



EGNOS potential in railway safety-critical applications

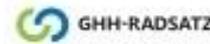
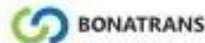
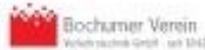
Peter Gurnik
Technical Affairs Manager (UNIFE)

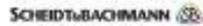
- UNIFE represents the **European Rail Supply Industry** (rolling stock, infrastructure, sub-systems and signalling)
- UNIFE is a **trusted partner of European and international institutions** in all matters related to rail transport
- Over 85 full members of the largest and small and medium-sized companies in the rail supply sector and 17 associated members including 14 National Associations, representing almost 1000 suppliers of railway equipment

World leaders:

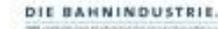
UNIFE members have a 84% market share in Europe and supply 46% of the worldwide rail production







Associate Members

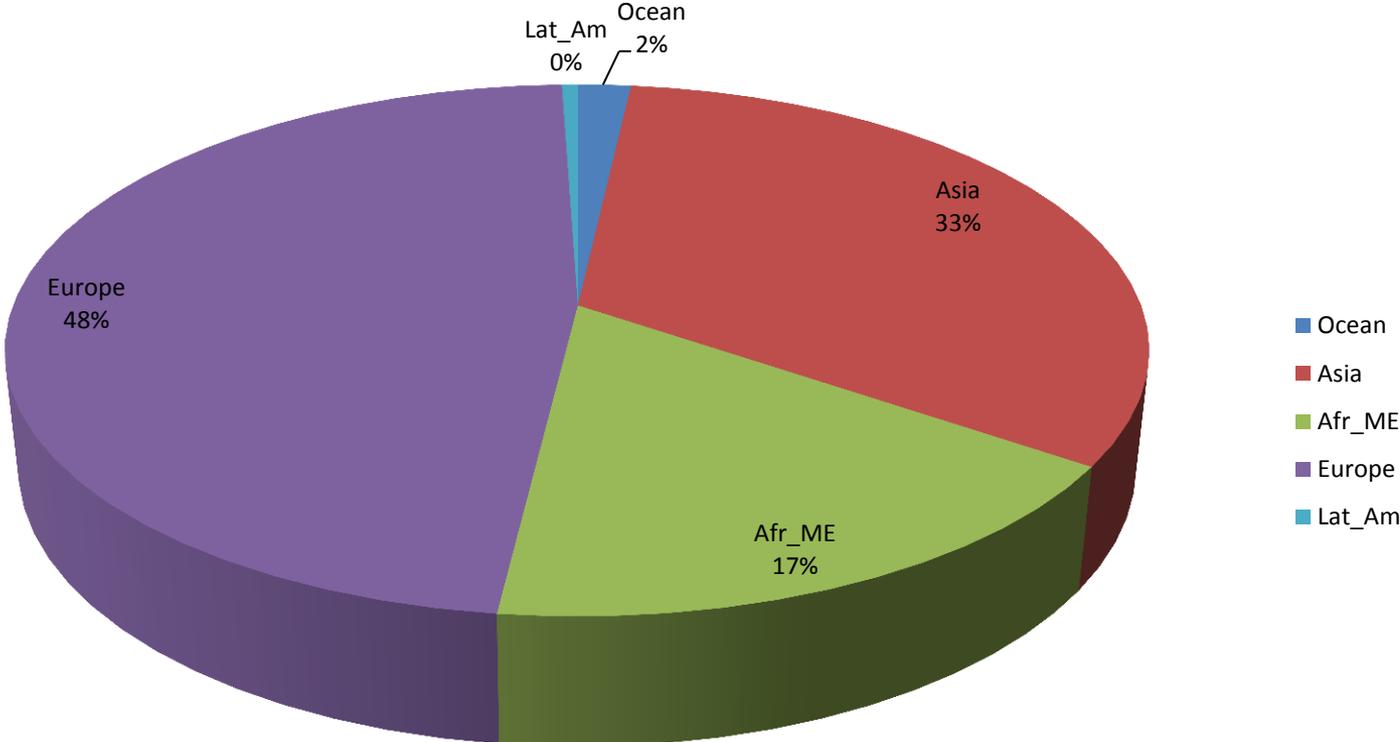


■ ERTMS / ETCS (European Train Control System) in a nutshell:

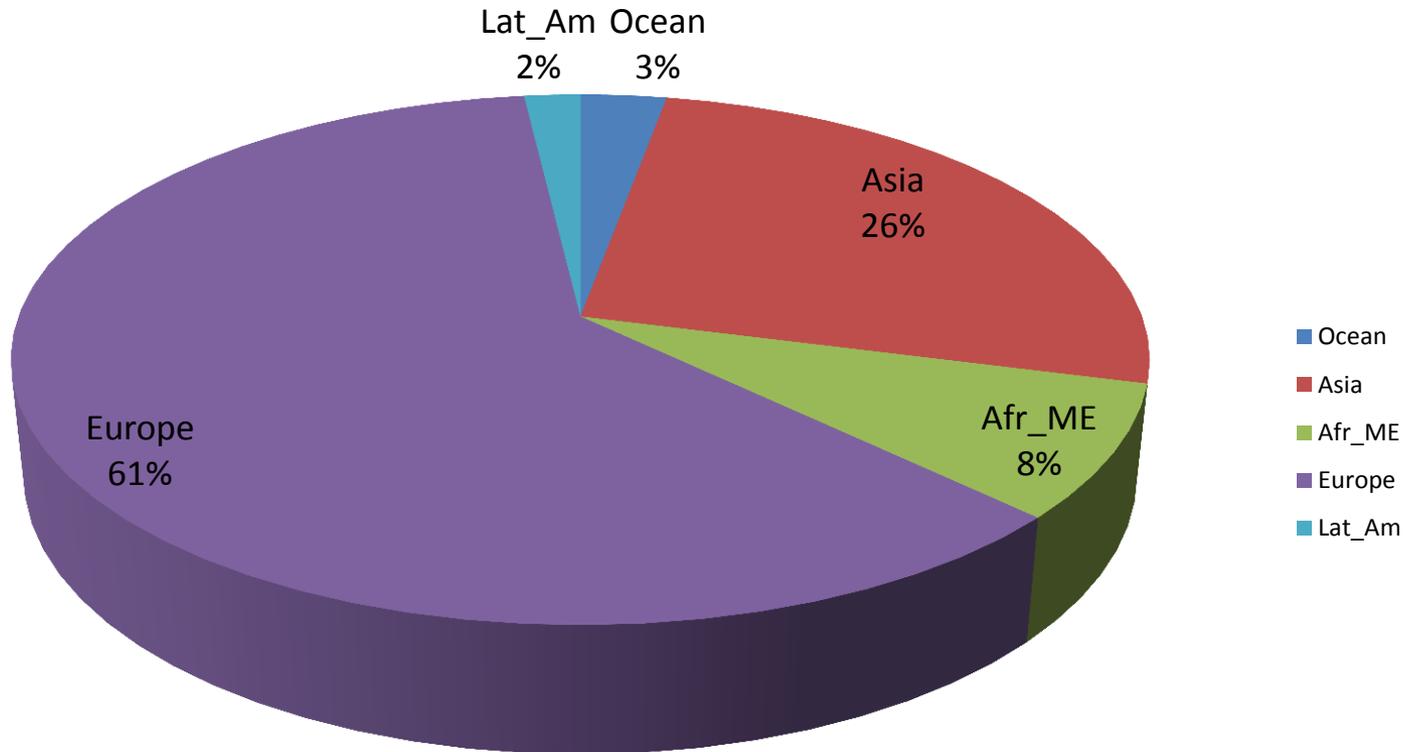
- ETCS is a train control system, developed to replace more than 20 existing systems in Europe
- ETCS provides the driver with signalling information, such as how fast he is allowed to drive and until where
- ETCS supervises the movement of the train and prevents the driver to exceed the indicated limits
- ETCS complies with highest safety standards, permitting operation at very high speeds and traffic density, and without traditional optical lineside signals
- Compatible ETCS equipment is available from multiple suppliers



