 4
- Project Reference BRPR960257
- Total Cost: € ....
- EU Contribution: € ....
- Timescale: December 1996- November 1999
- Project Coordinator: Prof. Mark Robinson (UNIVERSITY OF SHEFFIELD)

Partners

UNIVERSITY OF SHEFFIELD	United Kingdom;
AACHEN UNIVERSITY OF TECHNOLOGY	Germany;
Anthony Patrick & Murta Exportacao Lda	Portugal;
Cetma Consortium	Italy;
Costamasnaga SpA	Italy;
D'APPOLONIA SPA	Italy;
Flexadux Plastics Limited	United Kingdom;
Irizar S.coop.	Spain;
NATIONAL TECHNICAL UNIVERSITY OF ATHENS	Greece;
Università degli Studi di Perugia	Italy

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European Rail Research Advisory Council

HYCOTRANS: Background

Partners interviewed:

Organisation	Name of interviewee	Country
UNIVERSITY OF SHEFFIELD	☑ Prof. Mark Robinson	UK
Anthony Patrick & Murta Exportacao Lda	☑ Anthony SIMMONDS	Portugal

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HYCOTRANS: Background

Project description:

HYCOTRANS is directed towards the development of composite sandwich panels for rail vehicle body-shells and other passenger transportation structures. The research reflects a requirement for lightweight, impact absorbent materials to replace the use of metals in such applications.

Approach

- HYCOTRANS approach to the development of structure crashworthy composite is based on the use of foam-cored sandwich panels with integral energy absorbing Fibre Reinforced Plastics (FRPs)
- Sandwich panel designs were chosen as the basis for the project because of their mechanical properties are somewhat analogous to those of I-beams. Therefore, these sandwich structures have the necessary strength and stiffness to be used in structural applications
- The main function of FRP inserts is to control the failure loads and hence the energy absorption capabilities of the panels. The intension is to harness the high energy absorption capabilities of FRPs with in single structurally useful hydride composite

HYCOTRANS: Background

Project description:

Methodology

- In order to produce a component as complex as rail vehicle body shell, the composite material must offer high degree of flexibility. It also should be possible to manufacture curved profiles with variable thicknesses and it should be possible to tailor the fibre reinforcement according to the anticipated loading conditions
- HYCOTRANS has overcome this limitation by way of an innovative design approach based on the corrugated 'tied' core sandwich concept. The corrugation represents an integral part of the construction, forming a continuous channel between the upper and lower faces. In the event of a collision, the corrugation is designed to fail at a pre-determined stress level, selected in order to protect passengers from experiencing severe impact forces.
- Tests conducted on small scale tubular structures at the Advanced Railway Research Centre (ARRC) and the National Technical University of Athens (NTUA) have shown that the resultant collapse mode is one of progressive failure, absorbing large amounts of energy in a stable and reproducible manner. The side impact strength of panels is also suitably high, as demonstrated by ball impact tests conducted at the University of Perugia

ERRAC *European Rail Research Advisory Council*

HYCOTRANS: Background

Project description:

Technical challenges:

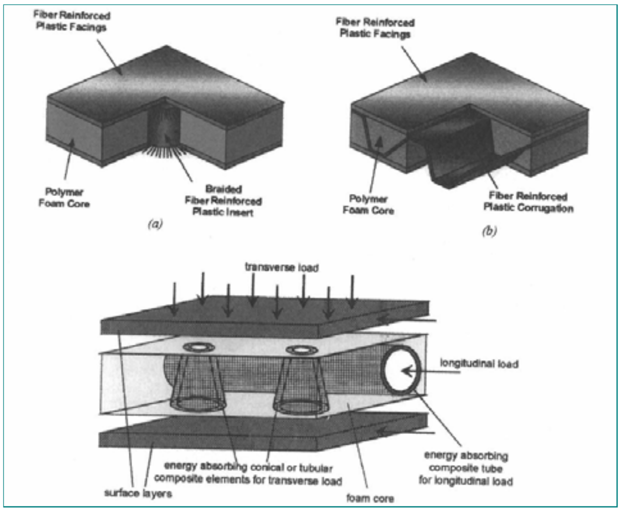
- There were a number of concerns about the widespread adoption in crashworthy structures which can be summarised as follow:
    - ✓ The development of high energy composite systems which are affordable across the broad range of transportation industries;
    - ✓ Much of the pioneering work has been done with expensive high-grade aerospace materials;
    - ✓ There is a lack of clear understanding of **FRPs** under dynamic loads;
    - ✓ Little work has been done with geometric other than simple tubes
- In addition to the above there are number of important issues related to the energy absorption of campsites which have received little attention
- HYCOTRANS project aimed to develop an accurate and reliable methods for predicting the energy absorption behaviour of composite structures for efficient designs of railway vehicles

ERRAC *European Rail Research Advisory Council*

HYCOTRANS: Background

Achievements:

- HYCOTRANS investigated and tested the suitability of three different types of sandwich panels for body-shell structure which can be shown in the figure
- Each panel consists of polymer foam core, incorporating some form of internal FRP structure surrounded by FRP facings
- Although the three designs are quite different in the geometry, they all share the common feature of using FRP structure to tie opposing faces together



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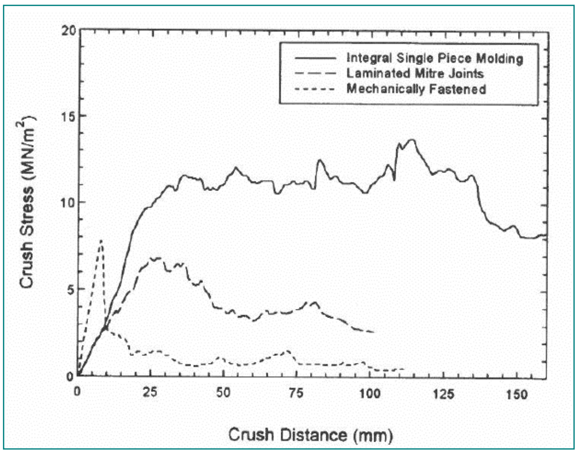
HYCOTRANS: Background

Achievements:

- HYCOTRANS performed several tests for different geometries of composite structures in order to study the effect of features such as macroscopic geometry and joining methods which can significantly affect the crashworthiness property of a structure
- The figure shows a comparison of the compressive response of structures with different types of joints. It can be seen that the distinction between the limited low energy failure of the joined structures and extensive high energy crushing of integral single piece moldings is clearly marked



Comparison of representative compressive stress-displacement characteristics

European Rail Research Advisory Council

HYCOTRANS: Background

Achievements:

Claimed innovative aspects of this project include:

- An energy absorbing structural system applicable to a wide range of composite materials
- A standard procedure for determining the properties of a structure without the need for expensive full size testing
- A predictive tool for designing energy absorbing structures which utilise the new materials system. tool has been developed with the aim of providing the users with a tool for the evaluation of the in-service characteristics of the material (strength, resistance, crashworthiness).
- The project has proven that the flexibility of composites also means that the complex shapes required for aerodynamic design can be achieved at a significantly lower cost. More fundamentally, significant reductions in vehicle weight can be achieved. These are factors of particular importance to the end-users in the consortium: Ifor Williams Trailers Ltd. (a British trailer builder), Costaferroviaria (an Italian rail vehicle manufacturer) and Irizar (a Spanish bus builder).

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HYCOTRANS: Background

Achievements:

- The values of the parameters required by the different models used in the project were extrapolated by experimental tests on samples of different scales, and by results of numerical simulations performed considering configurations not available experimentally.
- The study of the structural behaviour indicated that the response of the structure is influenced by the variability of the main parameters that comprise material, geometrical, and structural parameters.
- It was recommended that in design and manufacturing of advanced materials, it is desirable to find which of the many processing variables mostly contribute to the desired properties of the material.
- A further development of the predictive tool is envisaged to consider the estimation of the effects on design of the variability (due to the manufacturing process) of the main parameters.

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European Rail Research Advisory Council

HYCOTRANS: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   – Yes particularly in the automotive sector (IRIZAR bus); however, there was no specific implementation in the rail sector.
2. Is new legislation and standardization based on findings from this research project
   – Yes, i.e.:
   UK Patent Application Nº 9300924.9, Energy Absorbing Composite Material
   European Patent Application Nº 94300329, Composite Structure
3. Are the results of the project implemented across Europe or only in a small number of Member States?
   – Across Europe as it led to the HYCOPROD and the DELIGHT project
4. Were the results of the project implemented outside Europe before being accepted in Europe?
   – **No.**

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ERRAC *European Rail Research Advisory Council*

HYCOTRANS: Evaluation

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
   – Too early to say

6. Did the project increase competitiveness of railway transportation compared to other transport modes?
   – Too early to say

7. Are the results of the project taken into consideration when preparing public tenders?
   - No.

8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
   – No.

