Integrated Project

F A S T E R

Facilities for ***A***ccelerated ***S***ervice ***T***esting and ***E***xecution for ***R***ailways
(A European Institution)

Priority thematic areas of research in FP6:
1.6.2.2 Making surface transport safer, more effective and more competitive
1.6.2.1 Developing environmentally friendly transport systems and means of transport
Support of policies and anticipation of scientific and technological needs

I Need and relevance

This paper describes the need of an integrated project for the creation of European test facilities of railway components under the leadership of a self-financing European institution. It is meant to accelerate new developments which are needed by railways to achieve the intended market share in the next two decades. Respective rail organisations together with CEC plan to increase rail traffic in the passenger sector by 40% and in freight by 70%. The respective shares in the transport market will then be 12% and 15% respectively. To achieve these overall goals railway organisations like UIC and UNIFE define and try to solve together with their members very ambitious challenges in different sectors:

Provision of an efficient network
- Double capacity of lines
- Reduce door-to-door travel time by 25% to 50%
- Increase rail average speed (to 150 km/h (P), 80 km/h (F))
- Implement interoperability at low costs
- Extend high-speed network
- Increase axle load
- Develop a dedicated freight network (>25t)
- Integrate transport systems, networks (e. g. with light rail)
- Increase punctuality to >95%
- Increase reliability and availability (maintenance free)

Guarantee of economic operation and construction, e. g.
- Halve costs per passenger- and ton-km
- Reduce LCC for production factors
- Increase productivity of infrastructure, rolling stock, staff by a factor of 2 to 4
- Make use of automation
- Reduce maintenance costs by 50%
- Exploit economies of scale

Amelioration of the positive balance for the environment and safety, e. g.
- Improve advantages compared to other modes (energy, pollutants)
- Reduce noise emission to 69 dB (freight) and 83 dB (high-speed)
- Reduce internal rail fatalities by 75%
- Reduce fatalities caused by externalities by 75 %
- Ensure safe transport of dangerous goods
- Provide emergency and rescue measures

On their way to solve these issues railways encounter big problems. Networks are already congested today. Higher speeds and traffic volumes will again increase the emission of pollutants and noise. It will also lead to higher wear, increase the probability of fatalities and adversely effect safety (This is one lesson learned in the accident at Hatfield together with experts of TTCI of USA). The time to market for new rail products is considerably higher than for other modes. (E. g. for new track systems > 40 years, for automatic switch diagnosis > 20 years, for ERTMS under development > ?)

It is not obvious at all that the above stated challenges will be met without specific measures. The positive instruments of *Networks of Excellence* and *Integrated Projects* will certainly contribute to an increase in knowledge. But they are difficult to manage and the co-ordination (of the broad field of activities with numerous participants) towards realisation and execution of necessary new services in the available short time frame till 2020 may not be feasible.

The rationale for this proposal is the conviction that without precise activities aiming at the mobilisation of synergies by the creation of facilities for accelerated testing and realisation of new services *(FASTER)*, the existing problems will not be solved, at least not fast enough. In addition *FASTER* as a central platform for research and development is regarded as necessary for the demonstration of the economic advantage and strategic importance of the rail mode. It provides a competitive edge for the railways compared with other modes and especially also for the rail industry having markets outside Europe in mind.

II Scale of Ambition and Critical Mass

The development of a new product from idea to service realisation depends on the positive passing of the following principal steps

- Idea, how to solve a problem
- General investigations on state of the art, necessary technical design, potential market
- Theoretical analyses, e, g. using modelling and simulation
- Prototype development with technical specification
- Laboratory tests of specific features with regard to technical specification
- Market analysis for potential users, basic business concept
- New concepts, product modifications
- Field tests with regard to intended service performance
- Check of RAMS figures (very important for railways, safety assessment)
- Establishment of business concept with financing needed
- Production line
- Service implementation

To achieve short times to market, the simulation and modelling of the service behaviour of a product gains growing importance. In the railway sector the assessment of reliability, availability, maintainability and safety is also of primary concern. National and European safety authorities have to be engaged who generally require tests under realistic conditions. Part of these tests may be performed under laboratory conditions, but generally field tests are indispensable covering influencing factors due to seasonal changes in temperature, precipitation etc. In these field tests it is of the first importance to have reliable and consistent data about the service performance of new equipment under operational load. For a number of reasons it is difficult to generate this data in the live railway track. These reasons include

- Disproportionate expense of installing and removing components to be tested
- Difficulty of safe access for scientific staff to examine components
- Reluctance of infrastructure owner to permit installation of untested equipment (safety)
- Difficulty in maintaining consistent conditions
- Long time lapse to achieve very high service usage volumes
- Difficulty in operating tests on equipment in near-defective state (for example when testing resilience).

