



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

HUSARE

EVALUATION FROM SEPTEMBER 2007

Project acronym:	HUSARE	
FP:	4	
Programme acronym:	TRANSPORT: Specific RTD programme in the field of transport	
Project Reference:	RA-97-RS-2094	
Call identifier:	The 4th Call for Proposals	
Total Cost:	€ 1,208,493	<input type="checkbox"/> Presented by: L. Velardi
EU Contribution:	€ 900,000	<input type="checkbox"/> Date evaluation: 11.12.07
Timescale:	January 1998 - January 2000	<input type="checkbox"/> Market uptake: Weak
Project Coordinator:	Ruediger Wiedenmann (TÜV EURO RAIL)	<input type="checkbox"/> Follow up projects: HEROE
Web references:	http://cordis.europa.eu/transport/src/husare.htm	<input type="checkbox"/> Other related Projects: None



European Rail Research Advisory Council

ERRAC Project Evaluation Group

HUSARE - HEROE

Meeting of 11 September 2007



HUSARE & HEROE Projects:

Premise:

The HUSARE and HEROE projects were created by the EC in view of the foreseen implementation in the European Railway system of ERTMS/ETCS and introduction of the technical standards of Interoperability for train control, with the aim to achieve efficient and seamless cross-border rail travel not only through harmonisation of safety regulations specific to signalling and traffic management (HEROE, HUSARE), but also by assessing the risks involved in the need for the human interface to adjust rapidly to the new logics (HUSARE).



HUSARE: Background

(Human Safe Rail in Europe)

*Managing the Human Factor in Multicultural Multilingual Rail Environments
Human Factor Analysis Techniques for Cross-Border Rail Operations*

Rationale:

The overall rationale of the project, as of other similar ones dealing with human factor for other forms of transport, was summed as follows:

*“Efficient and safe transport systems in Europe need to put prominent focus on contributing human factors in all respects. Whether the behaviour of human operators or users of transport services is considered, or sometimes rapidly changing working conditions are causing problems, the required solutions cannot be limited to the technical side. **Human centred approaches are encouraged for enhancing transport systems, in particular for those with the highest demand for technological improvement, RTD is delivering practical tools, guidelines and recommendations to underline the successful implementation policy measures that respect the human element, and demonstrate the suitability and benefits of new concepts.**”*

(from: Thematic Synthesis, Extra Project, EC Transport RTD prog., IVth Framework Programme, Paper 8, Human Factors, Aug.2001)



HUSARE: Background

(Human Safe Rail in Europe)

Objective:

The overall objective of the HUSARE project was **to develop and test a toolkit of human factor analysis techniques**, to provide the EU Railways with the **means to identify and manage the human related risks in safety critical tasks, in cross-border operations, so as to increase safety, efficiency and reliability in Trans-European rail travel.**

The aim was to develop **a practical toolkit of analysis techniques for railway operators** that allowed to identify possible human errors, offer available recovery measures and risk introduction strategies related to cross-border rail operations.



HUSARE: Background

(Human Safe Rail in Europe)

Details

- **FP4**
- **Project Reference** **RA-97-RS-2094**
- **Total Cost:** **1,208,493 Euro**
- **EU Contribution:** **900,000 Euro**
- **Start and end date:** **01.01.98 to 31.01.00**
- **Scientific Coordinator:** Dipl.- ing. Ruediger WIEDENMANN (retired)
Address: TÜV EURO RAIL

- **Contact person for information:** **Susan Reinartz**
formerly in TÜV Rheinland Anlagentechnik GmbH
Regionalbereich KÖLN GmbH
now in European Rail Agency
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NB: The project was funded jointly by DG VII, CEC, (Framework IV, Transport RTD Programme) and UIC.



HUSARE: Background

(Human Safe Rail in Europe)

Partners

<u>Organisation</u>	<u>Type</u>	<u>Country</u>
TER - TÜV EURO RAIL	Software, Testing & Certification Co	DE
DNV - DET NORSKE VERITAS A/S	Independent Risk Based Certifier	NO
ERRI - FOUNDATION EUROPEAN RAIL RESEARCH INSTITUTE	Rail Research Institute (closed 2004)	NL
HRA - HUMAN RELIABILITY ASSOCIATES LTD.	Human Factors Consultancy	GB
SNCF - SOCIÉTÉ NATIONALE CHEMINS DE FER FRANÇAIS	French Railway Operator	FR
TAT - TÜV RHEINLAND ANLAGENTECHNIK GMBH – REGIONALBEREICH KÖLN	Consultant & Certifier	DE
HR - HALCROW RAIL	Rail Safety Consultant (ex British Rail Safety Directorate staff)	GB

NB: Being it a project dealing with cross border travel, **it is singular that only one Railway company (SNCF) was among the members of the project**, though many members of other European railway companies were interviewed during the scenario work.