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ERRAC *European Rail Research Advisory Council*

HYCOTRANS: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
   – Not Applicable

10. Can benefits be assessed in financial terms?
    – Not Applicable

11. Applicability of results to future scenarios?
    – Yes, given the patents raised.

12. Usefulness of research procedures for future projects (incl. modeling)
    - Yes had follow-on project uses in HYCOPROD and DELIGHT

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European Rail Research Advisory Council

HYCOTRANS: Reasons for outcome

- ✓ A good consortium has proven the feasibility
- ✓ The application in rail is too difficult
- ✓ Other land transport modes are more open to innovation

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HYCOTRANS: Lessons learnt

- ✓ Design with composites is complex and further work is needed to develop a reliable design tool
- ✓ Composites can be used for energy absorption
- ✓ Application into the transport sector is achievable
- ✓ Application in the rail sector is yet possible as there is no way to certify these materials structures
- ✓ A follow on project is needed

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European Rail Research Advisory Council

ERRAC Project Evaluation Group

HYCOPROD

EVALUATION FROM APRIL 2016

Project acronym: HYCOPROD
FP: 5
Programme acronym: GROWTH
Project Reference: G3RD-CT-1999-00060
Call identifier: CSC - Cost-sharing contracts
Total Cost: € 5,541,280
EU Contribution: € 3,519,500
Timescale: January 2000 – September 2004
Project Coordinator: Prof. Roderick Smith
(University of Sheffield, Advanced Railway Research Centre)

Web references: http//:www……

- Presented by: Conor O'Neill
- Date evaluation: April 2016
- Market uptake: Medium
- Follow up projects: DE-LIGHT (partially)
- Other related Projects: none

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European Rail Research Advisory Council

HYCOPROD

Design of an advanced composite production process for the systematic manufacture of very large monocoque hybrid sandwich structures for transport sectors

Premise:

- Lightweighting is becoming an increasingly important issue for rail vehicles because their weight has generally risen over the last 30 years. Rail vehicle components and assemblies that would be good candidates for lightweighting using composites are identified in this paper. The potential for composite materials is examined by highlighting some of the technical, regulatory, economic and cultural aspects that normally influence the design process.
- The exploitation of the novel technology of using monocoque composite structure, however, depends on the invention of a new production process that can cope with very large structure as such as buses , trains, trams, containers and trailers. For the transportation sector the need for advanced composite sandwich monocoque is driven by the need to
    - Have a sustainable and improving product to maintain and improve market share;
    - React to the social needs for efficiency and quality of transport system and services;
    - Improve the security of people and goods in non-personal transport and more environmentally friendly modes

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European Rail Research Advisory Council

HYCOPROD

Design of an advanced composite production process for the systematic manufacture of very large monocoque hybrid sandwich structures for transport sectors

Rationale:

- There is a problem in the composite manufacturing industry that at the present there is no feasible method for the manufacturing of very large monocoque composite sandwich structure
- HYCOTRANS project (BRPR CT96 0257) has demonstrated that sandwich monocoque composite structure can be designed to absorb energy and perform in a predictable manner
- HYCOPROD aimed to design an advanced composite production process for the static manufacture of very large monocoque hybrid composite sandwich structure for the transportation sector
- End users representing the transport sectors are convinced that the materials technology for these applications is proven but are aware of the need for HYCOPROD.

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European Rail Research Advisory Council

HYCOPROD

Design of an advanced composite production process for the systematic manufacture of very large monocoque hybrid sandwich structures for transport sectors

Rationale:

The manufacturing of transportation structure using HYCOPROD will provide the enabling technology to asses the European union to implement the objectives of the common transport policy and the transport polices of national government. Providing a lightweight crashworthy transportation structure will result in the following advantages:

- ✓ *Improved competiveness;*
- ✓ *Reduce the time to market and development cost for new vehicle concepts;*
- ✓ *Lower the emissions due to lower power requirements;*
- ✓ *Improved performance and energy savings;*
- ✓ *Improved modal shift from road to rail;*
- ✓ *Reduction in the vehicle whole life cycle cost*

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European Rail Research Advisory Council

HYCOPROD

Design of an advanced composite production process for the systematic manufacture of very large monocoque hybrid sandwich structures for transport sectors

Main Objectives:

1. To design an advanced composite production process for the static manufacture of very large monocoque hybrid composite sandwich structure for the transportation sector
2. To develop a manufacturing oriented design tool to take into account the optimum composite material properties;
3. To determine the quality control procedures for manufacturing process based on the design criteria;
4. To improve the developed design tool based on the data of generic products;
5. Design and manufacture a cost effective moulds
6. Development of non-destructive techniques for the quality control assessment of very large composite sandwich structures

European Rail Research Advisory Council

HYCOPROD: Background

Details

- **FP** 5
- **Project Reference G3RD-CT-1999-00060**
- **Total Cost:** € 5,541,280
- **EU Contribution:** € 3,519,500
- **Timescale:** January 2000 – September 2004
- **Project Coordinator:** Prof. Roderick Smith (University of Sheffield, ARRC)

Partners

- AACHEN UNIVERSITY OF TECHNOLOGY Germany;
- ADVANCED TECHNOLOGIES RESEARCH INSTITUTE SL Spain;
- AHLSTROM GLASSFIBRE OY Finland;
- ANTHONY, PATRICK & MURTA - EXPORTACAO LIMITADA Portugal;
- APC COMPOSITS AB Sweden;
- ASHLAND ITALIA SPA Italy;
- BOX MODUL AB Sweden;
- D'APPOLONIA SPA Italy;

European Rail Research Advisory Council

HYCOPROD: Background

Partners

- FIBROCOM OY Finland;
- HUEBNER GUMMI- UND KUNSTSTOFF GMBH Germany;
- IFOR WILLIAMS TRAILERS LIMITED United Kingdom;
- IRIZAR S.COOP. Spain;
- NATIONAL TECHNICAL UNIVERSITY OF ATHENS Greece;
- NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO* Netherlands;
- PETER- GFK SPOL. S.R.O. Czech Republic;
- RIGA TECHNICAL UNIVERSITY Latvia;
- SICOMP AB Sweden;
- UNIVERSITA DEGLI STUDI DI PERUGIA Italy.

European Rail Research Advisory Council

HYCOPROD: Background

Partners interviewed:

Organisation	Name of interviewee	Country
University of Sheffield	☑ Mark Robinson	UK
ANTHONY, PATRICK & MURTA – EXPORTACAO LIMITADA	☑ Anthony Simmonds	Portugal

HYCOPROD: Background

Project description:

HYCOPROD

1st Phase

The first phase utilized the combined knowledge and experience of composite manufacturing experts and practitioners to drive the technologies for the design tool, manufacture, mould handling and building, quality control, and support systems

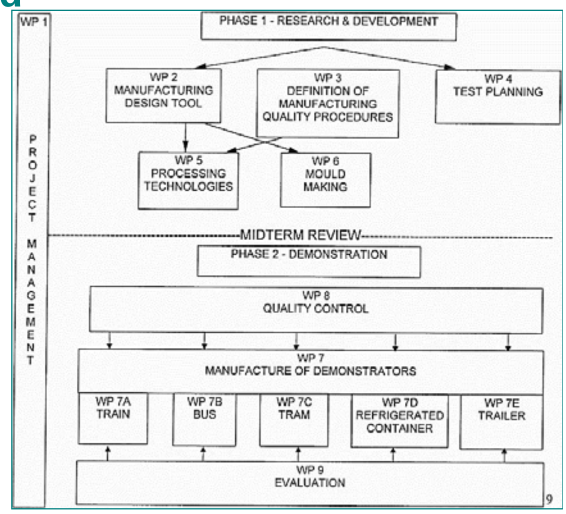
2nd Phase

The second phase focused on the production of the demonstrators for bus, trains, trams, refrigerated containers, and trailers. These demonstrators were assessed using non destructive techniques. All the provided information was used to improve the manufacturing process. It also anticipated that a composite manufacture design tool was trailed that can be developed for further applications

HYCOPROD: Background

Project description:

The HYCOPROD advanced composite production process for the systematic manufacture of a very large monocoque hybrid composite sandwich structure for the transportation sector. The HYCOPROD was developed in 2 phases as it can be shown in the project work plan in the picture



HYCOPROD project work plan

European Rail Research Advisory Council

HYCOPROD: Background

Project description:

WP1: Project Management

The main objective was to carry out the overall management of the project to ensure that co-ordination and the quality of the project ate maintained

WP2: Manufacturing Design Tool

The main objective was the development of a manufacturing design tool (HYCOTOOL) for the estimation of the effects on the design of the composite properties variability due to the manufacturing process

Tasks

1) Definition of Material and Processing Parameters;
2) Quantification of Parameter Variability;
3) HYCOTOOL Development and Implementation.

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European Rail Research Advisory Council

HYCOPROD: Background

Project description:

WP3: Definition of Manufacturing Quality Procedure

The main objective was to produce methodological procedure for the implementation of design criteria and quality control in manufacturing of composite material components. The results of this work package are expected to provide the manufacturers with guideline and standard procedures to be used in the production phase in order to guarantee the reliability specifications required to the structure.

Tasks

1) Definition of the requirements and specifications for the quality control procedures taking into account the needs of users and operators
2) Specifications of material properties relevant to the structural performance for which quality control will be applied
3) Definition of criterial i.e. sampling according to given rules and agreed testing procedure
4) Definition of compliance criteria in supply
5) Compatibility of design rules i.e. design values of material properties and quality control criteria
6) Definition of quality control procedures

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HYCOPROD: Background

Project description:

WP4: Test Planning

The main objective was to plan specific tests to qualify and choose the materials and the composite structures. It also include the definition of standard procedure for testing of the composite structure both of destructive and non-destructive types, in order to provide the required properties to be used in design and guarantee an appropriate quality control of the production.

Tasks

1) Analysis of the mechanical and physical properties of the materials in order to develop a procedure for its qualifications
2) Development of specific techniques to evaluate the bolt bearing strength and stiffness
3) Definition of the testing on the structure including mechanical and dynamic impact tests.
4) Planning of quality conformance tests to assess the continued integrity of the materials and of the structures

European Rail Research Advisory Council

HYCOPROD: Background

Project description:

WP5: Processing Technologies

The main objective was the determination of appropriate processing for manufacturing the monocoque sandwich structures

Tasks

1) Determination of the most suitable processing techniques
2) Selection of the most promising processing technologies
3) Investigating the design and construction of test moulds;
4) Investigating the variation and optimisation of process parameters;
5) Investigating the of the measurement of process data (mould pressure, temperature of mould and resin);
6) Investigating the mechanical testing samples;
7) Investigating the determination of fibre impregnation, sample morphology and surface quality

ERRAC *European Rail Research Advisory Council*

HYCOPROD: Background

Project description:

WP6: Mould Making

The main objective was to produce the mould for the train, bus, train, refrigerated container and trailer demonstrators to use with the processing technologies developed in WP 5

Tasks

1) Defining the consistency in the moulds for the structure demonstrators in order to ensure quality in the demonstrators and little processing variation
2) Determination of suitable techniques and processes used in the mould construction
3) Determination of the possible mould/tools for the production of demonstrators
4) Analysis of the tool options according to technical and economical point of view
5) Determination of the quid lines used in the selection of the tool concepts

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ERRAC *European Rail Research Advisory Council*

HYCOPROD: Background

Project description:

WP7: Manufacturing of Demonstrators

The main objective was to manufacture different demonstrators which were described in WPs7A to 7E (shown below) with continues support and knowledge transfer of the partners included in this work package in co-operation with the manufacturer.