Contracted routes World share



Contracted vehicles World share



Worldwide ERTMS investments



Total track km: 88,885



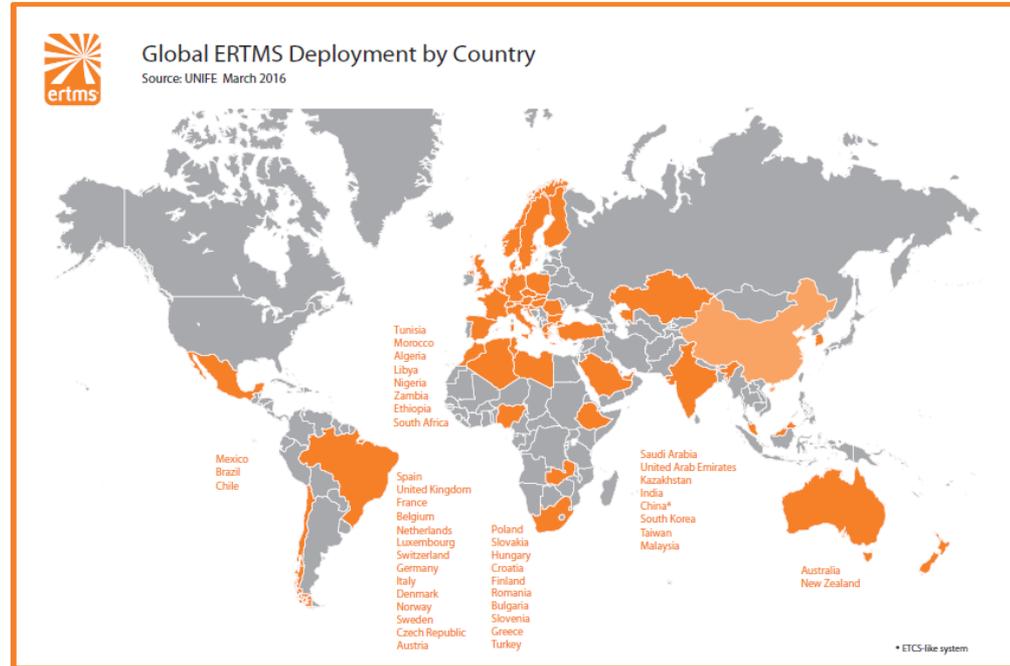
48 Countries are using ETCS trackside



Total No vehicles: 11,687



45 Countries are using ERTMS vehicles



- UNISIG is an industrial working group within UNIFE actively contributing to the technical specification of the European Train Control System (ETCS);
- UNISIG has started investigating the application of GNSS for ETCS in June 2011, when a global market study showed a significant interest in the possibility to reduce trackside infrastructure;
- To maintain and improve the ETCS specification UNISIG works closely with e.g. the European Commission, the European Railway Agency, the Community of European Railways and the European Rail Infrastructure Managers;
- It can also be noted that all developments of UNISIG are published as open standards, and are in the public domain.



