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KEYNOTE

The role of the ertms users group in the consolidation of the ERTMS technical specification for baselines 2 and 3

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Abstract

The ERTMS Users Group is a European Economic Interest Group (EEIG) constituted by the Infrastructure Managers from Belgium, Denmark, France, Germany, Holland, Italy, Norway, Spain, Sweden, Switzerland and the United Kingdom. This group, founded in the middle of the nineties, working in tight cooperation with the European Signaling companies, grouped in UNISIG, has played a fundamental role in the consolidation of the ERTMS technical specification and its upgrading to Baseline 3, covering all requirements of the conventional railway system.

In this communication, two Managing Directors of the group show the complete process going from the proof of concept of ERTMS to the specification of ERTMS Baseline 3. This Baseline will be the basis for the deployment on the interoperable European railway network. Along this communication, the two managing directors will address the critical points encountered along the consolidation and the features envisaged along the enhancement of ERTMS with the Baseline 3 new functionalities.

1. The demonstration of the feasibility of the Railway interoperability in the nineties (EMSET)

In the middle of the nineties, Head of DG TREN Mr. Edigio Leonardi was commissioned with full political support for the consolidation of the interoperability of the Trans European Network for Railways. He decided to close the pure paper work launching a project within the Fourth

Framework Program with the aim of demonstrating at real scale the feasibility of Railway

Interoperability by the deployment of ERTMS. Spain offered the new high-speed line MadridSevilla to perform the experimental demonstration. 40 Km of this line between La Sagra and Mora stations and the CEDEX railway laboratories where allocated to this project, of EMSET acronym (European Madrid – Sevilla Eurocab Test). This project carried out under the umbrella of the ERTMS Users Group took place between the years 1.994 and 2.000.

This project was performed under the technical supervision of the European Commission, represented by Mr. Antonio Colaço, Mr. Emmanuel Parent de Curzon and Mr. Claudio Traverso. The main outcomes from this project where the following four:

I. The signalling companies of UNISIG, in a precompetitive phase, found a neutral place, of highest quality, to perform cross tests, fundamental for interoperability consolidation.

II. The UNISIG companies where able to cooperate closely at technical level producing a reference test lab constituted by 37 tools. This lab at CEDEX was later the seed for the reference laboratories, accredited for the certification of ERTMS Constituents.

III. Before testing on the line, the cross test between two companies going to the line was previously debugged in the CEDEX laboratory. Consequently, there were no incidents with the commercial traffic during more than one year of the tests on line. Lesson learned: When putting a commercial project in service, debug the project in the laboratory before starting deployment of equipment on the track.

IV. At the end of this project, the ERTMS Users Group, UIC and RENFE delivered in Madrid to the European Commissioner for Transport, Ms. Loyola del Palacio the first version of the System Requirements Specification. The SRS version delivered was the 2.0.0 .

2. The first consolidation of the technical specification (Pilot Lines): Facing the first difficulties

After the experimental feasibility test carried out in EMSET, the technical specifications were not yet backed by the feedback of the experience of the commercial projects. The first commercial project was the Spanish High Speed Line Madrid – Lérida (460 Km), awarded to the French Compagnie de Signaux, later acquired by ANSALDO.

To get feedback from first commercial operation, the ERTMS Users Group, with the support of the European Commission, started the deployment of ERTMS pilot lines in the six countries of the group plus Austria, Switzerland and Vienna.

Mr. Antonio Colaço supervised technically the pilot experiences. The main difficulties faced along this phase were the following:

I. UNISIG delivered a version of the System Requirement Specification containing hundreds of the so-called “Designer Choices”. A designer choice was a requirement not affecting interoperability, of free election by the project designer. This approach introduced a great uncertainty in the certification process. The Steering Committee of UNISIG named them also “Don’t care” requirements.

II. The feedback from the commercial experience produced a great number of "Change Requests". These were proposals for the improvement of the System Requirement Specification resulting from the commercial exploitation. Commercial lines in exploitation had to migrate continuously to get them aligned with the consecutive versions of the technical specification: SRS 2.0.0 -> SRS 2.2.2 -> SRS 2.3.0 -> SRS 2.3.0 D. This has been the case of the Spanish Railway Administration, forced to migrate more than 1.000 Km of lines and hundreds of trains.

III. The feedback from the exploitation of the Madrid – Lérida line showed that the harmonisation of human factors was an open issue. For the first time, different suppliers of ERTMS On-board equipment, operated on tracks equipped by different ERTMS suppliers. A comparative study of the different DMIs, performed by CEDEX, forced the ERTMS Users Group to launch a new working group on Human Factors. Three different approaches were needed to solve this open point with experts on human factors, not linked to the technical world (HEROE Project).

    It is worthy to say that the operational interoperability is 50 % of the interoperability, the other 50% being the technical interoperability. Due to this unexpected issue, the ERTMS Users Group could not accomplish the operational harmonisation within the period of the pilot lines. It is only with the launch of the ERTMS Baseline 3, that the DMI specification becomes harmonised and its specification becomes mandatory. The Human Factors Working Group, transferred to ERA from the ERTMS Users Group, accomplished the operational harmonisation.

