

TSB-Workshop Rail Transport Technologies, 7 December 2011

EUDD – MODTRAIN – EUDD*plus*: Steps forward on the way to the European Train Drivers' Desk

Thomas Meißner / Lutz Hübner, TSB-FAV



Status quo

- ▶ Every locomotive class with specific drivers' desk design
- ▶ Insufficient consideration of ergonomic aspects
- ▶ Different arrangements of control elements according to national requirements
- ▶ Operators' and manufacturers' specific solutions available for available
- ▶ Small production runs

Challenges

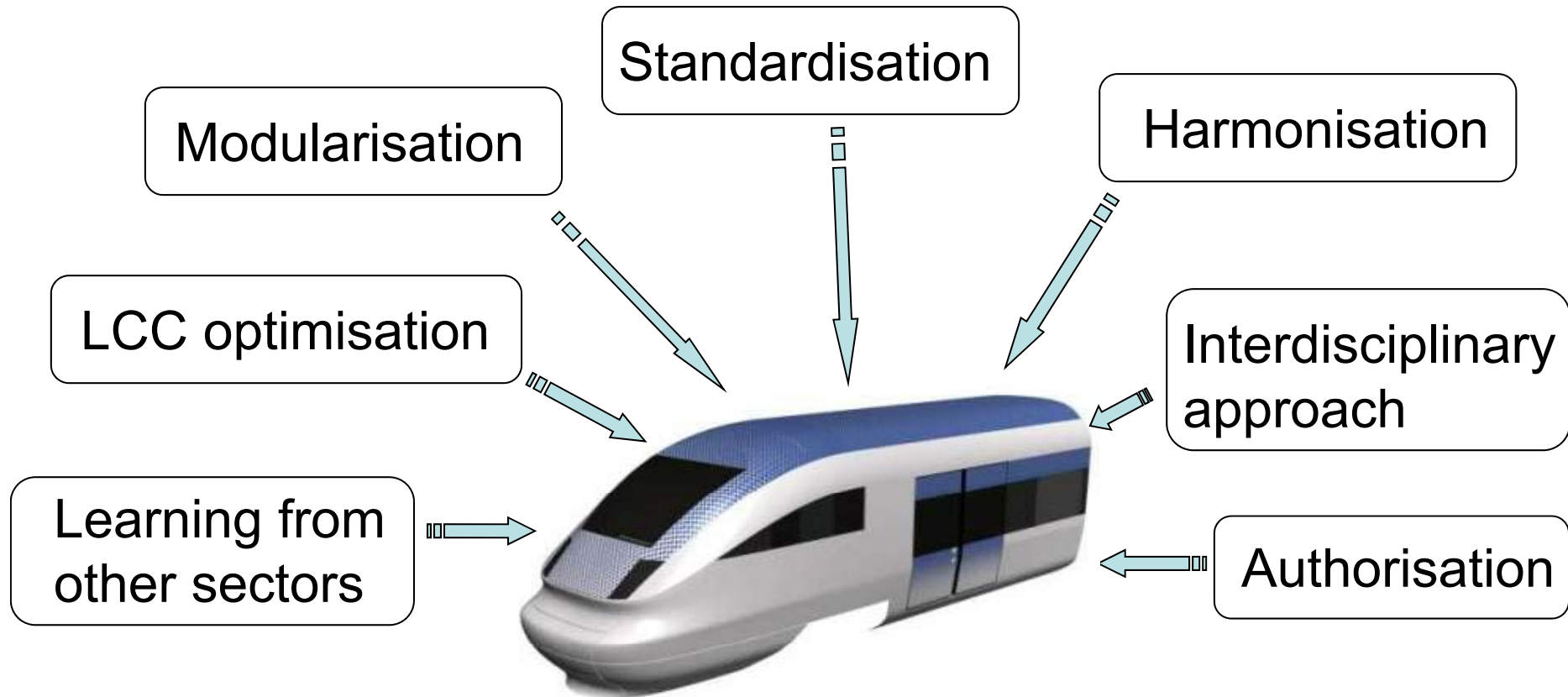


Standardisation
Harmonisation
Europe wide



RTD approach

The keys for the future competitive European Rail System – the motivation for the ModLink SP