There exist three big field test centres with test tracks (Germany, Czech Republic, Poland) within Europe. A lot of smaller field test centres are run by railways in their national R&D centres, in industry and research organisations. But the facilities they offer do not cover all existing needs. High speed operations and heavy load traffic e. g. cannot be tested satisfyingly and corresponding developments have to be examined in normal lines with disadvantages mentioned above. In the present situation with high traffic densities it is also nearly impossible to find a line on which innovative solutions can be tested under representative and consistent conditions. This difficulty relates to many areas like e. g. the investigation of techniques for noise and vibration reduction which depend on the interaction of track and vehicle.

In addition to field test centres several laboratory test beds are used by railways, industries, research organisations and safety assessment centres. Under laboratory conditions very often the interaction of the tested equipment with other equipment cannot be investigated under realistic conditions. The main interactions between classes of equipment may be summarised as those between

- track – vehicle
- train control – train protection
- control centre – driver's cab
- catenary – pantograph

which are also in the centre of harmonisation and creation of interoperability standards for the EU on their way to a single European railway system.

The depicted specific problems of railways contribute massively to the long innovation cycles in the rail sector. As a support of EU-policies and for the solution of scientific, technological and organisational needs it is therefore proposed to initiate the establishment of the European institution *FASTER* which offers services for the shortening of the innovation cycle for railway products (Fig. 1) with a natural drive into interoperability.

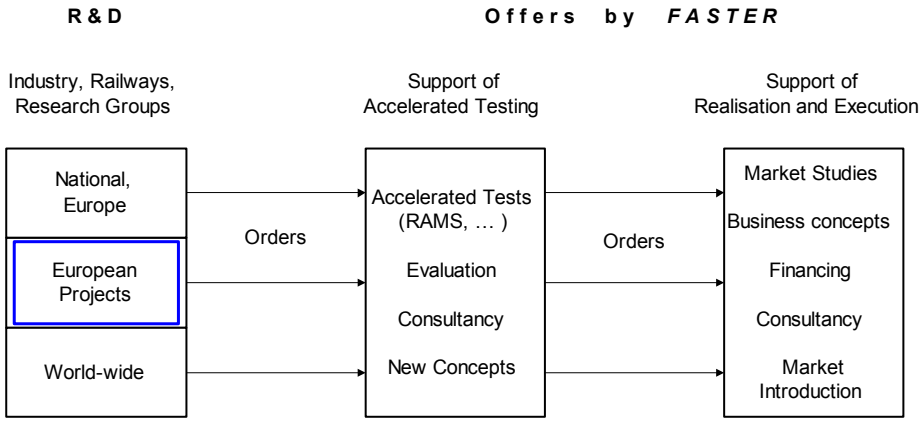

Fig. 1 Services offered by *FASTER*

It is intended to assist in innovations, accompanying steps from theoretical analyses right through to the final business concept, including RAMS investigations and economic aspects.

By the integration of players already on the market this institution will be self-financing.

III Integration

For the implementation of *FASTER* with an organisational concept as shown in Fig. 2 a horizontal integration of facilities across Europe for the acceleration of tests and execution of services is proposed. Five thematic focal points for services including the realisation of interfaces are foreseen. This will include resources (hardware, experience, personnel, capital) offered by the three field test centres and many smaller test and laboratory centres. This does not necessarily mean the spatial integration but certainly the organisational integration of resources.