IV. The handover between the RBCs at the border between Holland and Belgium in the Dutch High Speed Line South caused a major problem. The trains ought to cross the border in Level 1, disconnecting from the handing over RBCs to solve the problem. This patch, also used in other countries, had a big impact on the exploitation of the High Speed line due to the speed limitation in Level 1.

    UNISIG came with two proposals for the specification of the RBC handover, asking the ERTMS Users Group to choose the most convenient one. The election made was the basis for Subset-098 specification.

V. The starting of the commercial exploitation of the Spanish High Speed Line between Madrid and Lérida in ERTMS Level 1 was quite problematic due to the lack of reliability of the Eurobalises. This critical situation was solved thanks to an illegal duplication of fixed balises, placing contiguously two identical balises. If one balise was failing once every one thousand of readings, the two contiguous balises had a failure estimated in one every one million of readings, solving miraculously the problem. It is worthy to mention the role played by Mr. Jorge Iglesias in solving this crisis that could have strong political consequences.

VI. The Spanish High-Speed network includes the Madrid-Sevilla line, equipped with the German system LZB. A fleet of hundred high speed trains purchased by RENFE ought to operate on the ERTMS new lines and also on the Madrid – Sevilla line. This was forcing the Spanish Administration to request the STM for LZB, as proposed by UNISIG. At the end, major part of the train fleet was equipped with LZB onboard equipment operating independently from ERTMS because the LZB STM was not available. Today the use of STMs is optional and only trains equipped by Bombardier incorporate the LZB STM.

VII. The continuous evolution of the ERTMS Technical Specifications forced the Spanish Infrastructure Manager ADIF to undertake a continuous migration of their high-speed lines. Today all lines are aligned to the SRS version 2.3.0 D. New trains purchased by the Spanish operator RENFE will be equipped with EVCs of Baseline 3, the backwards compatibility between both consecutive versions is a challenge that will be verified at commercial level within the following years.

3. From Baseline 2 to Baseline 3 and onwards

Finalised the consolidation of the Baseline 2 with the pilot projects, The ERTMS Users Group (EUG) centred its activity on the deployment of the Trans-European Network based on the implementation of the new functionalities required, incorporated to Baseline 3 and on the specification of enhanced performances envisaged for future developments.

The Group management was adapted to the new mission profiles with new Managing Directors and additional members that joined the group.

The mission profile can be summarised into two main aspects:

1. To help the railways in applying ERTMS/ETCS in a harmonised and interoperable way, to enable the free flow of trains and a competitive railway.
2. To offer a platform for railway peers to share experiences and to consolidate their views.

Apart from the six initial members of the group (ADIF, DB, Network Rail, Prorail, SNCF Réseau and RFI), new infrastructure managers joined the group to share this mission: BaneNor, Banedanmark, Infrabel, SBB and Trafikverket).

3.1 Global approach: Common platforms with users, manufacturers and authorities

3.1.1 EUG RU ERTMS/ETCS Platform

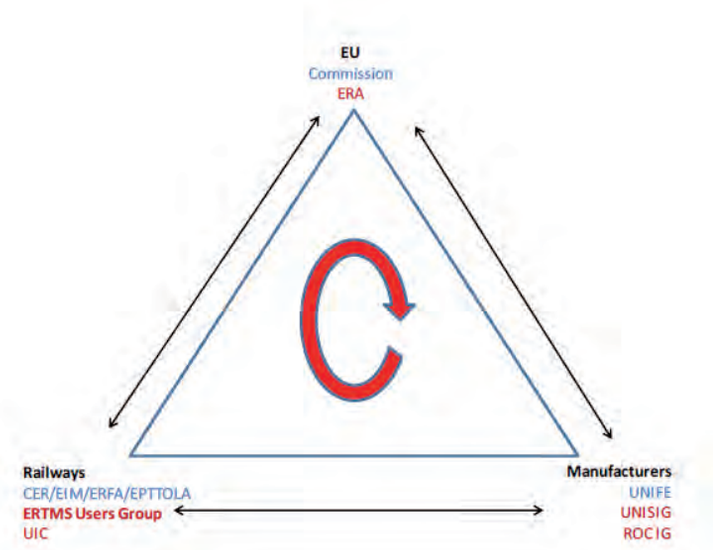
In order to collect the return of commercial experience, EUG invited the Railway Undertakings to join in a common platform set up in 2013 with the aim of sharing experiences and ideas in practical issues concerning specification, design, certification, installation, authorisation, performance, reliability, operation, tendering and maintenance of ETCS On-Board Units in rolling stock.