New culture of cooperation – consensus approach
Industry – operators – researchers – associations – standardisation bodies

Partner structure

Project partner – the EUDDplus example:



Further regional partners:

Fahrzeugwerke Mirastraße
 IFS Designatelier

SGW Werder GmbH
 TU Berlin

EUDD approach

„Learning from other sectors“ paves the way



from the thirties ...
 Junkers Ju-52

- Fly-by-wire
- Improved ergonomics
- Modularisation
- Display and terminal technology



... to Airbus A380

Consensus building process paved the way
 to modularised and harmonised *European Driver's Desk (EUDD)*



- ✓ 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



From EUDD via EUCAB to EUDDplus

European Driver's Desk (EUDD)

01/2001 – 12/2003 (EU project, FP 5)

→ Functional demonstrator
verified with tests in virtual reality
at Siemens simulator, Munich



MODTRAIN/EUCAB

02/2004 – 04/2008 (EU project, FP 6)

→ Functional cab demonstrator
verified with tests in virtual reality
at the SIMUFER simulator, Lille

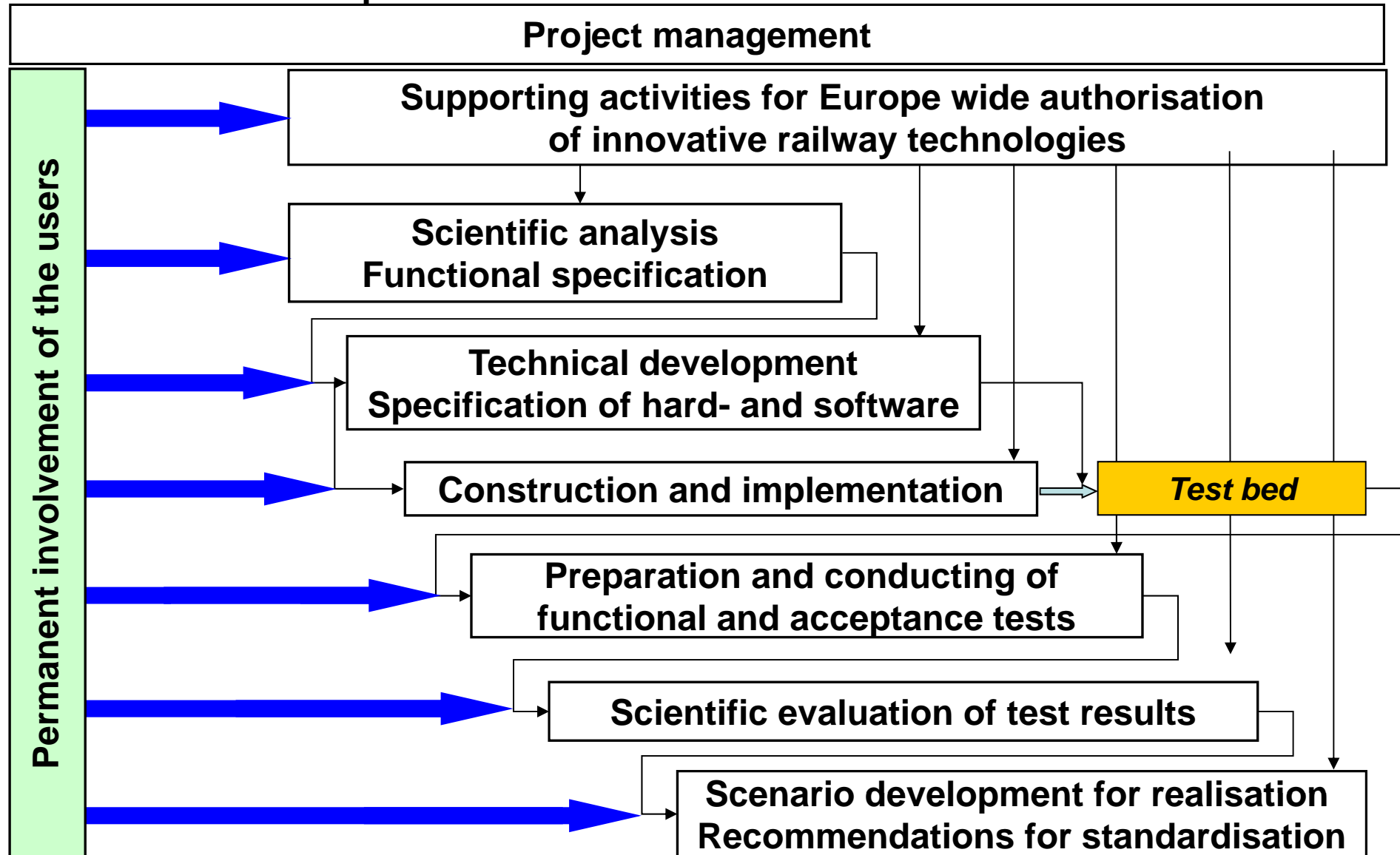


EUDDplus

07/2006 – 01/2010 (EU project, FP 6)

→ Multisystem demonstration and
field test verification in vehicle platform
at Siemens Test Validation Center,
Wegberg-Wildenrath

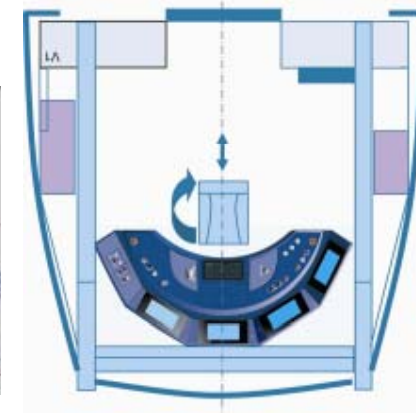
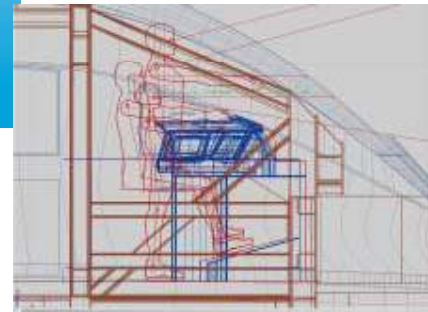
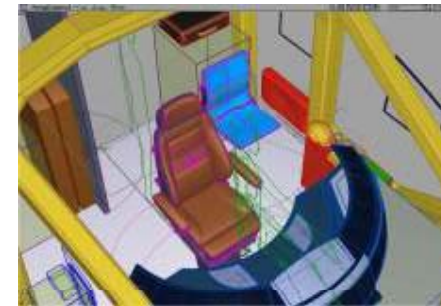
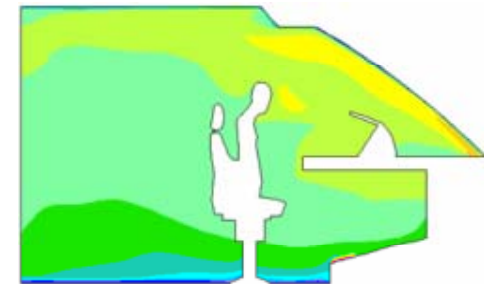
Typical project structure plan



Hardware development MODLINK/EUCAB

Translations of Requirements into tangible Hardware

- Thermal Comfort
- Exterior Design
- Aerodynamics
- Structural Layout / Crash
- Packaging of Systems and Interior Components
- Drivers Desk Layout / Ergonomics