- **7A** Manufacture of ***Rail Vehicle*** Demonstrator
- **7B** Manufacture of ***Bus*** Demonstrator
- **7C** Manufacture of ***Tram*** Demonstrator
- **7D** Manufacture of ***Refrigerated Container*** Demonstrator
- **7E** Manufacture of ***Trailer*** Demonstrator

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European Rail Research Advisory Council

HYCOPROD: Background

Project description:

WP8: Quality Control

The main objective was to apply quality control techniques to determine the production quality of the demonstrators and to evaluate the influence of the processing parameters defined in previous WP on the properties of the final products.

Another specific objective of this work package comprises the evaluation of the sensitivity of the composite structures to the environmental conditions, the surfaces finishing control, and the evaluation of the insulation capabilities.

Tasks

1) Non –Destructive tests of the demonstrators;
2) Destructive testing of the demonstrators;
3) In-Process control;
4) Validation

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HYCOPROD: Background

Project description:

WP8: Evaluation

The main objective was to evaluate the task 7 production of the demonstrators and to determine the effect of disseminating and using this technology within EU community and exploiting tit beyond

Tasks

1) Socio-economic impact evaluation
2) Process evaluation
3) Product evaluation
4) Business plans
5) Exploitation impacts

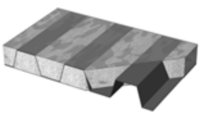
HYCOPROD: Background

Achievements: **1. Material Design**

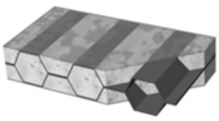
- Within HYCOPROD, novel "tied-core" sandwich designs have been developed. As well as possessing the necessary strength and stiffness for use in primary structural applications, these also provide stable, large displacement, high energy failure modes that overcome the normally unpredictable collapse behaviour of composites.

tied-core sandwich structures

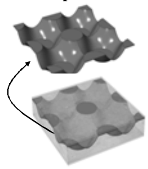
Single Corrugation



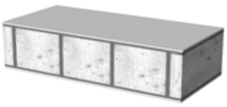
Double Corrugation



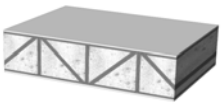
Dimpled



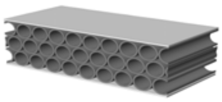
Perpendicular Webs



Perpendicular / Diagonal Webs



Tubes



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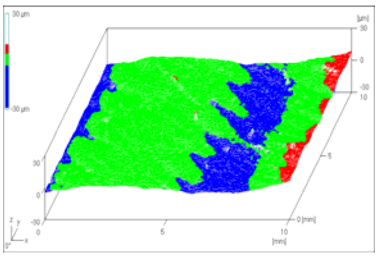
HYCOPROD: Background

Achievements: **2. Manufacturing quality procedures**

- When working with large composite components, the robustness of the manufacturing process is very important (scrap, re-work costs very high).
- Controlled manufacturing also essential for safety critical components such as crashworthy or fire retarded structures.
- Therefore, as part of HYCOPROD, several manufacturing quality procedures have been developed

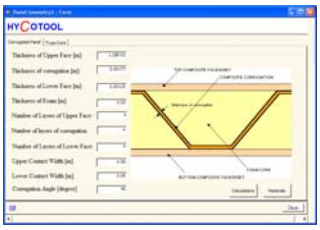
Within HYCOPROD project several procedures have been developed for the measurement of :

- Aluminium hydroxide filler content.
- Volume change during cure of filled resins.
- Surface quality (using a laser profilometer).
- Degree of cure (using Raman spectroscopy).
- Flow lengths in vacuum infusion reinforcements.

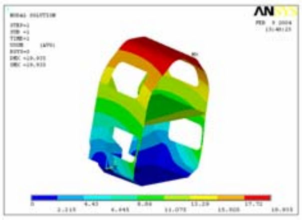


HYCOPROD: Background

Achievements: **3. Structural analysis: HYCOTOOL**



- HYCOTOOL used to estimate the key global properties of a given tied-core sandwich design from basic material and geometrical data.
- These properties can then be applied to computationally-efficient thin shell elements to give accurate predictions of global stiffness.
- No need to mesh the detailed sandwich construction.

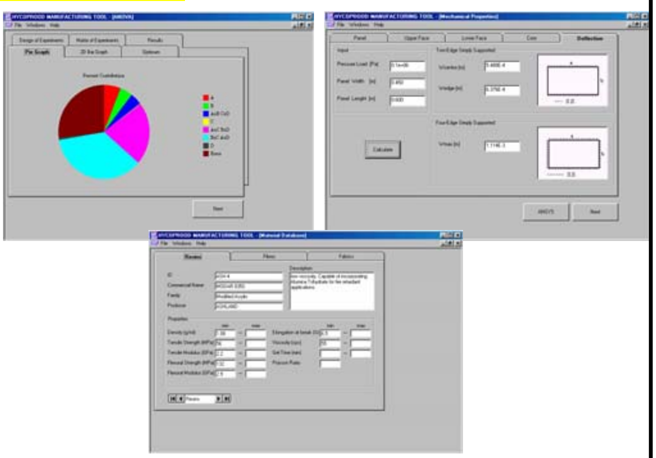


HYCOPROD: Background

Achievements: **3. Structural analysis: HYCOTOOL**

Other features of HYCOTOOL

- **Design of experiments module** for estimating the effect of variations in processing parameters on the mechanical properties of composite materials and structures.
- **Structural module** for predicting sandwich panel deflections under standard loadings.
- **Database of material properties**.



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HYCOPROD: Background

Achievements: **4. A next-generation rail vehicle cab: a case study in the use of composites for lightweight design**

The innovative HYCOPROD all-composite cab design has the following features:

- It has been designed to meet UK Railway Group Standard GM/RT2100 - "Structural Requirements for Railway Vehicles". This specifies mandatory requirements for proof loads, crashworthiness, missile protection, aerodynamic loads, etc. ;
- It is approximately 25% lighter than a traditional steel frame cab design;
- From a crashworthiness perspective, the cab has an estimated energy absorption capability of 1.5 - 2 MJ. This is derived from specialist composite energy absorbing "cells";
- The highly integrated design significantly reduces the number of parts in the cab assembly from 50-60 parts in a traditional steel frame cab, down to around 10-15 parts for the new composite design (see example illustrated).

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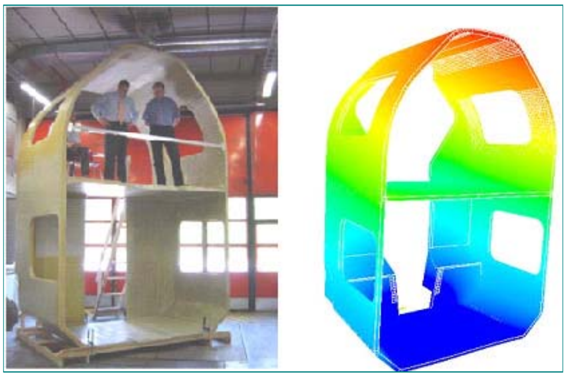
HYCOPROD: Background

Achievements: **5. The HYCOPROD all-composite sandwich body-shell**

- The HYCOPROD body prototype (pictured) successfully developed to meet the structural requirements of the application, but the development was predominantly focussed on manufacturing technologies and only resulted in a demonstration section of around 5 m in length.
  - Developed by Fibrocom.
  - 2.5 m x 2.9 m x 4.5 m.
  - 800 kg.
  - 20% lighter than aluminium equivalent.
- The wider operational (in-service) issues associated with employing composite in structural rail applications were not considered by HYCOPROD.



HYCOPROD bodyshell

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HYCOPROD: Background

Achievements: **6. Non-destructive examination – techniques**

Existing techniques

- There are many possible sources of defects, including:
  - Facing delamination.
  - Debonding between the tie and the facing.
  - Debonding between the tie/facing and the foam core.
  - Debonding of any inserts.
  - Cracking of the foam core.
  - Impact damage.

HYCOPROD employed Techniques

- For the facings:
  - Visual inspection.
  - Ultrasonic scanning.
- For the core / ties:
  - X-ray analysis – the addition of small quantities of inorganic fillers such as $BaSO_4$ have been found to be effective in amplifying (by 1-2 orders of magnitude) the distinction between wetted-out and dry fibres.
  - Ultrasonic scanning.

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HYCOPROD: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   – **The results paved the way for the reliable production of large-scale composite structures for the rail industry. Aspects such as repeat manufacturability, production quality and conformity to existing standards were all taken into consideration.**

2. Is new legislation and standardization based on findings from this research project
   – **No, but these items were addressed within the follow-on projects De-Light and REFRESCO.**

3. Are the results of the project implemented across Europe or only in a small number of Member States?
   – **Results, especially the analysis methodologies, can be implemented across the EU.**

4. Were the results of the project implemented outside Europe before being accepted in Europe?
   – **No.**

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HYCOPROD: Evaluation

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?

   – The industrial focus of the project has meant that the rail industry and it's suppliers can directly benefit from the project's outputs. This broadens the applicability of their products worldwide, giving them a competitive advantage.

6. Did the project increase competitiveness of railway transportation compared to other transport modes?

   – Yes. The understanding gained now allows for the future implementation of lightweight materials in a primary structural role within rail vehicles. This will reduce the energy consumption of rolling stock, and increase it's competitiveness against other transport modes.

7. Are the results of the project taken into consideration when preparing public tenders?

   – Not applicable

8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?

   – Not applicable

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HYCOPROD: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?

   – Not applicable

10. Can benefits be assessed in financial terms?

    – Based on the mass savings achieved and the overall reduction in part count there is a tangible cost reduction associated with the technologies and techniques developed within HYCOPROD. These have been built upon by subsequent projects to bring these outputs to a more market-ready state where the cost benefit can be better assessed.