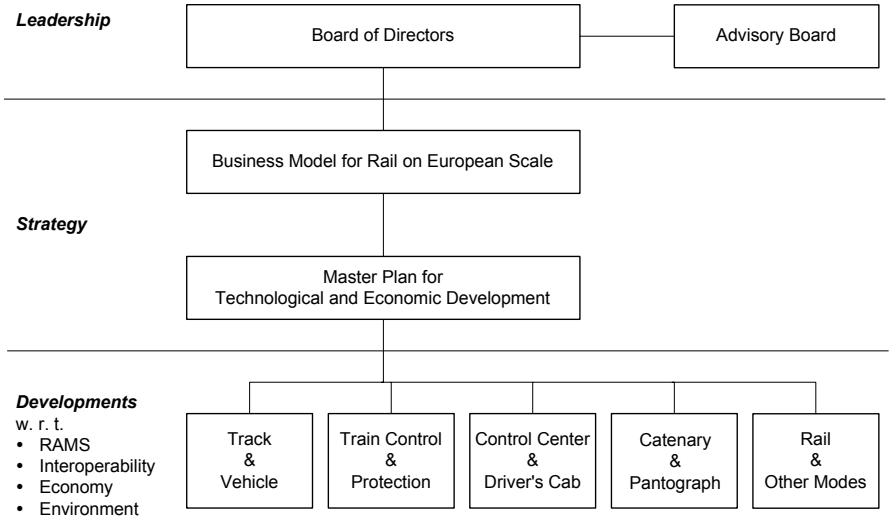

Fig. 2 Organisational concept of *FASTER*

Considering the fact that now already a lot of investigations in national R&D centres are carried out with regard to interoperability, the transition of hitherto national resources into *FASTER* may be a process that is facilitated by economic and organisational advantages on national level. In addition the construction of necessary new facilities for accelerating product developments (high speed sector, heavy load traffic, interfaces to other modes, light rail...) will attract partners from industry and research, who can place their orders and may provide resources for the construction.

The development carried out in *FASTER* is governed by the overall goal of increased market share in the next decades. But this needs a precise translation into a strategy, how the business can really be made and which developments, products, services should be realised with a clear time scale for completion

according to a priority list based on business needs. This is defined in the Master Plan for Technological and Economic Development based on the Business Model for European Rail.

The strategy for work in *FASTER* is developed under the leadership of the board of directors which are assisted by an advisory board. Members of the executive board should stem from organisations providing resources for *FASTER*. Primarily this will be the European railways with infrastructure and operating companies. Confinement to this sector may be very advantageous, because this group has to organise the traffic, to perform the transport, to make the core business on the European transport market. An opening towards industries which provide big resources for the operation of *FASTER* have to be organised in such a way and with primacy on European rail transport needs that their interests of marketing products world-wide contributes to a clear mission of *FASTER* without conflicting strategies due to different business concepts.

The advisory board comprises partners from policy, customers, authorities, industry, research, international organisations like UIC, UNIFE, CER, UITP etc.

FASTER is deemed to be self-financing based on the resources (hardware, experience, personnel, capital) provided by stakeholders and on the income from contractual developments.

Strategic issues in policy and research to be promoted and accelerated by *FASTER* are:

- Continuous development of business concepts for rail on European level
- Concentration on European instead of national developments
- Inherent drive into interoperability and standardisation which will unlock economies of scale
- More optimal exploitation of existing and new resources to avoid duplication and chance to increase rail R&D budget which up to now is lower than average in the transport sector
- Integration of all disciplines needed for the realisation of services
- Closer integration of railway (infrastructure and operation) and manufacturing industry
- Consistent conditions for test of new products with controlled changing of parameters
- Accelerated input from experiments into practical developments with optimised LCC figures whereas it normally takes decades to get feedback for refined product development
- Basis for development of modelling and simulation tools by giving facilities for validation
- Promotion of harmonised and interoperable developments
- Development and validation of charging regimes (incorporating track, vehicle, sound, vibration, pollutants)
- Test of safety issues with free access to equipment
- Integration of rail with other modes through testing and comparing solutions in a test bed
- Optimisation of materials and mechanics for rail/wheel contact
- Emission reduction
- Development and training of emergency and rescue methods
- Knowledge serving as decision support for financing of the European rail system
- Education on all levels (contact point for students to get familiar with rail under system aspects, test and propagation of harmonised maintenance procedures, ...)
- Regular dissemination of information on business concepts and progress

The realisation of *FASTER* is proposed in two steps:

Step 1: Masterplan for the implementation of *FASTER*

Tasks: Study of resources available from stakeholders, thematic key issues, different organisational concepts and acceptance, missing facilities to be constructed, support by stakeholders, proposal of the principal office, elaboration of the masterplan

Duration 1 year, funding 1 Mio Euro (10 persons representing stakeholders working continuously)

With the expected positive outcome and broad acceptance the second step would be initiated by CEC:

Step 2: Implementation of *FASTER*

Tasks: Physical and organisational integration of the resources, construction of the new facilities, starting of first development activities, initial financing aids from CEC decreasing over time

Duration 5 years, funding 10-30 Mio Euros (depending on the number of new facilities to be installed and based on a permanent team of 30 persons)

After this phase *FASTER* can execute its service as a profit oriented European institution on its own resources.