At the time only SNCF was interested in joining in the project promoted by TUV, and since the EC gave approval, the project was started. TUV was in contact with DB that did not join but took part in interviews.



HUSARE: Background

(Human Safe Rail in Europe)

Partners interviewed:

<u>Organisation</u>	<u>Name of interviewee</u>	<u>Country</u>
TER - TÜV EURO RAIL	<input checked="" type="checkbox"/> Rüdiger vom Hövel Prokurist / Director	DE
DNV - DET NORSKE VERITAS A/S	<input checked="" type="checkbox"/> Terje Andersen	NO
ERRI - FOUNDATION EUROPEAN RAIL RESEARCH INSTITUTE	<input type="checkbox"/> Rail Research Institute (closed 2004)	NL
HRA - HUMAN RELIABILITY ASSOCIATES LTD.	<input checked="" type="checkbox"/> David Embrey	GB
SNCF - SOCIÉTÉ NATIONALE CHEMINS DE FER FRANÇAIS	<input type="checkbox"/> Yves Mortureux (not found)	FR
TAT - TÜV RHEINLAND ANLAGENTECHNIK GMBH – REGIONALBEREICH KÖLN	<input checked="" type="checkbox"/> Susan Reinarz (now in ERA)	DE
HR - HALCROW RAIL	<input type="checkbox"/> Rail Safety Consultant (ex British Rail Safety Directorate staff)	GB



HUSARE: Background

(Human Safe Rail in Europe)

Project description:

The project was to provide analysis techniques to aid the implementation of cross border operation and contribute to safety of operation by identifying the possibilities for human error and proposing measures to prevent error of train crews dealing with differing technological systems, languages, operational rules, procedures and practices, for both their “home” and “foreign” infrastructures, in normal and degraded conditions.

A **risk-based approach** was adopted in this project.

This more specifically implied the following activities:

- Analysis:

- human factor analysis techniques were **applied to 8 selected test scenarios using hazard and risk analysis related to cross-border rail operation under normal and degraded conditions and in emergency situations.**
- carrying out of a survey, **developing a framework and toolset for the analysis of human aspects of railway operations**, taking into consideration the balance between safety systems and increased traffic;
- **analysis of existing rules and procedures of different countries** for cross-border operations and identifying contradictory and inadequate rules and procedures as well as their associated risks;



HUSARE: Background

(Human Safe Rail in Europe)

Project description:

- **Definition of tools and techniques for general risk and human reliability analyses** of cross-border operations with particular reference to future structural changes in railway operations. This lead to the **development of a practical toolkit of techniques for rail operators**. The toolkit provided for a structured approach to the management of human factors in cross-border operation (both existing and proposed routes)
- Definition of tools and techniques to be used for **staff training**
- **Proposal of modifications and harmonization of rules** and procedures to minimize risk and maximize reliability of train operations;
- **Exchange and discussion of the respective results from HUSARE work packages with HEROE representatives** since three partners of HUSARE were active in HEROE (this activity was not so prolific, due to difficulties encountered during the project and the one-year interruption of HEROE due to re-writing of ERTMS specifications);



HUSARE: Background

(Human Safe Rail in Europe)

HUMAN FACTOR ISSUES IN TRAIN OPERATION

The study was based on assumption that **train crew** being a vital safety factor in rail operation, however are **not infallible** and a structured approach to analysis of human factors could **reduce risk of human error**. **Factors** included but were not limited to :

- **time stress** (such as meeting Timetable/operational requirements)
- **limited information available or visible** for few seconds – specially with increasing speeds (eg. Line-sided signals)
- **automation of control (ATC) systems and effects on human performance** (eg. Dependence on automatic train control systems or ability to intervene in event of system failure or unexpected circumstances)

Focus was put on psychological influences on train driver behaviour to identify possible human error relating to:

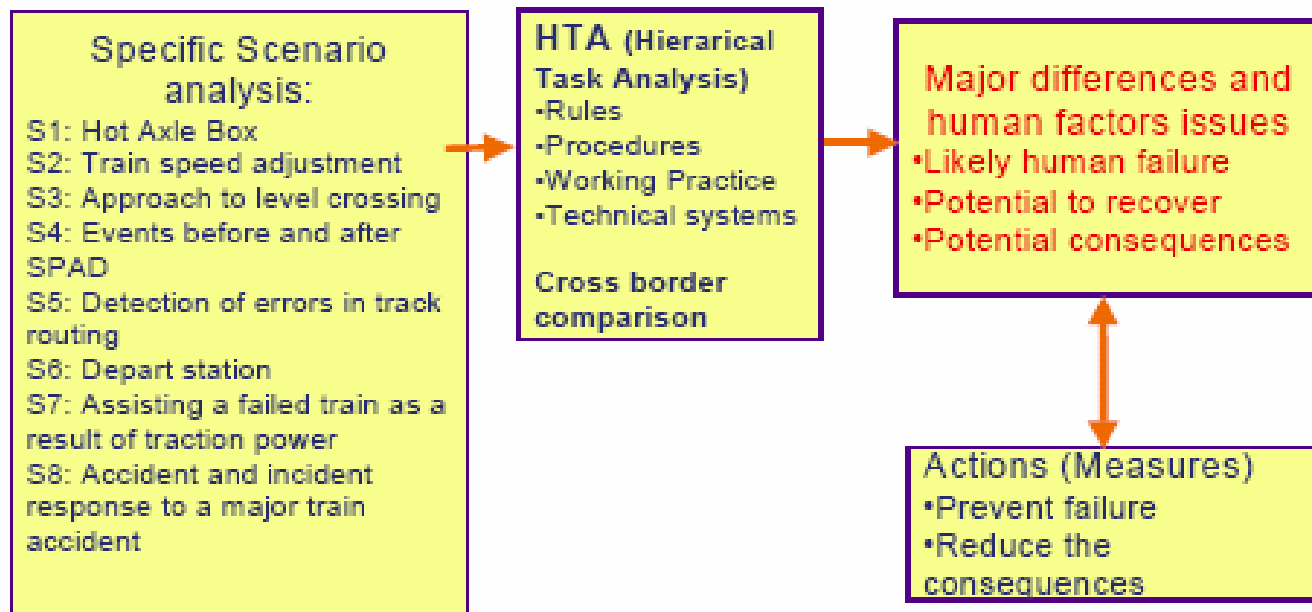
- **difference and similarities between infrastructures** (eg. same code/colour used with different meanings i two infrastructure)
- **experience and skill development** bring drivers to develop subconscious braking and attention strategies that might not work on other networks
- **unusual and stressful situations** could create a tendency for train crew to revert to behaviour appropriate in their home infrastructure when faced with unfamiliar or emergency situations

HUSARE: Background

(Human Safe Rail in Europe)

HUSARE APPROACH

HUSARE : Human Safe Rail in Europe, Managing the Human Factor in Multicultural and Multilingual Rail Environment (9/3-2000)