ALSTOM



Ansaldo STS



BOMBARDIER



CAF



mermec group



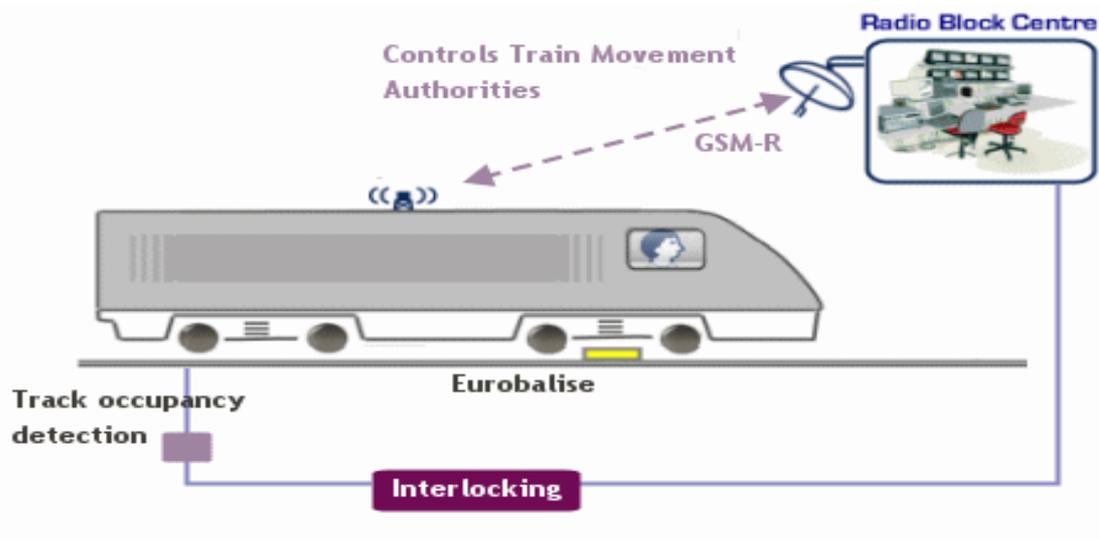
SIEMENS



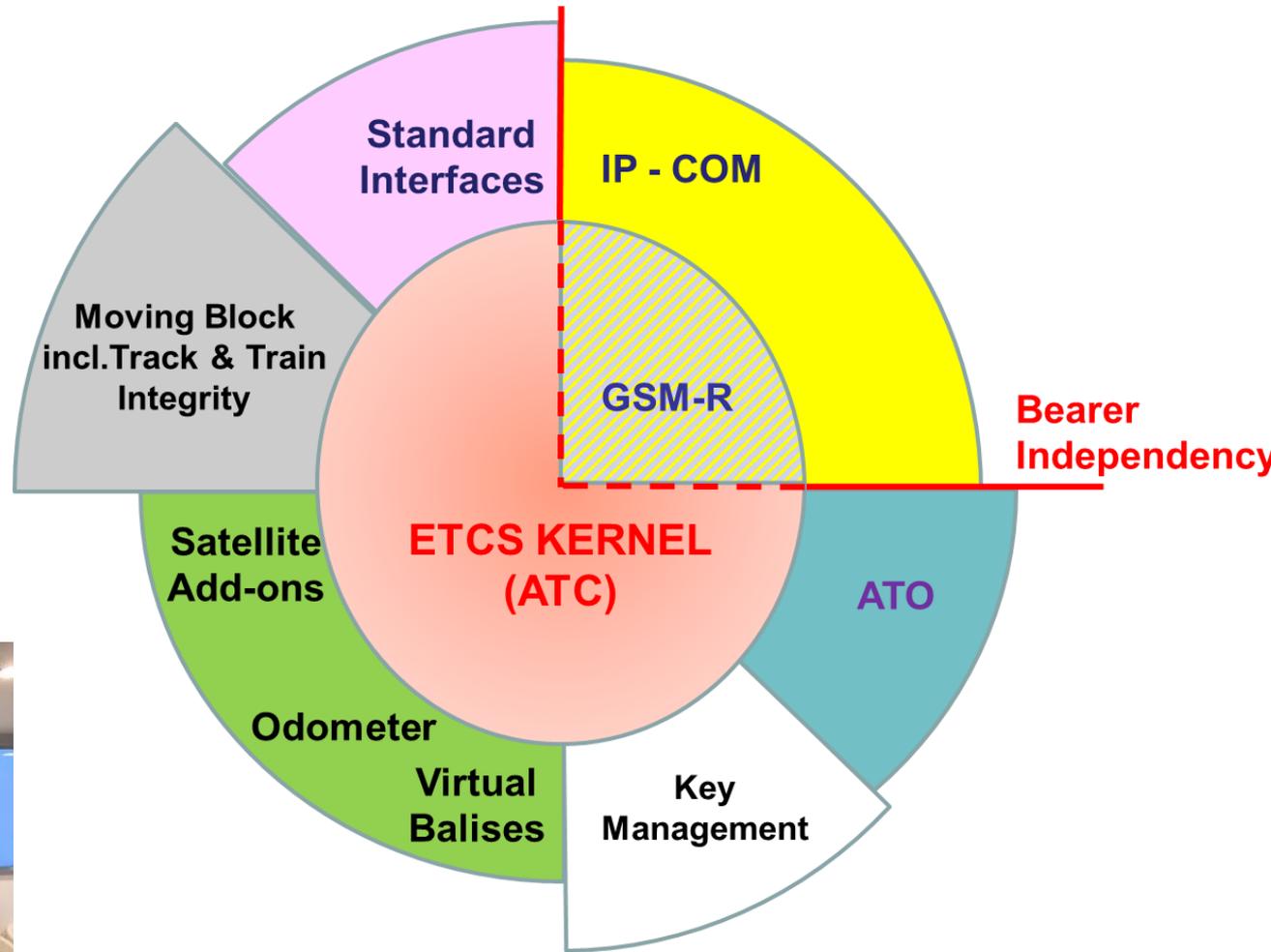
THALES

Concept of “virtual balises” in the scope of ERTMS/ETCS

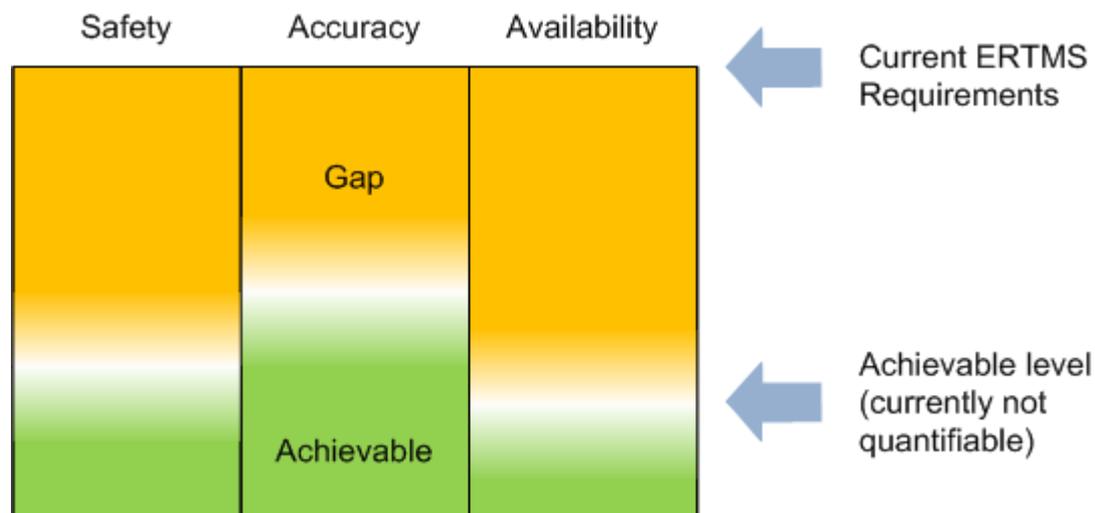
- The aim is to reduce cost of ETCS trackside by reducing the number of (real) balises in the track, which would also increase availability, reduce exposure to theft, vandalism etc.
- To minimize the impact on ETCS the concept of “virtual balises” was developed, in which a GNSS based positioning system shall confirm train position at defined reference points
- This also allows handling of gaps in coverage, compared to a solution which requires permanent coverage