IV Preliminary list of partners

A. Partners engaged in the development of this EoI or knowing and supporting it

Organisation (in alphabetical order)	**Country**	**Name of person**	**Expertise w. r. t. *FASTER***
Agency for Industrial Planning GmbH	Germany	W. Pieper	Engineering company
AS Oslo Sporveier	Norway	R. Bergstrand	Railway operator
Bane Partner – NSB	Norway	J. Fossli	Railway operator
BSL-Consulting	Germany	Dr. H. Bente	Business concepts, maintenance, LCC
Ceske Drahy, s.o.	Czech Republic	D. Marusicova	Diagnoses of infrastructure, signalling and rolling stock, railway research institute incl. test circuits and corresponding facilities
Cracow University of Technology	Poland	Prof. Dr.-Ing. habil. W. Czyczula	Railway transport, track structure and maintenance, transport economics
Czech Railway Research Institute	Czech Republic	Dr.-Ing. Opava	Railway research, Test center Velim
Dr. Graband & Partner GmbH	Germany	A. Schulz-Klingner	Railway consultants
Eaton Ford Consultants Ltd	England	N. Ogilvie	Experience as engineering director of British Railways and Railtrack, evaluation of track components
EDILON B.V.	Netherlands	G. Schnellbögl	Railroad technology
ERSA	France	P. Deutsch	ETCS simulation and visualisation
ETH Zürich	Switzerland	Prof. Dipl.-Ing. ETH H. Brändle	Railway engineering & public transportation
FhG-IITB	Germany	Prof. Dr. F. Quante	Automatic diagnosis, track concepts, IT, modelling
FhG-IVI	Germany	Prof. Dr.-Ing. J. Schütte	Transport science, strategies
Franz Grötz GmbH+Co.KG Building Company	Germany	V. Rosenthal	Railroad technology
German Aerospace Center, DLR	Germany	Prof. Dr.-Ing. K. Lemmer	Traffic management and traffic safety, interoperability
German Air force Institute of Aviation Medicine	Germany	Dr. med. H. Pongratz	Aviation psychology and – physiology, ergonomics, science of aviation problematics
German Railway Authority	Germany	Dr.-Ing. A. Thomasch	Certification association
Hartmark Consulting AS	Norway	L. Langseth	Railway consultants
Holland Railconsult	Netherlands	H. Newi	Railway consultants
Karlsruher Verkehrsbetriebe	Germany	Dr.-Ing. D. Ludwig	Railway operator
Media-Network	Germany	W. Wassmuth	Communication, knowledge transfer
Norges Geotekniske Institutt	Norway	Dr. C. Madshus	Vibrations in soil and rock
Pfleiderer AG	Germany	H. Bachmann	Infrastructure, railroad technology
RWTH Aachen	Germany	Prof. Dr.-Ing. T. Dellmann Prof. Dr.-Ing. E. Wendler	Rail vehicles, transport science
SBB	Switzerland	W. Wildener	Railway operator
Siemens AG	Germany	H. Zander	Rail vehicles, Test center Wegberg-Wildenrath
Statkraft Grøner AS	Norway	B. Corneliussen	Acoustics

Swedish National Road and Transport Research Institute (VTI), Human, Vehicle and Transport Interaction	Sweden	Dr. J. Förstberg	Road and vehicle measurement and testing, driver simulator, human factors, railway dynamics
Traintech Laboratories	Sweden	M. Wrang	Advanced testing and analyses in mechanical and chemical areas
TU Braunschweig	Germany	Prof. Dr.-Ing. E. Schnieder	Traffic safety, automation
TU Graz	Austria	Prof. Dr. K. Rießberger	Rail/wheel interaction, track-design, simulations
TU München	Germany	Prof. Dr.-Ing. Dr.-Ing. habil. G. Leykauf	Road, railway and airfield construction
TUEV Intertraffic	Germany	Dr. H. Jansen	Test laboratory, safety assessment, railway technology
UITP	Europe	Y. Amsler	International Association of Public Transport
University of Hannover	Germany	Prof. Dr.-Ing. T. Siefer	Transport, railway construction and operation
University of Karlsruhe	Germany	Prof. Dr.-Ing. E. Hohnecker	Guided ground & public transportation systems
University of Pardubice	Czech Republic	Prof. Dr.-Ing. V. Mojzis Prof. Dr.-Ing. habil. J. Cap Dr.-Ing. M. Kunhart	Transport technology and control
VAE AG	Austria	R. Oswald	Track construction, switches, diagnosis, business concepts
Warsaw University of Technology	Poland	Prof. Dr.-Ing. A. Chudzikiewicz	Transport Technology, Test center Zmigrod

B. Proposed groups of partners during implementation of *FASTER*

Railways (infrastructure and operation) with test facilities
Public Transport
Manufacturing Industry with test facilities
Research
User Organisations
Banking Industry
Policy
UIC
UNIFE
UITP

C. Contact

ProM@in
Fraunhofer-Institut IITB
Prof. Dr. Franz Quante
Fraunhoferstr. 1
76131 Karlsruhe

quante@iitb.fhg.de