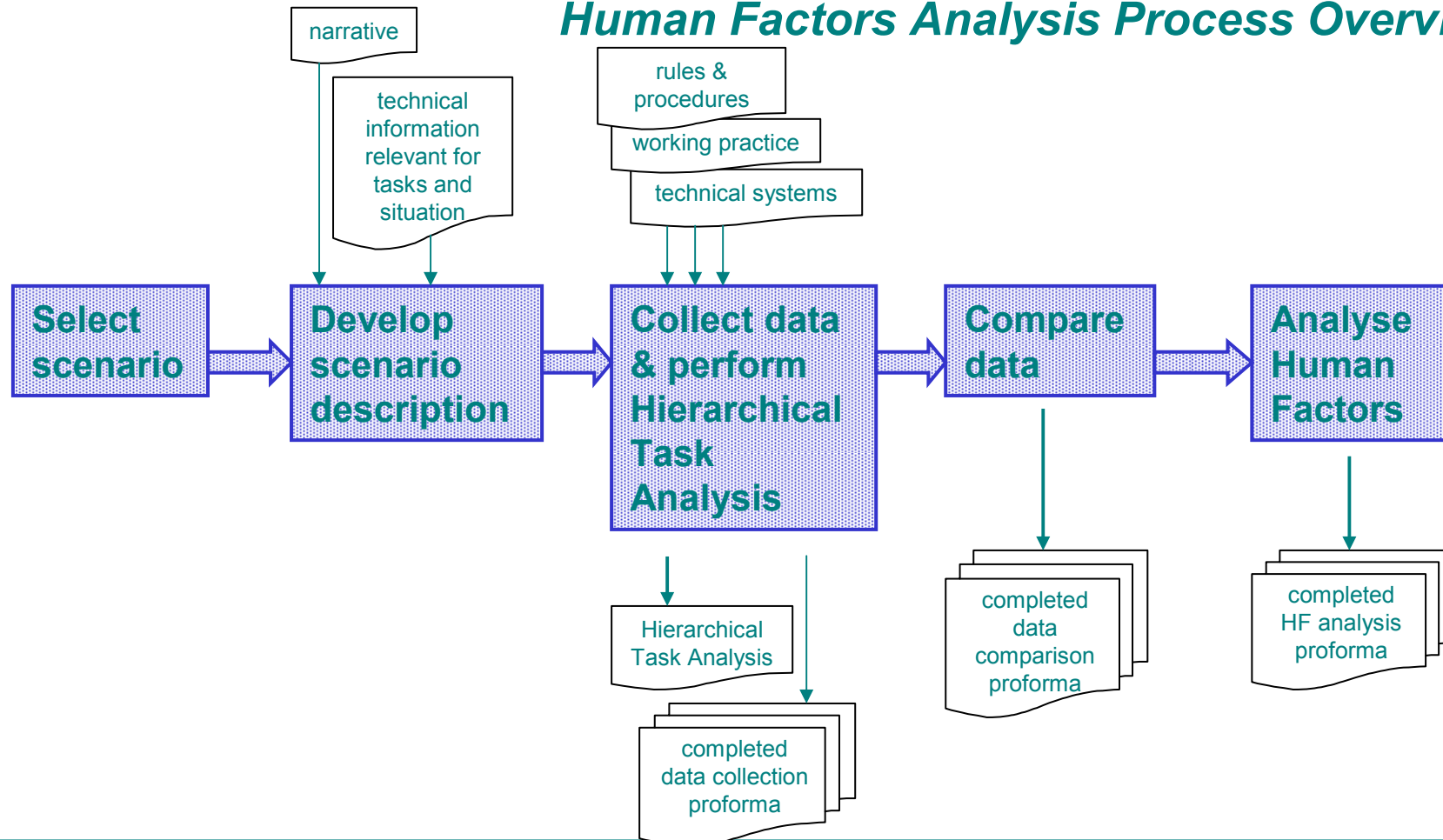


Source: SINTEF Report, September 2003 (Study on Safety Culture at interfaces for the International Union of Railways UIC)

HUSARE: Background

(Human Safe Rail in Europe)