11. Applicability of results to future scenarios?

    – The De-Light project was born out of the results of HYCOPROD, and the techniques developed were based upon the findings and lesson-learned from the HYCOPROD project. The rail industry is moving towards mass reduction, and HYCOPROD brought the industry one step closer to achieving this goal.

12. Usefulness of research procedures for future projects (incl. modeling)

    - Modelling, manufacturing techniques and material analysis have all contributed to the knowledge-base for use within industry and for future projects. It is a wealth of information, especially with respect to composite materials properties.

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HYCOPROD: Reasons for outcome

- ✓ The research was targeted at innovative rail products
- ✓ The research is ahead of the industry
- ✓ Rail industry is conservative
- ✓ Prototypes are expensive
- ✓ Good research with good consortium results in awards
- ✓ More lightweighting research is needed

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HYCOPROD: Lessons learnt

- ✓ Fully composites rail vehicle cab is feasible and can achieve crashworthiness standards
- ✓ A fully composite cab is not optimised for lightweighting
- ✓ A fully composite double deck coach is possible
- ✓ A composite semi-trailer is feasible and viable and is in active use
- ✓ Composite energy absorbers can be expensive due to complex manufacturing
- ✓ Excellent research wins awards and gains recognition
- ✓ Lightweighting is an increasing issue

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ERRAC Project Evaluation Group

DE-LIGHT TRANSPORT

EVALUATION FROM APRIL 2016

Project acronym: DE-LIGHT TRANSPORT
FP: 6
Programme acronym: SUSTDEV
Project Reference: 31483
Call identifier: FP6-2005-TRANSPORT-4
Total Cost: € 3,713,094
EU Contribution: € 2,497,519
Timescale: November 2006- January 2010
Project Coordinator: Dr. Frank Roland
(CENTER OF MARITIME TECHNOLOGIES E. V.)

Web references: http://www.delight-trans.net/

- Presented by: Mark Robinson
- Date evaluation: April 2016
- Market uptake (rail sector only): Medium
- Follow up projects: none
- Other related Projects: none

European Rail Research Advisory Council

DE-LIGHT TRANSPORT

Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design

Premise:

Although lightweight modules bear significant cost saving potentials in the entire life cycle, the application of lightweight structures in large transport vehicles is currently limited due to the following main reasons:

- The limited fitness for purpose (operation) in particular when primary load carrying structures are concerned,
- The lacking cost competitiveness of lightweight solutions in particular in terms of their final on-site assembly and outfitting,
- The lack of reliable design tools and performance assessment methods,
- Insufficient production, repair and maintenance techniques as well as lacking economy of scale due to an insufficient use of modularization and synergies between application cases across the industry sectors,
- The high risk related to operational safety and cost during the implementation of innovative lightweight solutions,
- The lacking consideration of lightweight potentials in the concept design of ships and railway vehicles.

European Rail Research Advisory Council

DE-LIGHT TRANSPORT

Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design

Premise:

Currently, the use of lightweight materials (e.g. sandwich structures) in rail vehicles is restricted to non- or semi-structural components such as aerodynamic cladding and interior fittings. For structural applications, sandwich technology is generally not employed. Traditional steel and aluminium fabrication remains the state-of-the-art.

The rail industry's reluctance to embrace sandwich and lightweight technology for structural applications is mainly driven by concerns over:

- Cost, particularly development costs and material costs
- A lack of reliable tools for the design and analysis of sandwich and lightweight structures
- A lack of confidence over ongoing fitness for purpose (e.g. long term durability)
- Concerns over fire for composite material sandwich structures.

A lack of reliable design tools and design data for innovative sandwich and lightweight solutions is a drawback for a wider application.

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DE-LIGHT TRANSPORT

Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design

Rationale:

Challenge: currently available lightweight components for transport systems are expensive one-off products. Their properties do sometimes not fit to the extreme operational requirements in transport systems. They are primarily designed to fulfil single purposes and do not integrate multiple functions.

Approach: develop innovative multi-material components integrating a variety of functions,

use synergy effects between the different application cases and transport sectors, extent the applications to achieve a better economy of scale.

Innovation: integrated modular lightweight components at competitive prices covering load-bearing and outfitting functionalities, which can be efficiently combined to fit the requirements of various application cases.

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European Rail Research Advisory Council

DE-LIGHT TRANSPORT

Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design

Rationale:

Challenge: insufficient design tools and design data make optimum design for end-users difficult and time consuming

Approach: validate, improve and integrate algorithms and solutions developed in previous projects, use a structured approach for knowledge development in the project to make available solutions transparent and exploitable

Innovation: integrated sandwich design tool and knowledge catalogue including a proper user guidance and support in the selection of available solutions.

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European Rail Research Advisory Council

DE-LIGHT TRANSPORT

Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design

Rationale:

Challenge: joining, onboard assembly and onboard outfitting are complicated and expensive, operational cost and potential benefits are not sufficiently specified. This puts the life cycle cost efficiency of available lightweight solutions at risk.

Approach: develop multi-functional lightweight modules which foster pre-outfitting under workshop conditions, design efficient joining, assembly and outfitting processes leading to an overall reduction of production cost, develop and apply efficient methods for the evaluation of life cycle cost and customer benefits

Innovation: lightweight solutions which feature cost advantages in the entire life cycle of transport systems, rather than in individual process steps

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European Rail Research Advisory Council

DE-LIGHT TRANSPORT

Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design

Rationale:

Challenge: potential benefits of lightweight solutions for the transport industry are not fully used, because product and production concepts do not support the application or because safety and commercial risks cannot be controlled

Approach: develop innovative product and production concepts before detailed design of application cases is started, use risk based design methods to address safety and economic risks throughout the development process

Innovation: innovative overall concepts for transport systems which support the efficient application of lightweight materials and modules and provide sufficient safety. Methodology for risk based design for selected application cases.

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European Rail Research Advisory Council

DE-LIGHT TRANSPORT

Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design

Rationale:

Challenge: research results do not meet the requirements for a practical application case or are not known to the end-users, research results are not tested and validated under practical conditions

Approach: provide a close link between scientific development and practical application cases, document developments and the knowledge gained for further use, validate the achievements in the context of practical application cases and demonstrate the results

Innovation: proven and applicable solutions for industrial competitiveness based on real products

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DE-LIGHT TRANSPORT

Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design

Rationale:

The rail industry needs lightweight materials and structures for vehicles in order to meet the challenges it faces in terms of energy efficiency. Lightweighting also brings reductions in vehicle operating costs, and lighter vehicles cause less damage to track, thereby reducing levels of infrastructure renewal.

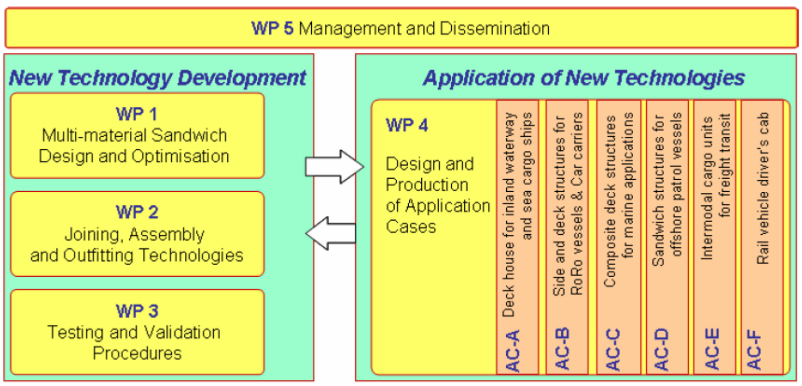
Conventional rail vehicle cab structures are typically based on welded steel assemblies and are therefore relatively heavy. Furthermore, current cab designs tend to be very complex, high part count assemblies with fragmented material usage. This is because they must meet a wide range of demands including proof loadings, crashworthiness, missile protection, aerodynamics and insulation.

Assembly costs are high, and there is little in the way of functional integration.

DE-LIGHT TRANSPORT

Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design

Rationale:



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DE-LIGHT TRANSPORT

Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design

Main Objectives:

1. To make better use of innovative materials and material combinations in multi-functional lightweight components (DESIGN SOLUTIONS)

2. To improve reliability, quality, cost and lead time in developing and designing lightweight solutions and to make knowledge more easily accessible to a wider community of industrial users (DESIGN TOOLS)

3. To improve cost efficiency and quality and to reduce lead time in production and service of integrated lightweight modules (PRODUCTION, MAINTENANCE and SERVICE TECHNIQUES)

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European Rail Research Advisory Council

DE-LIGHT TRANSPORT

Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design

Main Objectives:

4. To elaborate and harmonize efficient and reliable testing, validation and life-cycle cost assessment methods and procedures (TEST PROCEDURES)

5. To control the safety and commercial risks related to the development and application of innovative lightweight modules and to prove fitness for purpose of the developed solutions to customers and approving bodies (RISK BASED DESIGN METHODS)

6. To foster a wider and more efficient industrial application of integrated lightweight modules and structures (INDUSTRIAL APPLICATION)

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ERRAC *European Rail Research Advisory Council*

DE-LIGHT TRANSPORT: Background

Details

- FP 6
- Project Reference 31483
- Total Cost: € 3,713,094
- EU Contribution: € 2,497,519
- Timescale: November 2006- January 2010
- Project Coordinator: Dr. Roland Frank (CENTER OF MARITIME TECHNOLOGIES E. V.)