Hardware implementation MODLINK/EUCAB

Modlink EUCAB – driver cabin concept

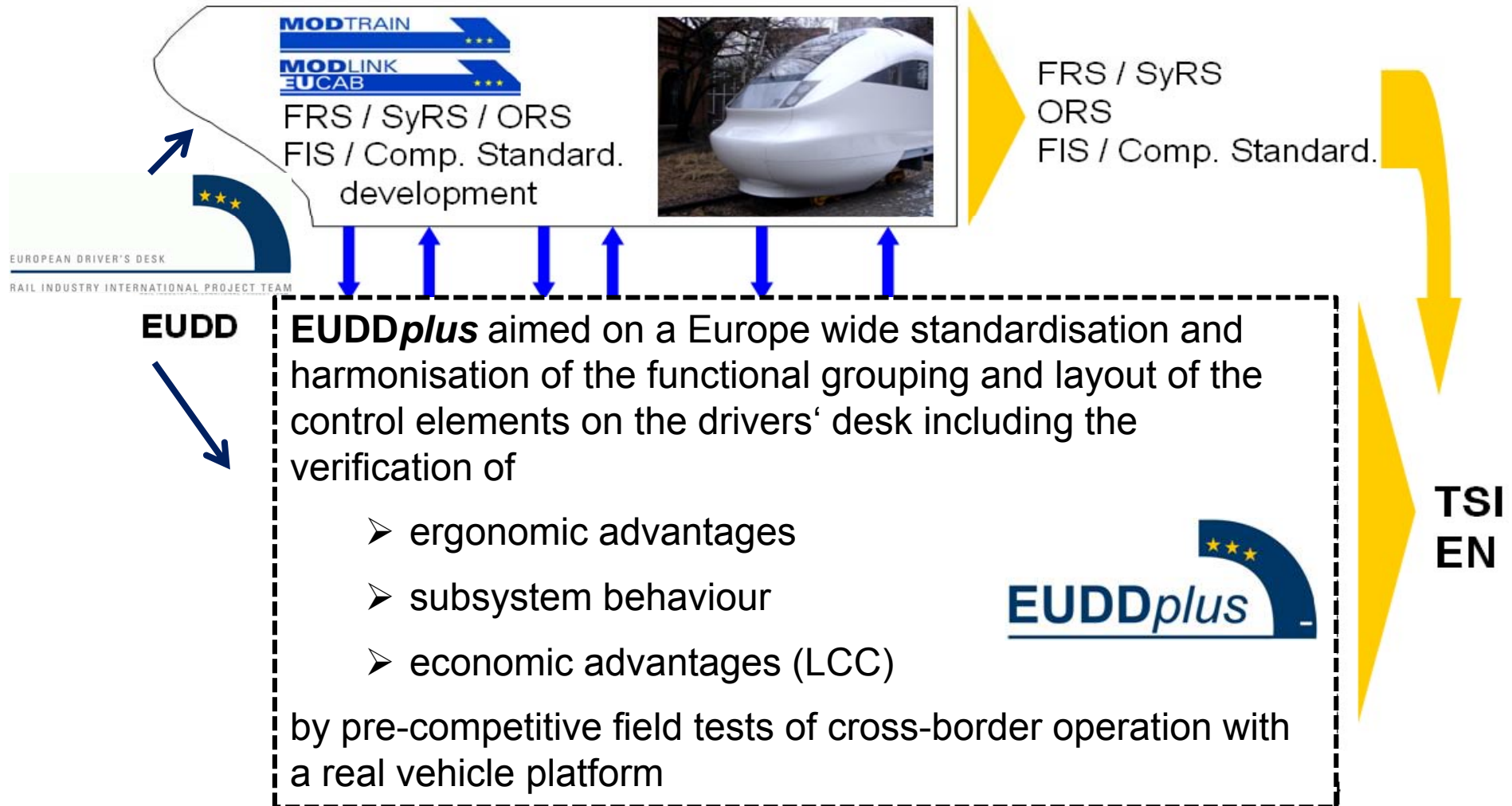


Validation/Testing MODLINK/EUCAB

- **Tests at Simufer in Lille**
 - Scientific analyses by IAS
- **Validation of Desk designs against operational practise**
 - Three test campaigns with four design variants
 - Almost 60 comprehensive test cycles with drivers from 11 countries
- **Generally extremely positive feedback!**
 - But no desk was perfect
 - Constructive comments lead to continuous improvements between the campaigns
 - All desk variants are proven in practise!
- **Results form the basis for upcoming EN (CEN WG 37)**