Human Factors Analysis Process Overview

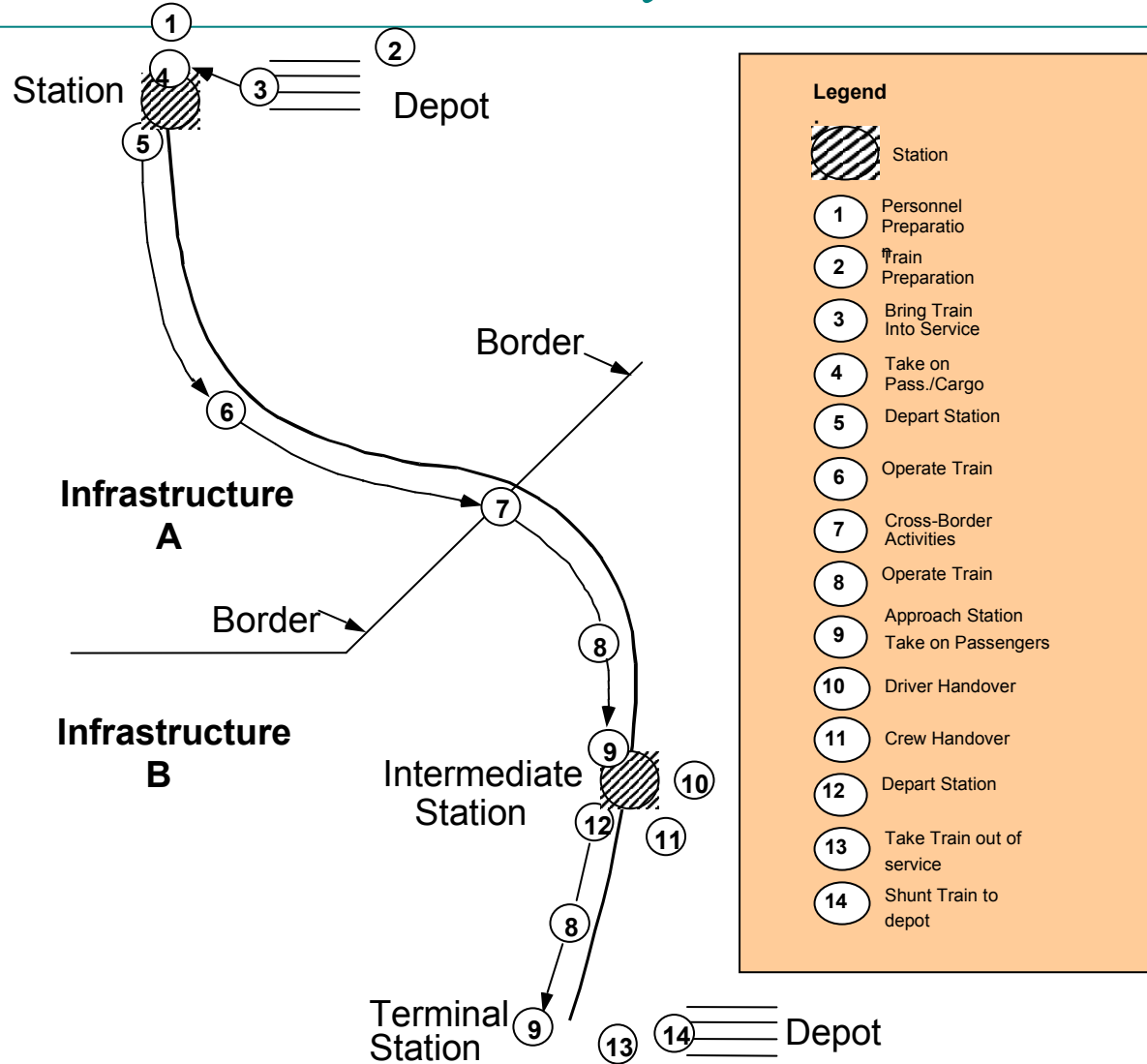




HUSARE: Background

(Human Safe Rail in Europe)

Topographical representation of cross-border operation



Source: HUSARE Workshop, Utrecht, NL – Jan. 2000

HUSARE: Background

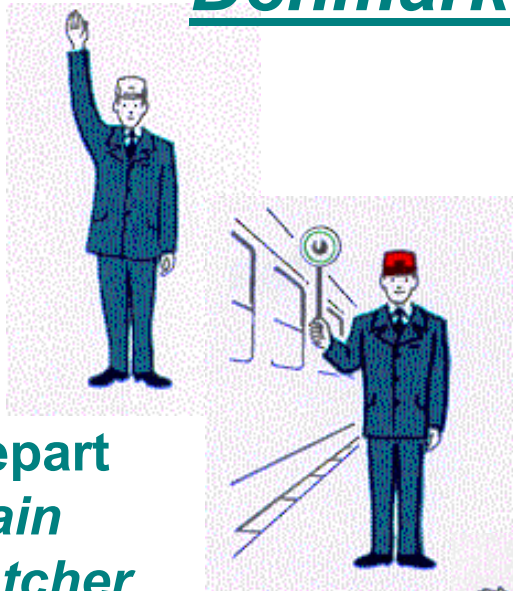
(Human Safe Rail in Europe)

Example: Depart Station

Denmark

Germany

1. Ready
Train
Crew



1. Ready
Train
Crew



2. Depart
Train
dispatcher

2. Ready
Train
manager

3. Finished
Train driver
Light on train

4. Finished
Train
manager



3. Depart
Train
dispatcher





HUSARE: Background

(Human Safe Rail in Europe)

THE 8 TEST SCENARIOS ON EUROPEAN CROSS-BORDER ROUTES

The analyses of selected scenarios were based on comparison of rules, procedures, technical systems, standards and working practices in the following European rail infrastructures (run through interviews and site visits):

- **Sweden/ Denmark/ Germany** : **S2, S4, S6**
- **UK / Eurotunnel / France** : **S1, S2a,b,c,d, S4a,b, S5a, S7**
- **Germany/ Netherlands** : **S3, S4a,b, S6, S8**
- **Austria/ Germany** : **S2b,e**
- **Italy/ France** : **S2a,c,e**
- **Belgium/ Germany** : **S1, S3**



HUSARE: Evaluation

Achievements:

HUSARE was finalised in January 2000 .

At the end of the analysis a **workshop was organised in Utrecht,NL**, to share and discuss methodology and results with key representatives from European Rail industry (31 participants from 27 countries).