Partners

- CENTER OF MARITIME TECHNOLOGIES E. V. Germany
- "OVIDIUS" UNIVERSITY OF CONSTANTA – CENTER FOR ADVANCED ENGINEERING SCIENCES Romania
- ANTHONY, PATRICK AND MURTA LDA Portugal
- APC COMPOSIT AB Sweden
- BALANCE TECHNOLOGY CONSULTING GMBH Germany
- BOMBARDIER TRANSPORTATION UK LTD United Kingdom

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ERRAC *European Rail Research Advisory Council*

DE-LIGHT TRANSPORT: Background

Partners

- DAMEN SCHELDE NAVAL SHIPBUILDING B.V. Netherlands
- DET NORSKE VERITAS AS Norway
- FRAUNHOFER-GESELLSCHAFT ZUR FÖRDERUNG DER ANGEWANDTEN FORSCHUNG E.V. Germany
- GDANSK UNIVERSITY OF TECHNOLOGY Poland
- INSTITUT FUER HOLZTECHNOLOGIE DRESDEN GGMBH Germany
- MEYER WERFT GMBH Germany
- NOSKE-KAESER GMBH Germany
- RIGA TECHNICAL UNIVERSITY Latvia
- SICOMP AB Sweden
- TEKNILLINEN KORKEAKOULU Finland
- ULJANIK BRODOGRADILISTE, D.D.(ULJANIK SHIPYARD) Croatia
- UNIVERSITY OF NEWCASTLE UPON TYNE United Kingdom
- UNIVERSITY OF ZAGREB, FACULTY OF MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE Croatia

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DE-LIGHT TRANSPORT: Background

Partners interviewed:

Organisation	Name of interviewee	Country
AP&M	☑ Guy Simmonds	Portugal
University of Newcastle Upon Tyne	☑ Conor O'Neill	UK

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European Rail Research Advisory Council

DE-LIGHT TRANSPORT: Background

Project description:

Complex lightweight modules for ships and railway will be developed using risk based design methods. The modules will contain structural and outfitting components. The modules can be efficiently pre-assembled under favourable working conditions using economy of scale. Modules can be adopted to customer needs thus featuring structural and functional integrity, improved safety and environmentally friendliness as well as efficient operation and reduced life cycle cost. The development of lightweight modules will thus contribute to increase the competitiveness of European producers and operators of transport systems. The application of risk based design methods will allow to develop highly innovative solutions exceeding the range of existing classification rules by exploring new material combinations, innovative joining, assembly and pre-outfitting techniques.

The scope of applications followed by DE-LIGHT reaches from passenger and RoRo ships, through cargo and short sea ships, to intermodal transport units and railway carriages.

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European Rail Research Advisory Council

DE-LIGHT TRANSPORT: Background

Achievements:

The lightweight, crashworthy cab that was developed in DE-LIGHT Transport contained a number of innovations compared to more traditional designs. These included a modular construction, an energy absorbing nose section, lightweight concepts for the main crash energy absorbing devices, and the use of an integrated composite sandwich for the main cab structure.

A full-scale prototype of the lightweight crashworthy cab was manufactured (right). This realised significant savings in both mass (up to 50%) and part count (up to 40%).

The integrated modular design of the DE-LIGHT Transport cab also significantly reduces outfitting and assembly costs, leading to overall cost savings.

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European Rail Research Advisory Council

DE-LIGHT: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   – **Yes, two patents were derived from the DE-Light projects. One led be Bombardier secured the cab design using composite materials, the other led by Newcastle University secured the design of a self-aligning energy absorber for rail vehicles. Commercial outlets for both these are being sought.**

2. Is new legislation and standardization based on findings from this research project
   – **This project became a precursor to the FP7 REFRESCO project which delivered updates and recommendations to EU standards for the certification of rolling stock using new materials.**

3. Are the results of the project implemented across Europe or only in a small number of Member States?
   – **The patents filed cover all of the EU, and the REFRESCO project which used the findings of De-Light is applicable across the EU member states.**

4. Were the results of the project implemented outside Europe before being accepted in Europe?
   – **No.**

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DE-LIGHT: Evaluation

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?

   – The cab design patented by Bombardier will in the future protect them and the design on a global scale, allowing them to offer innovative new solutions to the market.

6. Did the project increase competitiveness of railway transportation compared to other transport modes?

   –Yes, the lightweighting achieved using composite materials has a positive impact on energy consumption in rolling stock

7. Are the results of the project taken into consideration when preparing public tenders?

   – Yes, as the two patents have been filed, public tenders can readily mention and cite these to deliver solutions within and outside the rail industry.

8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?

   – Not applicable

European Rail Research Advisory Council

DE-LIGHT: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?

   – Not applicable

10. Can benefits be assessed in financial terms?

    – The cab prototype was produced at a fraction of the cost of the current solution, delivering a 40% reduction in manufacturing and assembly costs.

11. Applicability of results to future scenarios?

    – Composites are making their way into rolling stock as primary structures slowly, but a concerted effort by the EU and EU projects means that the certification of rolling stock using these materials is now better understood, paving the way for future adoption.

12. Usefulness of research procedures for future projects (incl. modeling)

    - The crash simulations performed strengthened the industry's capability to perform detailed analysis on complex composite structures to verify compliance.

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DE-LIGHT: Reasons for outcome

- ✓The research was targeted at innovative rail products with a view to moving them to market-readiness.
- ✓The research is ahead of the evolution of standards, and follow-on projects are needed to ensure the EN standards fully incorporate new material requirements of the rail industry.
- ✓Rail industry is relatively conservative, with low market volumes reducing the opportunity to apply innovative solutions cost-effectively.
- ✓More research is needed to fully test some of the crashworthy elements which have been proven through simulation.
- ✓Fire performance of the materials is to be determined.

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DE-LIGHT: Lessons learnt

- ✓It is possible to implement lightweight crashworthy materials in rail vehicles.
- ✓It is possible to implement composite materials in a primary structural role.
- ✓Verification through testing of the performance of the materials is expensive and intensive.
- ✓Adoption of these materials will require the industry to adapt its manufacturing and assembly processes significantly.
- ✓There is a significant opportunity in lightweighting energy absorbers (up to 60% lighter)
- ✓Definitive research for industry produces patents and IP.

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European Rail Research Advisory Council

MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- **To make it more competitive**
- **To foster increased innovation**
- **To guide research efforts at the European level**

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- **Determine the market impact of previous rail research to improve use of research funding**
- **Ensure a strategic approach to the prioritisation of rail research**

Project Evaluation

- **Individual projects are evaluated after they have been completed to ensure successful dissemination of project results**
- **To ensure that the results of previous rail research can be taken into account for future projects**
- **To avoid weak market uptake of results by learning the lessons of previous research**
- **The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes**

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European Rail Research Advisory Council

ERRAC Project Evaluation Group

RAILECT

EVALUATION FROM APRIL 2016

Project acronym: RAILECT
FP: 7
Programme acronym: BSG-SME - Research for SMEs
Project Reference: 222425
Call identifier: FP7-SME-2007-1
Total Cost: € 1,486,487.94
EU contribution: € 1,120,350
Timescale: Sep 2008 - Dec 2010
Project Coordinator: Mrs. Tamara Colombier (TWI)

Web references: http://www.railect.com/
http://cordis.europa.eu/project/rcn/92648_en.html

- ❑ **Presented by:** Mark Robinson
- ❑ **Date evaluation: April 2016**
- ❑ **Market uptake: Strong**
- ❑ **Follow up projects: none**
- ❑ **Other related Projects: none**

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European Rail Research Advisory Council

RAILECT
Development of an ultrasonic technique, sensors and systems for the volumetric examination of alumino-thermic rail welds

Premise:

There are an estimated 11 million site alumino-thermic welds on the European rail network. There are thousands of new welds (estimated at 300,000 to 400,000 annually) being made daily throughout Europe. These welds form the basis of ‘continuous welded rail’ (CWR) that is a common feature of the European rail system. CWR has, in the main replaced the ‘fishplate’ rail jointing method and has produced a vast improvement in the quality of ride for passenger trains.

Although the alumino-thermic welding technique is well proven, it is, none-the-less, a critical safety component of the rail infrastructure and yet these welds are not volumetrically examined in any of the countries in the EU as there is currently no suitable NDT technique. The irregular weld bead is ground flush on the railhead running face and railhead running side(s). In the UK, France and Germany the proportion of rail breaks attributed to weld failures is similar at about 20% of all rail failures. Although this is proportionally a very small percentage of the total number of welds on the three rail networks, nevertheless it still totals several hundred weld failures annually including those on high speed and high passenger density routes.

European Rail Research Advisory Council

RAILECT
Development of an ultrasonic technique, sensors and systems for the volumetric examination of alumino-thermic rail welds

Rationale:

An increase in rail speeds, density of rail traffic and freight train weights are now causing an increasing number of rail breaks across the European rail network. The EU Strategic Rail Research Agenda 2020 includes the reduction in EU rail fatalities by 10% and a 50% reduction in rail breaks. This document also states that regarding vehicle and track performance, ‘this approach would also encompass the maintenance and inspection technologies required to reach these goals’.

The structure, geometry and thickness of the weld do not make it easy to apply volumetric NDT. The need for this project arised from the fact that breakages at rail welded joints occur when there are flaws in the weld. Welds without flaws tend to have very long lives and will therefore reduce the risk of breakages. There is no data connecting defect size to fatigue performance, and no inspection procedures that size flaws in an adequate time interval.

The two main conventional volumetric NDT techniques, i.e. angled pulse echo ultrasonics and film radiography, are unsuitable for the rapid examination of alumino-thermic welds. Manual ultrasonic methods adopted to date are subject to difficult application, including multiple scans, and automated methods applied from the rail head require sophisticated interpretation and do not effectively inspect the weld foot. For film radiography, the large subject latitude (i.e. thickness varying from 15mm to over 70 mm) means that several lengthy exposures would be needed even if using a high output isotope such as Iridium 192 as the source of radiation. Also, when using a normal projection type container, the ‘radiation controlled’ area (internationally set at 7.5 microSv/hr) would be prohibitively large for the isotope strength consistent with penetrating the steel thickness in question.

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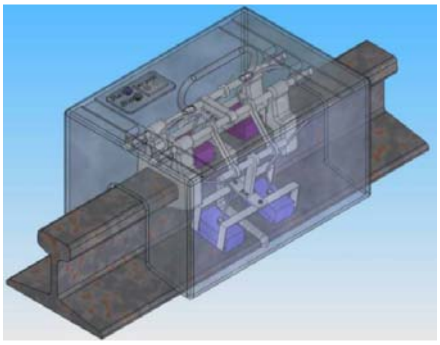
RAILECT
Development of an ultrasonic technique, sensors and systems for the volumetric examination of alumino-thermic rail welds

Project concept:

The concept of the project was to produce a "clamp-on" ultrasonic testing device that does an ultrasonic test of the weld, and classifies the weld according to pre-determined quality criteria. The challenge of the inspection of such welds is in the characterisation of the ultrasonic beam behaviour. The beam path will be distorted by the non linearities of the ultrasonic properties of the weld material caused by the grain structure.