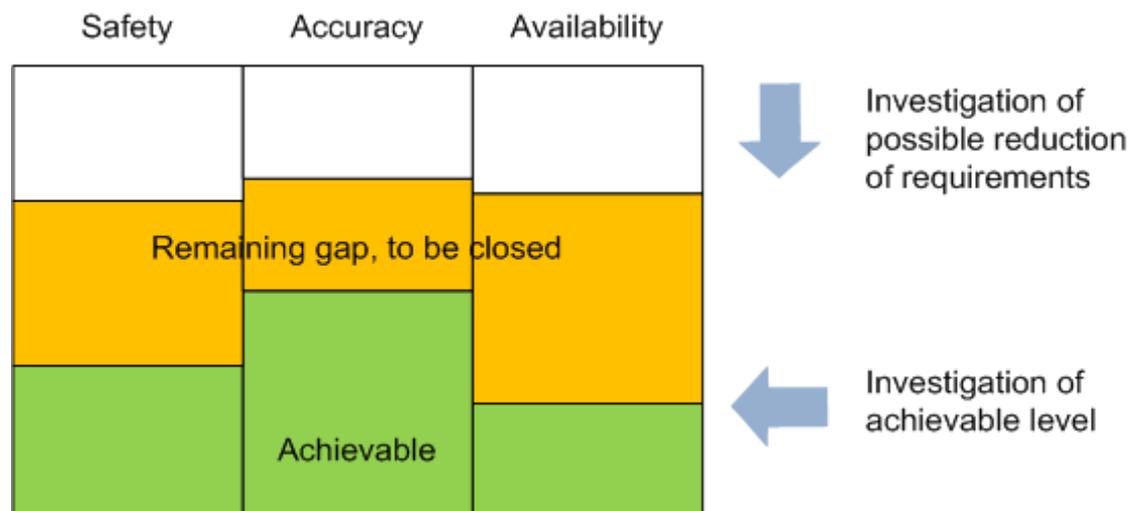
- ✓ Railway stakeholders have agreed that the satellite positioning is among the key objectives for the future evolution of ERTMS;
- ✓ New MoU signed by the sector on 20th September 2016



- ETCS complies with highest safety standards, permitting operation at very high speeds and traffic density, and without traditional optical lineside signals
- Compatible ETCS equipment is available from multiple suppliers
- Satellite positioning alone will not fulfill these requirements, a gap exists that has to be filled with other means (such as e.g. balises or additional sensors)
- Factors that should be taken into account: harsh railway environment including multipath, interference and signal blockages, interoperability requirement, safety and security, etc.



- Experts have to investigate to which extent the overall requirements can be reduced, e.g. by limiting the use of satellite positioning to certain applications.



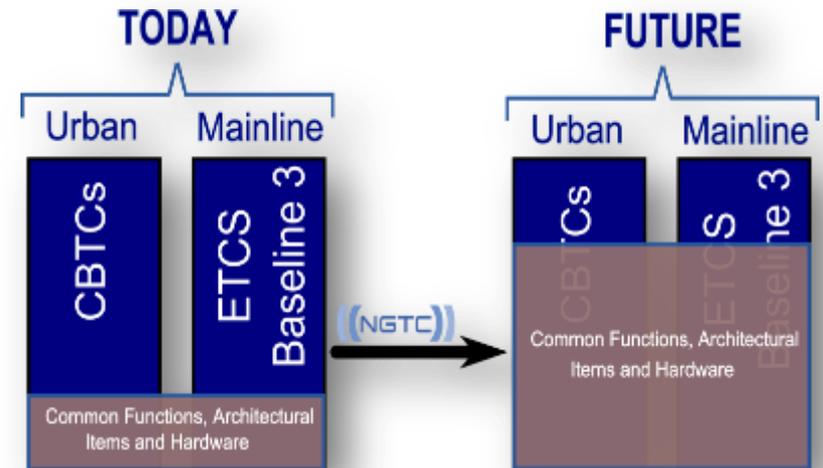
- Multi-constellation approach, including European GNSS, has the positive effect for number of performance parameters, but is not enough, especially from the safety perspective.