The key results produced by HUSARE were:

- **Selected human factor analyses techniques** which were applied to the eight test scenarios comprising hazards related to cross border operations under typically degraded and emergency situations;
- **A practical toolkit of techniques** for railway operators including the following main features:
 - a) data collection comparison techniques** and documentation forms for rules, procedures and operational practices, in order to identify differences in rail infrastructures and connected human factors issues;
 - b) human factor analysis techniques**, to identify possible human errors, available failure recovery measures and risk reduction strategies; and
- **Suggestions for possible risk reduction measures**, based on the analysis of the specific test scenarios.

“Responsibility for the actual use of the toolkit was left to the European railway companies who would need to ensure safe operations. Dedicated policy measures to promote the implementation of the toolkit and to foster its introduction as a common European standard, was recommended at the end of the project.” (Source: EXTRA\ THEMATIC PAPER 7\ 31 august 2001\ Safety and Security – Issued by the EXTRA Project within the European Community’s Transport RTD Programme – Fourth Framework Programme.)

HUSARE: Evaluation

Achievements:

It was the first time the expertise on human factor risk management was brought in from other industries and applied to the analysis of possible consequences of human error related to rail systems operating with different technologies. Focus was mainly put on diversity of rail signalling systems.

The project provided:

- **awareness** to the need of a unified approach
- **a methodology** to apply human factor risk management to a rail context (considering effect of infrastructure technology diversity on human factor)
- **first hand knowledge** for the test scenarios from the interviews to European railway undertakings involved,
- **task analyses and prioritization of activities** in case of failures or emergency.
- **analysis of function requirements** defined in the core ERTMS/ETCS Function Requirements Specification (FRS) (Version 4.0)
- **elements regarding human risk factors** .

“At the conference organised by the ERA Safety Unit last November (cfr. 2006), there were strong indications that the importance of Human Factor is now being recognised - need for actions, rather than only spoken references to its importance. Perhaps the value of the Husare project will be reconsidered in the light of these developments.”

from interview with Susan Reinartz

HUSARE: Evaluation

Evaluation criteria:

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 results of HUSARE fed partly into the HEROE project, in relation to the methodology for the risk analyses, but it was left to the European partners involved to implement the application of the findings, and the toolkit developed, into their organization. (As far as we know, none of the European Railway undertakings implemented the results.**
2. Is new legislation and standardization based on findings from this research project
– **No, but the project results and methodology were used as input for the rules built in the HEROE project and in the Operational Rules Group (of EEIG-ERTMS) that built the operational rules based on the new ERTMS specifications, which were absorbed into TSI Operation**
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**



HUSARE: Evaluation

Evaluation criteria:

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
– **yes, potentially it offered a model that the railway undertakings could use and actually generated calls for proposals (in FP5)**
 - **in 1999, to develop and validate training methods to be used for the training of crews, traffic control staff and other staff involved in cross border operations, closely linked to the directive on interoperability of conventional rail**
 - **In 2001 for a new approach to railway safety management**

HUSARE: 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 – **no**
10. Can benefits be assessed in financial terms
– **not applicable**
11. Applicability of results to future scenarios
– **yes, with reference to the new ERTMS specifications**
12. Usefulness of research procedures for future projects (incl. modeling)
- **The HUSARE experience was useful to the projects that followed and provided guidelines and a methodology for future implementations. Members of the HUSARE work groups later worked on the HEROE project and on the construction of the TSI OPE and other projects for ERTMS and in ERA.**

HUSARE: Reasons for outcome

- **The project was carried out in a period in which the railway undertakings were heavily involved in the transition and definition of new functional requirement standards (FRS) and system requirement specifications (SRS), which were finally approved for the ERTMS/ETCS system by UNISIG, after the project ended.**
- **Therefore the project did not meet the interest of the railway undertakings, who did not participate fully to the elaboration of the project itself, which in fact was carried out by companies that had done risk analyses in other industries.**

HUSARE: Reasons for Outcome

- **In the case of the HUSARE project, before the call for proposals there was no previous action done to ensure that the railway undertakings, which were to benefit from its results, would be interested in participating and take an active involvement in the project itself (only SNCF participated in the project). This brought to results that were never implemented, since they were not applicable, though the methodology of analysis proved of some use to those members that worked also for the HEROE project.**
- **The railway undertakings were already dealing with such issues internally and probably did not see the point in having to share their experiences with experts external to the industry and with potential competitors.**



HUSARE: Lessons learnt

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