RAILECT Concept of Inspection System

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ERRAC *European Rail Research Advisory Council*

RAILECT
Development of an ultrasonic technique, sensors and systems for the volumetric examination of alumino-thermic rail welds

Main Objectives:

1. Determine the performance of alumino-thermic welds in the presence of defects through material property characterisation tests and Engineering Critical Assessment (ECA) calculations.
2. Develop and validate ultrasonic models determining the ultrasonic beams interaction with defects and the weld metal.
3. Design an ultrasonic system containing phased array and conventional multi-probe systems with a combined output.
4. Produce a prototype system consisting of (1) a manipulator that will position the probe array to operate on complex geometry of the rail weld, (2) an ultrasonic system constructed from series of multiplexers and a new output display method suitable for the sizing analysis required, (3) an automatic sizing of flaws by means of the combined time domain analysis of ultrasonic signals and (4) a software to compare the sizing and the ECA and give an output to sentence the weld.
5. Laboratory and field trials to validate the final prototype.

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RAILECT: Background

Details

- **FP** **7**
- **Project Reference 222425**
- **Total Cost:** **€ 1,486,487.94**
- **EU Contribution:** **€ 1,120,350**
- **Timescale:** **September 2008 – December 2010**
- **Project Coordinator:** **Mrs. Tamara Colombier / Mr. John Rudlin (TWI)**

Coordinator:

TWI Ltd	(TWI)	UK

Partners

Przedsiebiorstwo Badawczo-Produkcyjne Optel sp.Z o.o.	(Optel)	PL
VERMON SA	(Vermon)	F
Spree Engineering Ltd	(Spree)	UK
Kauno technologijos universiteto	(KTU)	LT
University of Newcastle Upon Tyne	(UNUT)	UK
Kingston Computer Consultancy Ltd.	(KCC)	UK
Network Rail Infrastructure Ltd	(NR)	UK

RAILECT: Background

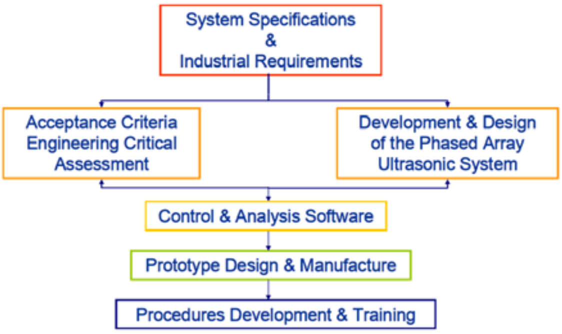
Partners interviewed:

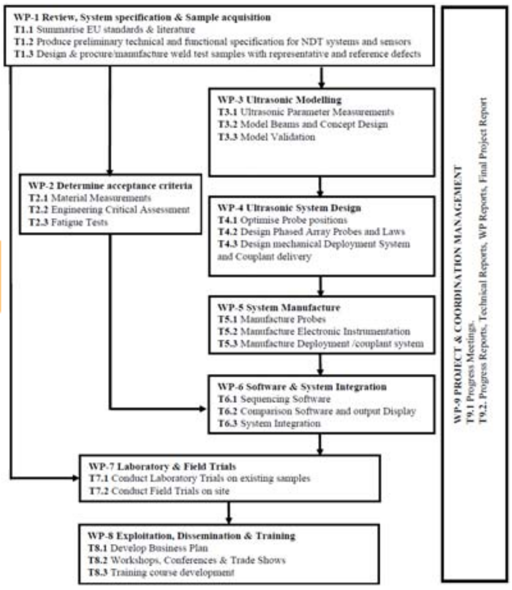
Organisation	Name of interviewee	Country
TWI	☑ John Rudlin	UK
UNUT	☑ George Kotsikos	UK

ERRAC *European Rail Research Advisory Council*

RAILECT: Background

Project description:





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RAILECT: Background

Project description ***(cont.):***

The project was divided into:
i. Data acquisition and design phase (WPs1-4); and
ii. Implementation phase (WPs5-8).

WP1. Review, System specification & Sample acquisition (led by Jarvis and Network Rail)

A review and system specification was produced to guide the overall work packages. At the same time test samples were procured / manufactured for testing the ultrasonic system and determining the acceptance criteria.

WP2. Determine acceptance criteria (led by TWI)

The acceptance criteria were generated by the Engineering Critical Assessment (ECA) and fatigue testing for different defects and locations in the weld. This created a new database of acceptable defects within alumino-thermic rail welds.

WP3. Ultrasonic Modelling (led by Vermon)

The design of the ultrasonic system required measurement of the ultrasonic properties of the weld, and incorporating the measurements into models to determine the beam behaviour and its interaction with defects in such welds. Furthermore the complex theoretical analysis of the beam enabled discrimination between reflected signals from the weld itself and volumetric defects.

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RAILECT: Background

Project description ***(cont.):***

WP4. Ultrasonic System Design (led by TWI)

The prototype was designed using information from WP3 to produce a complete design specification for the system. The first part of this process was to establish the optimum position of the probes, the parts of the system and phased array laws.

WP5. System Manufacture (led by Optel)

A supporting instrumentation, "hybrid of phased array and complex interrogation patterns", such as: tandem pitch-catch probes and highly focused beams operating in sequence was developed. The system produces signals that will be interpreted with algorithms to give an automatic assessment of defect size.

WP6. Software & System Integration (led by KCC)

Control and analysis software and output display was written, and integrated with the hardware. It was firstly compared with the data from WP2 and WP3 to establish the relationship between the ultrasonic images and the defect size. Finally it compared the data with the multiple acceptance criteria.

WP7. Laboratory & Field Trials (led by Spree)

The equipment produced from WP4 was tested and the performance checked. This has been done against the samples produced in WP1 together with some new samples. The equipment was taken on site to initial field trials.

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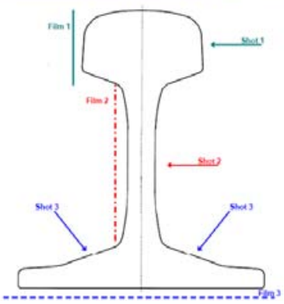
RAILECT: Background

Results – Conventional Inspection:

Radiographic Inspection of Welds

- Procedure for rail CEN60 E1
  - Associated document BS EN 1435 : 1997



In total, 3 shots:

Shot 1: Head

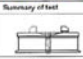
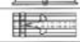
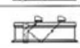
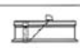
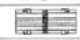
Shot 2: Web

Shot 3: Foot

Conventional Manual UT of Welds

Procedure for rail CEN60 E1

- Associated document BS EN 14730-1:2006 Annex C

Summary of test				
1	Test of head for non-planar defects		One 70° double crystal probe from both sides	2 MHz transducer
2	Test of head for planar defects		Two 70° single crystal probes (TX & RX)	2 MHz transducers (X2)
3	Test of web for planar defects		Two 45° single crystal probes in tandem with a positioning rig	2 MHz transducers (X2)
4	Test of middle of foot		One 45° single crystal probe from both sides	2 or 4 MHz transducer
5	Test of ankles		One 70° single crystal probe	2 or 4 MHz transducer
6	Test of toes		One 70° single crystal probe	2 or 4 MHz transducer
	Total number of probes required	6 or 7		

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European Rail Research Advisory Council

RAILECT: Background

Results – Conventional Inspection *(cont.):*

Comparison of the Results (UT/X-rays)

Sample	Defect	Radiography	Coventional Manual UT
RPS001	Non defective	Gas pores	No indications
RPS003	Non defective	Gas pores	No indications
RPS004	Non defective	Gas pores	1 indication in the web
RPS005	Porosity	Detected	Detected
RPS006	Porosity	Detected	No indications
RPS007	Porosity	Detected	No indications
RPS008	Porosity	Detected	Detected
RPS009	Porosity	Detected	Detected
RPS010	Porosity	Detected	Detected
RPS011	LoF	Gas pores detected	1 indication in the web
RPS012	LoF	Large gas pores detected	1 indication in the web
RPS013	LoF	Large and gross gas pores	No indications
RPS014	LoF	Large and small gas pores	No indications
RPS018 (S10)	Shrinkage	Detected	Detected
RPS019 (S11)	Shrinkage	Detected	Detected
RPS020 (S12)	Shrinkage	Detected	Detected
RPS021 (1RE)	Second batch of LoF	LoF along full length of web	No indications

- Results not consistent when the two techniques are compared
- Performance of radiography technique > performance of conv.manual UT
- Standard BS EN 14730-1:2006 Annex C not adapted?
- LoF difficult to detect using conventional manual UT

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European Rail Research Advisory Council

RAILECT: Background

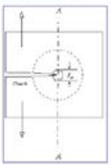
Results – Mechanical Testing:

- ❑ Fatigue testing of non defective and defective welds
- ❑ Evaluation of the weld rail properties for ECA calculations
  - ➢ *Tensile testing (parent, HAZ and weld)*
  - ➢ *Hardness*
  - ➢ *Fracture toughness testing*
- ❑ ECA used to determine the acceptance criteria

Testing carried out:

- Hardness measurements of the parent material, HAZ and weld metal
  - Brinell hardness measurements EN ISO 6506-1
  - Vickers hardness measurements EN ISO 6507-1

- Tensile testing
  - 2 specimens from the base metal BS EN 10002-1



- Fracture toughness testing
  - CTOD tests BS 7448-1
  - 3 specimens for each welding condition (parent material, HAZ and weld metal)

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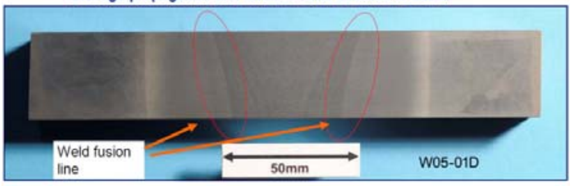
RAILECT: Background

Results – Mechanical Testing ***(cont.):***

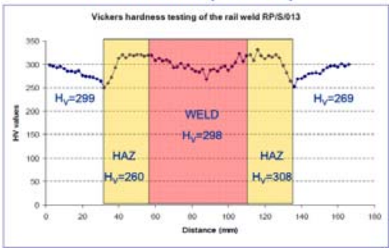
Fracture Toughness Testing

- Test results
  - All specimens failed in brittle fashion and displayed a low fracture toughness value
  - Failure mode is not a single event brittle fracture. A sequence of various cleavage propagation and arrest events seemed to occur.