■ EGNOS

- EGNOS system was designed to answer the Aviation requirements and some of its main features, if not adapted for railways, are not applicable;
- In close cooperation with all the relevant stakeholders to specify the user requirements for future EGNOS evolution relevant for railways;

Introducing NGTC project

- **42 months research project**, under the coordination of UNIFE, running in the frame of the EU FP7 programme.
- A number of **key urban and mainline railway related organisations** are involved.
- The crucial task of the project is **to analyse the commonalities and differences of required functionality of both ETCS and CBTC systems**.
- The target is to evolve urban and mainline system solutions and effectively utilising experiences from the existing train control systems.



Possible convergence of rail domain
As a result of NGTC



Consortium

NGTC Coordinator



Urban Operators



Mainline IMs & RUs



Signaling Companies

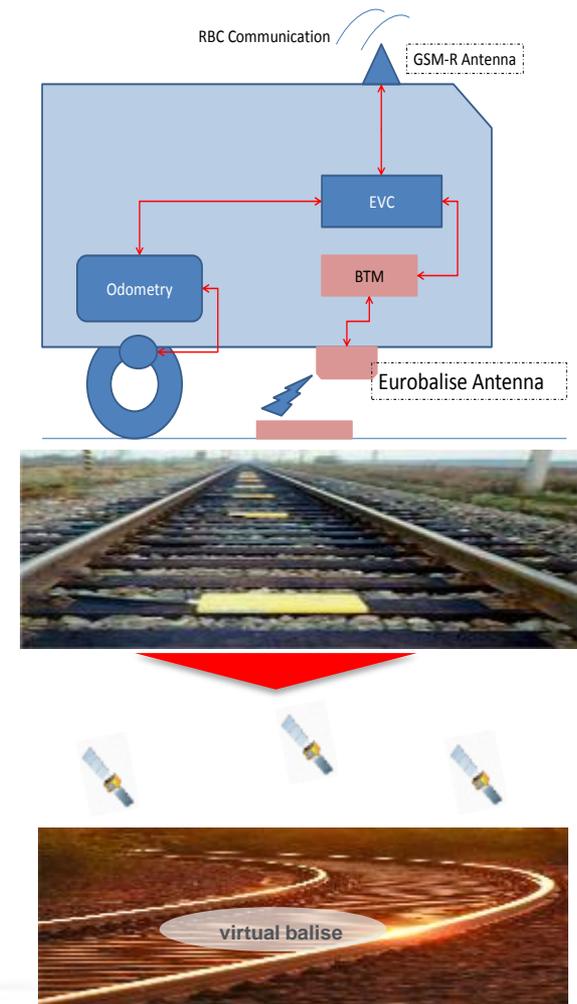


Research Centers & Others



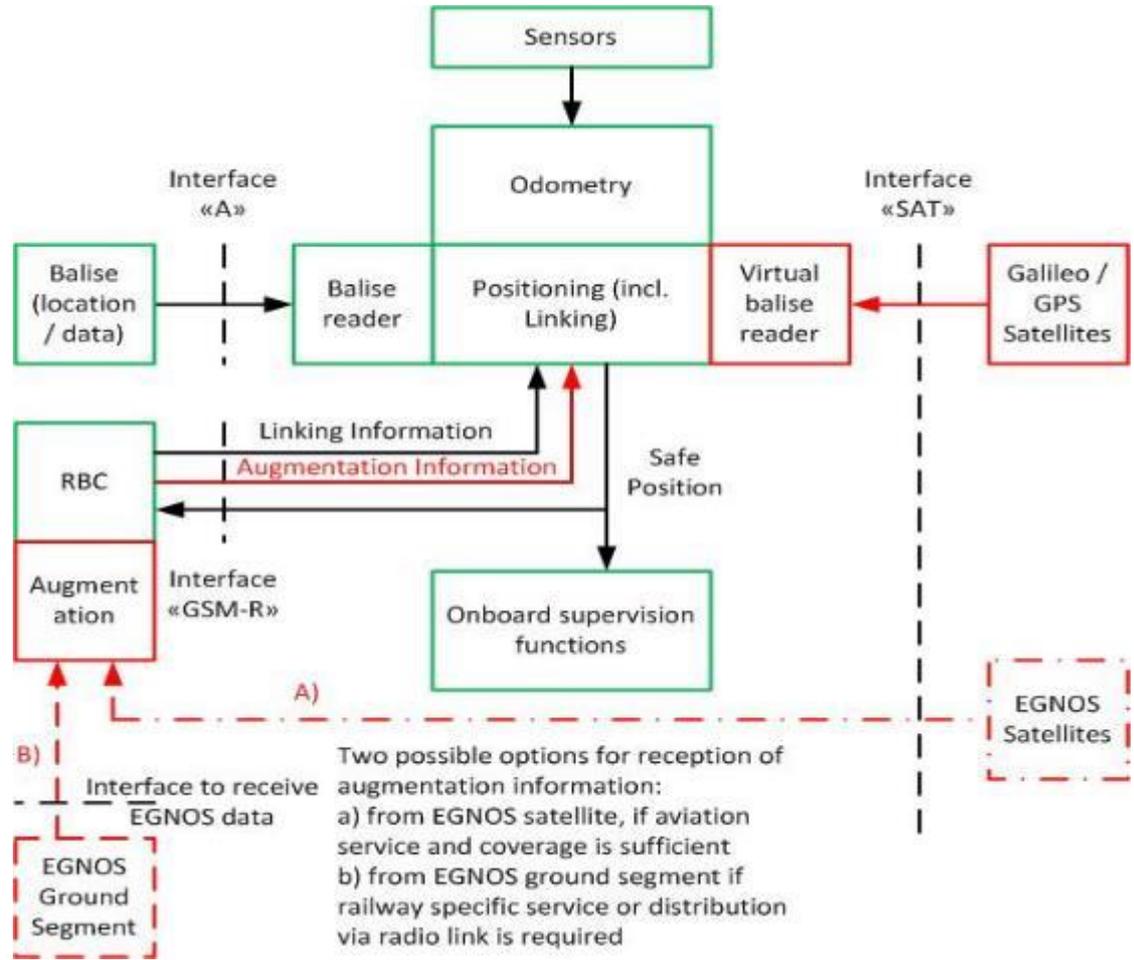
NGTC Technologies: Satellite Positioning 1

- Analyses of the **Satellite Positioning Signal Receiver Parameters** that are relevant for the signalling applications and the process of their qualification and validation;
- Definition of the **Operational Scenarios** with virtual balise applicable for ERTMS and the link **Database**;
- Initial **Safety Analyses** in regards to use of satellite positioning in ERTMS;
- Analysis of the other than ERTMS **applications of satellite positioning** functionality;



NGTC Technologies: Satellite Positioning 2

- The preliminary functional architecture for ERTMS virtual balise concept
- Assumption: Due to the limited visibility of EGNOS satellites in a typical railway environment, the messages may be forwarded by train radio communication system to the onboard signaling unit;





NGTC relations with Shift2Rail JU

NGTC was designed as a **light house project for SHIFT²RAIL (IP2)**, the first European rail joint undertaking to seek focused research and innovation (R&I) and market-driven solutions by accelerating the integration of new and advanced technologies:

NGTC Project



WP2 NGTC FRS

WP3 NGTC SRS IF specifications

WP5 Moving Block

WP6 IP-based Radio

WP7 Satellite positioning

Shift2Rail - IP2



TD2.1 Adaptable communications

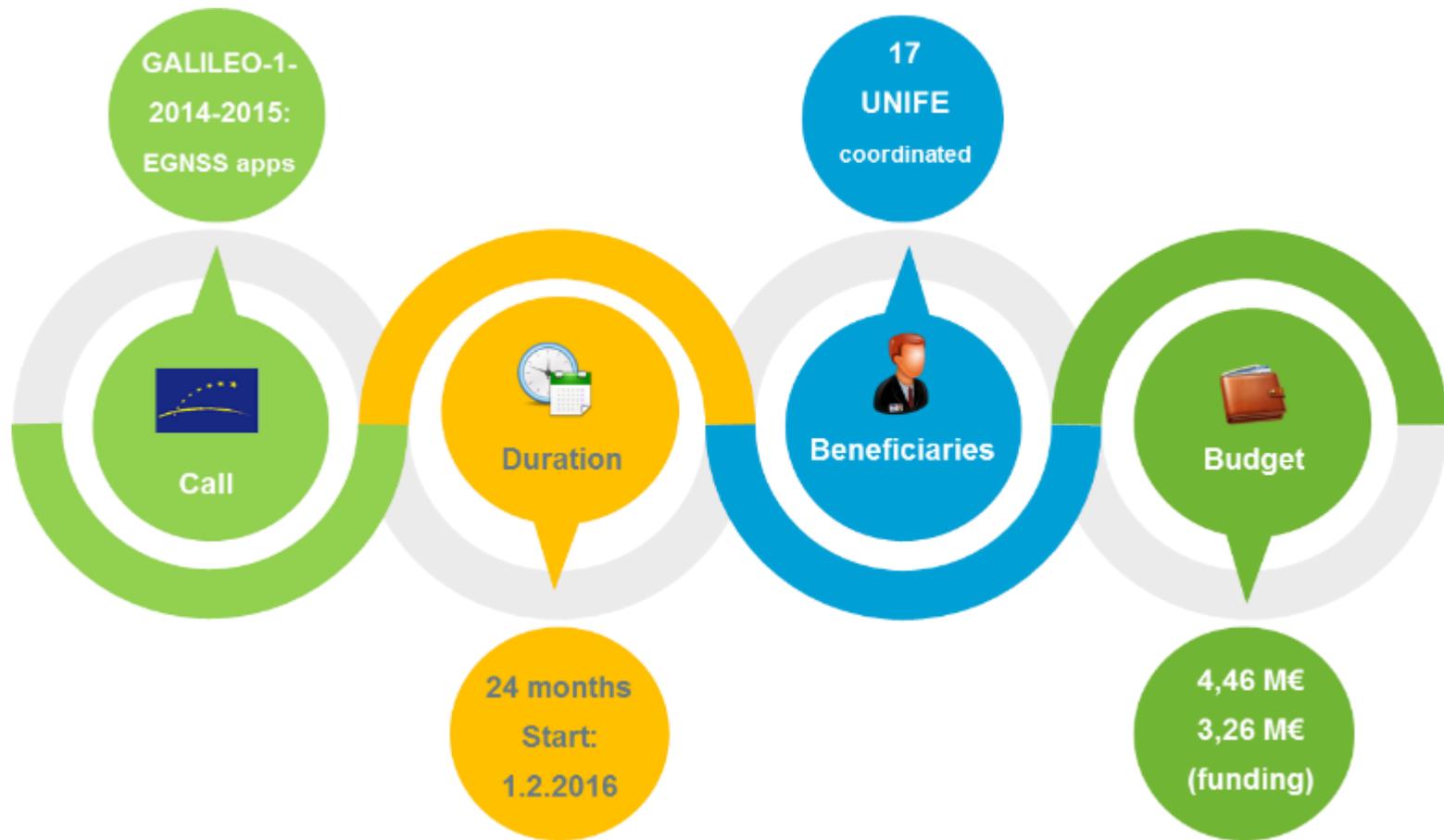
TD2.2 ATO up to GoA4

TD2.3 Fluid Moving Block

TD2.4 Advanced fail safe train positioning



Introducing the STARS project



STARS: The key project objectives

Expected results

- **To predict performance** in the railway environment in terms of accuracy, availability and safety
 - **To achieve interoperability** between equipment of different suppliers
 - **To allow inclusion of GNSS into ERTMS**
- To develop a **universal approach to predict the achievable GNSS performance in a railway environment**, especially for safety critical applications within ERTMS and to determine the necessary evolution of ETCS to include GNSS services
 - To **quantify the economic benefits** through reduction of cost, which will increase market appeal of ERTMS



STARS Project Consortium

STARS Coordinator



Signaling Companies

SIEMENS Ansaldo STS **ALSTOM**
A Hitachi Group Company

THALES **BOMBARDIER** 
the evolution of mobility PRÁHA

Space Industry

 
A Thales / Finmeccanica Company A Finmeccanica / Thales Company

Consultancy & Specific Expertise

  
UNIVERSITÀ DI TORINO

Research Centers

 **IFSTAR**  **CAF**
CONSTRUCCIONES Y AUXILIAR DE FERROCARRILES - INVESTIGACION - DESARROLLO

 Technische Universität Braunschweig  Università Commerciale Luigi Bocconi  UNIVERSITY OF WEST BOHEMIA





Overall structure of the STARS work-plan

GNSS Measurement Campaign

- Preparation of campaign
 - Methodology, Procedures, Identification of the suitable lines
- Field measurement, data collection



GNSS Data Analyses and Performance Evaluation

- Data post-processing, Railway environment characterization
- EGNSS services evolution, EGNSS performances assessment in rail environment

GNSS Economic Evaluation

- Cost Benefit & Impact Assessment
- EGNSS / ERTMS evolution roadmap
- Implementation plan

Thank you for your attention!

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