The partnership:

- Nine Railway operators are providing feedback from commercial exploitation: DB Fernverkehr, DB Cargo, MRCE, NS, ÖBB, SBB, SNCB, SNCF and Trenitalia. Renfe is also invited for the platform, but has so far not participated.
- Four European institutions linked to Railway exploitation are also engaged: CER (Community of European Railway and Infrastructure Companies), ERFA (European Rail Freight Association), EPTTOLA (European Passenger Train and Traction Operating Lessors' Association) and the UK based Rail Delivery Group (formerly called ATOC)
- Other stakeholders including European authorities like European Commission (EC) and European Railway Agency (ERA), suppliers, Notified Bodies (NoBos) and Reference Laboratories are invited on a case-by-case basis.

3.1.2 Role and Level

The mission results are circulated between the institutions having key roles in the consolidation and enhancement of Railway Interoperability through the use of ERTMS: European Authorities, (EC & ERA), Manufacturers of rolling stock (UNIFE) and signalling (UNISIG) and final users (CER, EIM, ERFA, EPTTOLA,ERTMS Users Group (EUG), Union Internationale of Railways (UIC).



3.1.3 The activities of the ERTMS Users Group within the global environment

The EUG focus its activity within this global frame on providing support within the different phases of the process of putting lines into service, considering aspects like:

- Analysis and design
- Testing
- Commissioning
- Operation
- Assessment

Specifically, this support provides help in areas related with the assurance of the interoperability of the projects, like Engineering guidelines, TSI clarifications, Mitigation measures, Correction of application guides and Correction of TSI trough the CCS. All these activities are fundamental for the processes of tendering, deployment and putting in service railway lines where the sharing of experience is a fundamental benefit.

Apart from this assessment, the EUG plays a central role in the enhancement of ERTMS with new functionalities making the system more attractive by its efficiency and performances. The innovation activities of the Shift2Rail programme (in which EUG also participates) are aligned with this enhancement.

3.2 Baseline 2: suited for its purpose

The specifications of Baseline 2 are the reference for the first railway lines put in service in almost all European countries. All these lines have meanwhile converted to Baseline 2 SRS 2.3.0d. They have reached very satisfactory performance after several migration processes with the lines in operation, before reaching the final consolidated specification. Baseline 2 specifications (SRS 2.3.0d) are included in TSI CCS since 2008.

Just to mention some of the most significant projects in service based on SRS 2.3.0d

- France: Paris – Strasbourg - Mulhouse - Basel
- Italy: Torino – Milano – Padua and Milano – Roma – Napoli,
- Spain: Madrid – Lérida – Barcelona – Figueras (French border) and Madrid – Valencia – Albacete - Alicante
- Switzerland: Mattstetten - Rothrist, Lötschberg Tunnel
- The Netherlands: High Speed Line South, Betuweline
- It must be underlined that some of these corridors have several infrastructure suppliers and different ERTMS On-board suppliers. This commercial experience is the confirmation of the railway interoperability at commercial level.

4. Development of Baseline 3

Baseline 2 covers the needs for new (high-speed) lines; however, additional functionality is needed for the conventional network, e.g. level crossings and shunting.

Conventional network puts high requirements on capacity, which Baseline 2 does not cover like Braking curves, enhanced capacity of the radio link and additional functionality needed for migration from class B to ERTMS (Level 1 Limited Supervision). Therefore, the European Commission took a decision in 2008 to develop Baseline 3.

Baseline 3 not only contains all functionality of Baseline 2, but also tackles around 300 errors/ ambiguities of Baseline 2 and assures backwards compatibility, i.e. Baseline 3 trains can run on Baseline 2 (2.3.0d) tracks.

Apart from the enhancement of Base line 2 with the cleaning process and the assurance of the backwards compatibility, the Base line 3 incorporates new functionalities required for deployment of the Trans – European Network, mainly:

- Level 1 Limited Supervision
- Level crossings
- Train categories
- Improved braking performance
- Packet switching technology for radio communication
- Online key management.

4.1 Evolution of Baseline 3

As stated before, the specification phase began in 2008 with SRS 3.0.0 and the first release incorporated to the European Technical Specification of Interoperability of the Control Command System (TSI CCS) was the release 3.3.0, incorporated in 2013.

A maintenance release of Base line 3 (SRS 3.4.0) was incorporated to the TSI in 2014, replacing the previous SRS 3.3.0. In 2016, a second release (SRS 3.6.0) was added to TSI CCS, adding the possibility to use packet switching technology (GPRS) and on-line key management.

4.2 Present and future developments

At present, the ERTMS Users Group is working in coordination with the European working groups and authorities in applied research areas included in the global approach of the Shift2Rail programme:

- Use of satellite navigation provided by Galileo to the incorporation of Level 3 applications (with hybrid Level 3 as a first step) and virtual balises
- Automatic Train Operation, (with and without train driver)
- Alternative for GSM-R
- Improved IT-Security
- Enhancement Braking Curves harmonisation

Facilitating the solutions to difficulties encountered along the deployment of Baseline 2 and Baseline 3, the EUG pays special attention to crucial aspects like:

- Backwards compatibility, assuring the compatibility of Baseline 3 trains with Baseline 2 lines
- Migration from conventional class B systems to ERTMS and migration within ERTMS
- Improved performance (RAMS) and
- Lower Life Cycle Costs, making ERTMS more competitive with conventional class B systems.