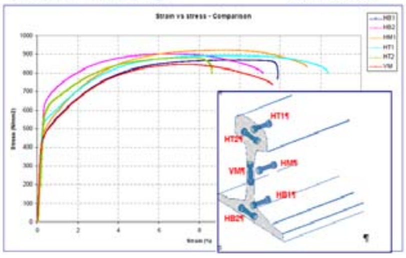
Hardness Testing

- Test results (RP/S/013)



Tensile Testing

- Test results



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RAILECT: Background

Results – Fatigue Tests:

Fatigue Test Results

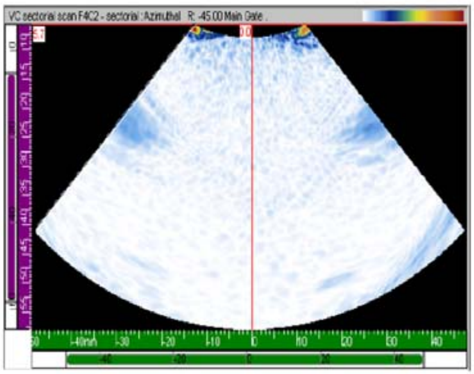
Sample Number	Frequency (Hz)	Stress ratio	Maximum stress (Mpa)	Minimum stress (Mpa)	Maximum load (kN)	State	Failure mode	No of cycles performed	Preliminary NDT
Production Welds									
RP/S/001	2	0.08	229	19	488	Runout	-	2.09E+06	R: indications UT: NRD
RP/S/002	5	0.07	245	17	582	Failed	In HAZ	1.48E+06	-
RP/S/003	2	0.09	221	20	469	Runout	-	2.00E+06	R: indications UT: NRD
Porosity in Rail Head									
RP/S/006	2	0.08	226	20	619	Runout	-	2.00E+06	R: indications UT: NRD
RP/S/007	2	0.10	254	26	615	Failed	In the weld	2.85E+05	R: indications UT: NRD
RP/S/010	1	0.08	238	20	586	Failed	In the weld	7.63E+03	R: indications UT: Indications
First Batch LoF									
RP/S/011	1	0.07	233	16	522	Runout	Parent material crack in the foot	7.73E+06	R: indications UT: Indications
RP/S/012	2	0.07	225	14	552	Runout	In HAZ	2.00E+06	R: indications UT: indications
Shrinkage Rail Foot									
S6	1.35	0.08	224	18	606	Failed	In the weld	3.17E+05	R: indications UT: indications
S8	1.6	0.09	222	21	515	Failed	In the weld	1.60E+06	R: NDR UT: indications
S9	1.5	0.08	225	19	529	Runout	-	4.26E+06	R: NDR UT: indications
Second Batch LoF									
1RE	0.5	0.08	239	21	380	Failed	In the weld	2.08E+05	R: indications UT: NRD
2RE	0.5	0.09	240	22	378	Failed	In the weld	4.07E+05	R: indications UT: indications

RAILECT: Background

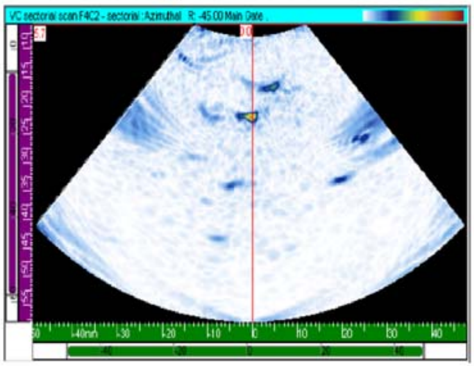
Results – Phased Array Ultrasonic System of Inspection:

Detection of Defects in Head

Non defective rail head



Porosity in the rail head

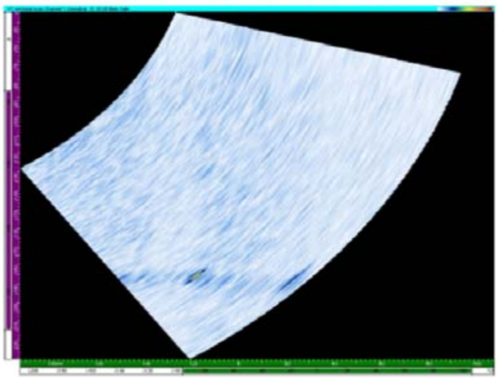


RAILECT: Background

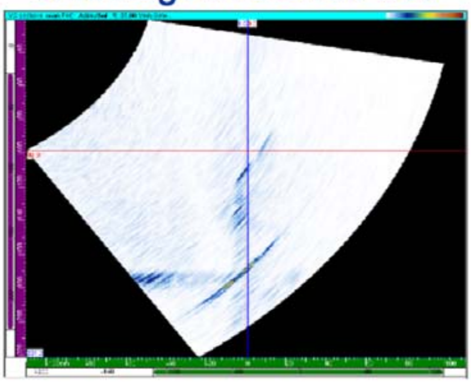
Results – Phased Array Ultrasonic System of Inspection *(cont.)*:

Detection of Defects in Weld Web

Non defective rail web



Shrinkage in the rail web



RAILECT: Background

Results – Phased Array Ultrasonic System of Inspection ***(cont.):***

Conclusions:

- The developed system is a semi--automated system ofautomated system of inspection of rail welds
  - Full volumetric inspection in 15 minutes!
  - No equivalent system available on the market
  - Very efficient and operator friendly system that can save time and resources
- Next stage:
  - Commercialisation of the Railect system
  - Further funding to be applied for to turn prototype into production system and to push it into market

RAILECT: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   – Yes, the results were implemented on TWI products/services (the test instrument).
   - No, there is no real commercialisation so far. However, a contract for inspections of rails was made with Hong Kog Railways where the Railect product was demonstrated. Several enquiries were made by China on the product. However as yet only demonstrations of the product have taken place and in China. Also the results of the product were used by TWI in inspections of the track in the new Docklands Light Railway.
2. Is new legislation and standardization based on findings from this research project
   – No
3. Are the results of the project implemented across Europe or only in a small number of Member States?
   – Yes, partly - the defect characterisation procedures are implemented in Europe. However the developed "test instrument" has not been commercialised yet. The prototype has been used in UK and Asia (where the only beneficiary of the contracts has been TWI !!!!)
4. Were the results of the project implemented outside Europe before being accepted in Europe?
   – No

European Rail Research Advisory Council

RAILECT: Evaluation

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
   – No.

6. Did the project increase competitiveness of railway transportation compared to other transport modes?
   – No

7. Are the results of the project taken into consideration when preparing public tenders?
   – No

8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
   – No

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RAILECT: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
   – No

10. Can benefits be assessed in financial terms?
    – Yes, they can be estimated on the income of one of the project partners that has been undertaking inspections using the RAILECT product. However, there is need for further development of the product for more wide use, in order to bring the cost down.

11. Applicability of results to future scenarios?
    – Yes, the technologies are still applicable for future rail track welding

12. Usefulness of research procedures for future projects (incl. modeling)
    - Yes

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RAILECT: Reasons for outcome

- ✓The technology is still high cost as it is still in the "prototype" phase. Partner TWI has already invested 120k euro on further development but still further work/investment is needed to have a "truly commercial" product on the market.

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RAILECT: Lessons learnt

- ✓The consortium underestimated the costs of bringing the product to market. One of the consortium members is exploiting the technology by "service provision" rather than sales of the RAILECT inspection instrumentation that could be marketed worldwide.

ERRAC *European Rail Research Advisory Council*

MARKET IMPACT EVALUATION

ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector :

- To make it more competitive
- To foster increased innovation
- To guide research efforts at the European level

ERRAC Project Evaluation Working Group (EWG)

Objectives:

- Determine the market impact of previous rail research to improve use of research funding
- Ensure a strategic approach to the prioritisation of rail research

Project Evaluation

- Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
- To ensure that the results of previous rail research can be taken into account for future projects
- To avoid weak market uptake of results by learning the lessons of previous research
- The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes

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ERRAC *European Rail Research Advisory Council*

ERRAC Project Evaluation Group

ACEM-Rail

acem_rail

EVALUATION FROM April 2016

Project acronym: ACEM-Rail
FP: 7
Programme acronym: FP7-TRANSPORT
Project Reference: 265954
Call identifier: FP7-SST-2010-RTD-1
Total Cost: € 3,849,273
EU Contribution: € 2,501,315
Timescale: December 2010- November 2013
Project Coordinator: Dr. Noemi Jiménez-Redondo
(CENTRO DE ESTUDIOS DE MATERIALES Y CONTROL DE OBRA SA - CEMOSA)
Web references: http://www.acem-rail.eu/

- ❑ Presented by: Eduardo Prieto and Aida Herranz
- ❑ Date evaluation: April 2016
- ❑ Market uptake: Strong
- ❑ Follow up projects: none
- ❑ Other related Projects: INFRALERT

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ACEM-Rail
Automated and cost effective maintenance for railway

Premise:

ACEM-Rail aims for the development of innovative solutions as well as the adoption of solutions from other industries in order to reduce costs, resources, time and impact on rail services due to maintenance activities. In that sense, infrastructure managers, railway operators, maintenance companies and users of rail services for both passengers and freight transport will benefit from the innovative solutions that ACEM-Rail is targeting.

The final goal is to reduce the cost and the interaction of maintenance interventions with railway services as well as to improve the quality, safety, reliability and sustainability of the railway system. As a consequence, the availability of the track for freight services will be enlarged.

ERRAC European Rail Research Advisory Council

ACEM-Rail
Automated and cost effective maintenance for railway

Rationale:

- Railway system requires of a high degree of safety and reliability.
- Railway infrastructure maintenance is one of the major issues representing the track around the 40% of total maintenance costs.
- As railway uses increase so does the need for maintenance while the availability of the track for maintenance tasks decreases.
- A major constraint is to avoid cut of rail services
- Inspection and maintenance of the track are still very little automated.
- Maintenance management is mainly based on cyclical preventive works and on costly corrective maintenance.

A close monitoring of the track (esp. the evolution of the parameters that determine track condition) together with an intelligent system to automate the planning of management would allow the evolution of a maintenance based on corrective/preventive actions to a more cost-effective model based on conditions/prediction. This is the aim pursued by ACEM-Rail.

European Rail Research Advisory Council

ACEM-Rail

Automated and cost effective maintenance for railway

Main Objectives:

ACEM-Rail project deals with automation and optimisation of railway infrastructure maintenance. This goal is supported by specific objectives in five different pillars:

1. Several track inspection technologies embarked on commercial trains.
2. Predictive algorithms to estimate the rail defects evolution.
3. Optimisation algorithms for cost-effective maintenance planning integrating the scheduling of preventive, predictive and corrective operations.
4. Technologies for the in-situ monitoring and reporting of maintenance execution.
5. Infrastructure management system integrating all the information with the tools for automation, optimisation and control of maintenance decision procedures

European Rail Research Advisory Council

ACEM-Rail: Background

Details

- **FP** 7
- **Project Reference** 265954
- **Total Cost:** € 3,849,273
- **EU Contribution:** € 2,501,315
- **Timescale:** December 2010- November 2013
- **Project Coordinator:** Dr. Noemi Jiménez-Redondo (CENTRO DE ESTUDIOS DE MATERIALES Y CONTROL DE OBRA SA)

Partners

1	CENTRO DE ESTUDIOS DE MATERIALES Y CONTROL DE OBRA SA – CEMOSA	Spain
2	UNIVERSIDAD DE SEVILLA	Spain
3	FRAUNHOFER	Germany
4	POLITECNICO DI TORINO	Italy
5	SECONDA UNIVERSITÀ DEGLI STUDI DI NAPOLI	Italy
6	OPTIM-AL	Bulgaria
7	DMA s.r.l	Italy
8	TECNOMATICA S.A.S.	Italy
9	SIEMENS	Germany
10	SCANMASTER SYSTEMS Ltd.	Israel

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ACEM-Rail: Background

Partners interviewed:

Organisation	Name of interviewee	Country
CEMOSA	Sergio Escribá Marín	Spain

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ACEM-Rail: Background

Project description (I):

The project is structured in **three main phases** and eleven Work Packages (WPs). These phases are described below, including the WPs involved:

PHASE 1:

The project starts with the state-of-practice analysis regarding current railway maintenance operations and other industries such as road, air and maritime transport. This allowS, on the one hand, to evaluate the railway infrastructure maintenance system in terms of cost, competitiveness and quality in order to perform comparisons, at the latest phase, with the ACEM-Rail developed technologies and procedures. On the other hand, technologies and maintenance processes in other industries (particularly in the road transport) are analyzed with the purpose of identifying best practices applicable to the rail sector.

> WP1: State-of-practice of maintenance in Railway & Other industries

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ACEM-Rail: Background

Project description (II):

PHASE 2: The development of innovative solutions for an automated and cost effective railway maintenance is performed at this stage. This is the main block of the project. Phase 2 includes the following WPs:

> WP2: Technologies and processes for the analysis of infrastructure condition
> WP3: Maintenance planning
> WP4: Execution and monitoring of preventive maintenance
> WP5: Execution and monitoring of corrective maintenance
> WP6: Infrastructure subsystems management

PHASE 3: The project ends with demonstration of the solutions and the analysis, dissemination and exploitation of the results. The phase 3 includes the following WPs:

> WP7: Solutions demonstration and results
> WP8: Competitive, quality, sustainability and environmental impact

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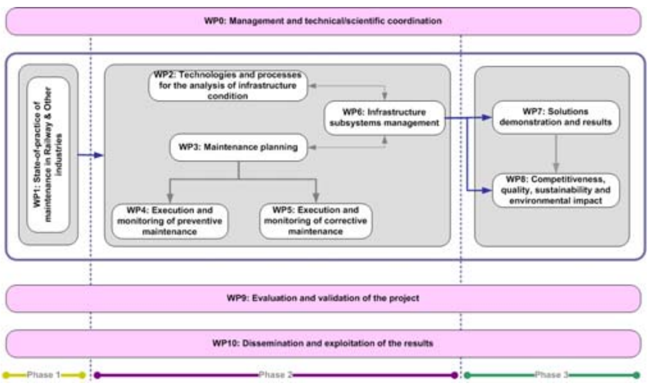
ACEM-Rail: Background

Project description (III):

In addition, three WPs involves the whole project duration and therefore are alive in the three mentioned phases. They are:

> WP9: Evaluation and validation of the project
> WP10: Dissemination and exploitation of the results
> WP11: Project Management



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ACEM-Rail: Background

Results and achievements (I):

The development of **inspection technologies** to evaluate track condition.

1. Fibre optic sensors distributed along track and structures

2. Thermographic testing system

3. Ultrasonic non-destructive fuzzy inspection

4. Hollow shaft acoustic system

5.Eddy Current distance sensor & accelerometers

6. Laser profiler and intertial pack for track geometry monitoring

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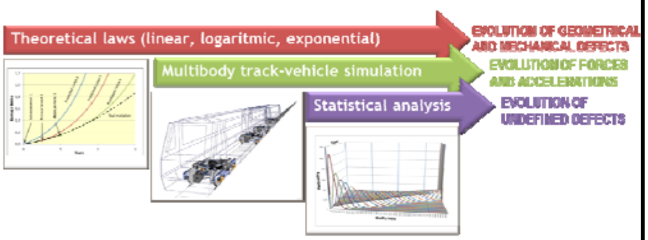
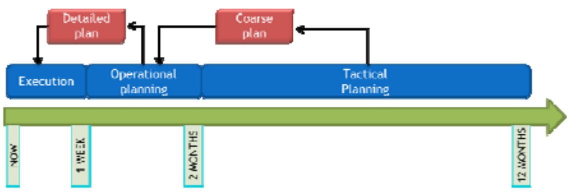
ACEM-Rail: Background

Results and achievements (II):

The development of **algorithms** for the identification of track defects and prediction of defect degradation.





The development of **algorithms and tools** able to schedule maintenance tasks in an optimal and robust to uncertainties way.

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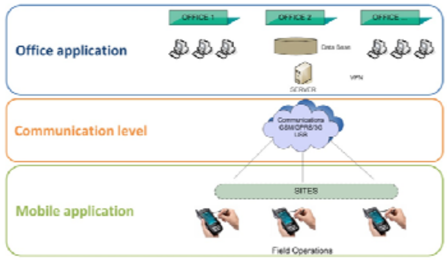
ACEM-Rail: Background

Results and achievements (III):

The development of a **comprehensive tool** able to compile all the information of the system and provide the shell to allocate Decision Support Tools to help railway infrastructure managers.

The development of tools based on **mobile computers** to bring the office to the field and assit operators in the inspecion, execution and reporting of maintenance tasks.



ACEM-Rail: Background

Results and achievements (IV):

The **demonstration of the technologies in two real scenarios**: The Wegberg-Wildenrath Test and Validation Center (Germany), owned by SIEMENS, and the railway line San Severo – Peschici (Italy), owned by Ferrovie del Gargano (FdG).

The definition of a set of 24 **Maintenance Performance Indicators** (MPIs) to evaluate the economic, social and environmental impact of the maintenance process.

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ACEM-Rail: Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation?
   Yes, several results became commercial products just after the project end, e.g.:
   - *the laser profiler and inertial pack developed by DMA (http://www.dmatorino.it/trackGeometry.html)*
   - *the field force automation system by OPTIM-AL (http://www.optim-al.com/bg_version/pages/zoom/29@FastyInspectorBrochure.pdf)*
   - *there was also a company born from the ACEM-Rail project, Optosensing s.r.l. (www.optosensing.it), dedicated to monitoring through distributed optical fibre systems, which was another inspection technology developed within this project.*
2. Is new legislation and standardization based on findings from this research project
   Yes, DMA belongs to the consultation group for the development of the standard EN 13848-5 and some conclusions on track geometry measurement from ACEM-Rail were taken into account.
3. Are the results of the project implemented across Europe or only in a small number of Member States?
   Across Europe.
4. Were the results of the project implemented outside Europe before being accepted in Europe?
   No.

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ACEM-Rail: Evaluation

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design?
   Not so much, since the products are commercialized by SMEs with low market share.
6. Did the project increase competitiveness of railway transportation compared to other transport modes?
   Not yet, but the developed technologies have the potential for it.
7. Are the results of the project taken into consideration when preparing public tenders?
   No.
8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability?
   No, not aplicable.

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ACEM-Rail: Evaluation

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality?
   No, not applicable.

10. Can benefits be assessed in financial terms?
    Yes, but these data are kept confidential by companies.

11. Applicability of results to future scenarios?
    The inspection technologies are applicable to trams, light rail and, some of them, also to high-speed railways.

12. Usefulness of research procedures for future projects (incl. modeling)
    The optimisation algorithms for maintenance planning, the logics implemented in the IMS for alert management and the evaluation framework based on MPIs are the core of a expert-based infrastructure management system being developed in the INFRALERT research project (www.infralert.eu), funded by H2020.

ACEM-Rail: Lessons learnt

- ✓ The project has to be realistic in setting objectives and try to be not too ambitious. It follows that project built on these lines will not achieve the expected results.
- ✓ Involvement of SMEs in R&D consortia has been a positive experience. SMEs are faster and more flexible to innovation and commercially exploiting research outcome. Most important whenever speed is important to arriving at the market before a competing organisation or technology does.
- ✓ The involvement of end-users to safeguard the actual application of knowledge produced is another important approach to take into account. Given the uncertainly to outcome, do not include end-users can limit the scope when it comes to market-oriented exploitation