Project goals EUDDplus

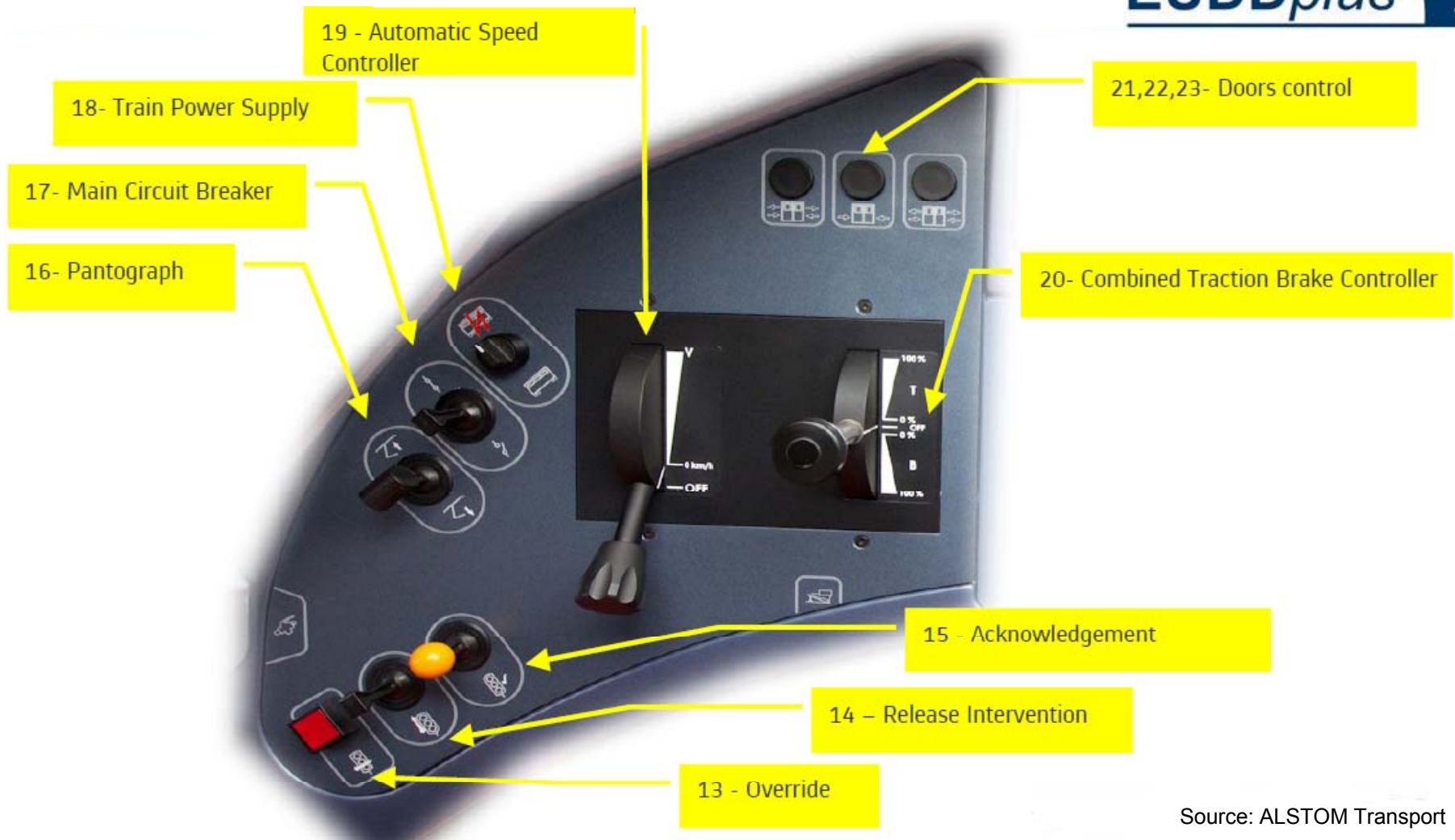


Drivers' desk design



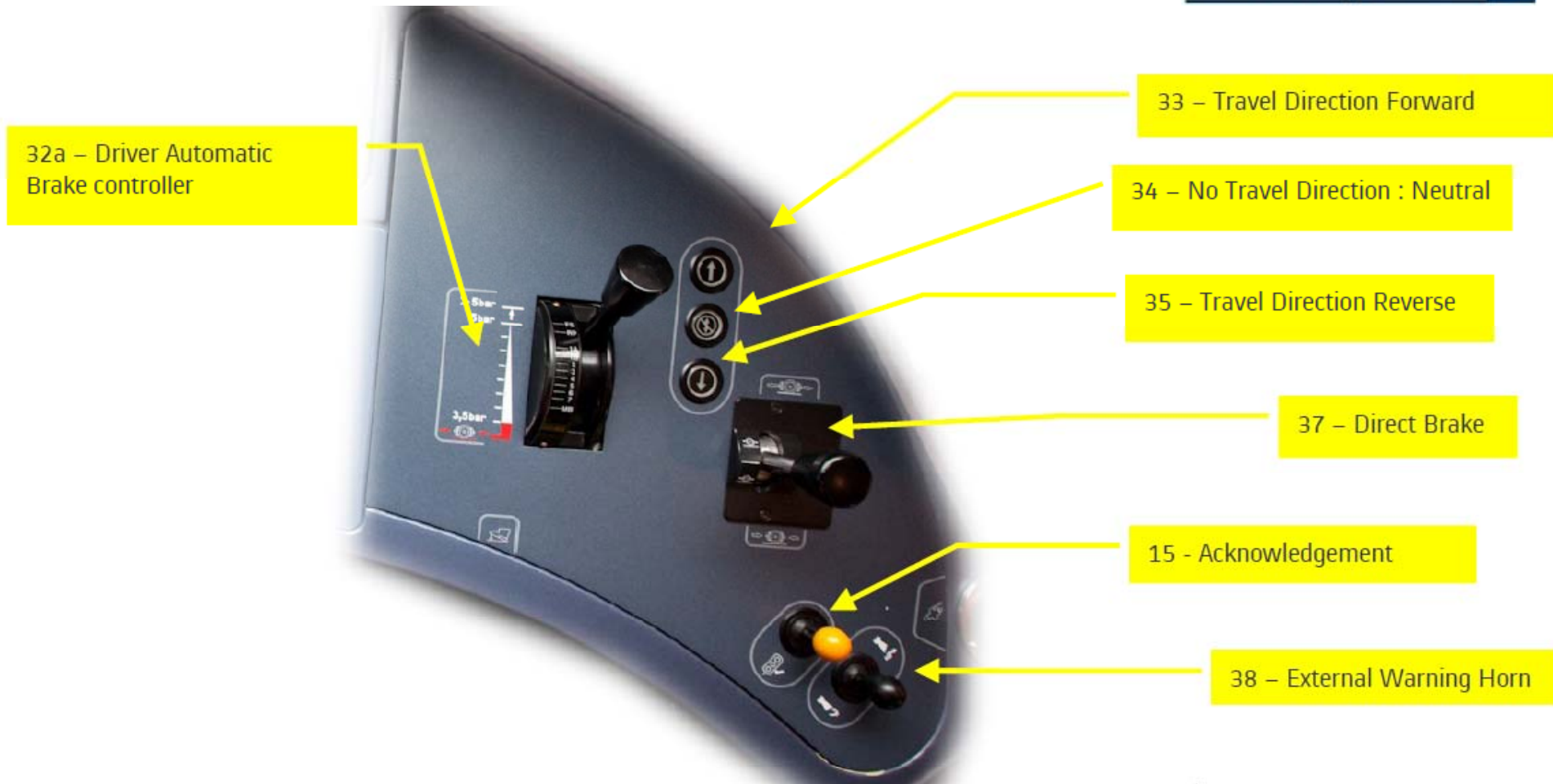
Source: ALSTOM Transport

Functional grouping of left side control elements



Source: ALSTOM Transport

Functional grouping of right side control elements



Source: ALSTOM Transport

EUDDplus Reference tests

Velim (Czech Republic, August 2009)



Testlok Škoda 109E



EUDD-Design of the drivers' desk



Instruction of drivers



During a test run

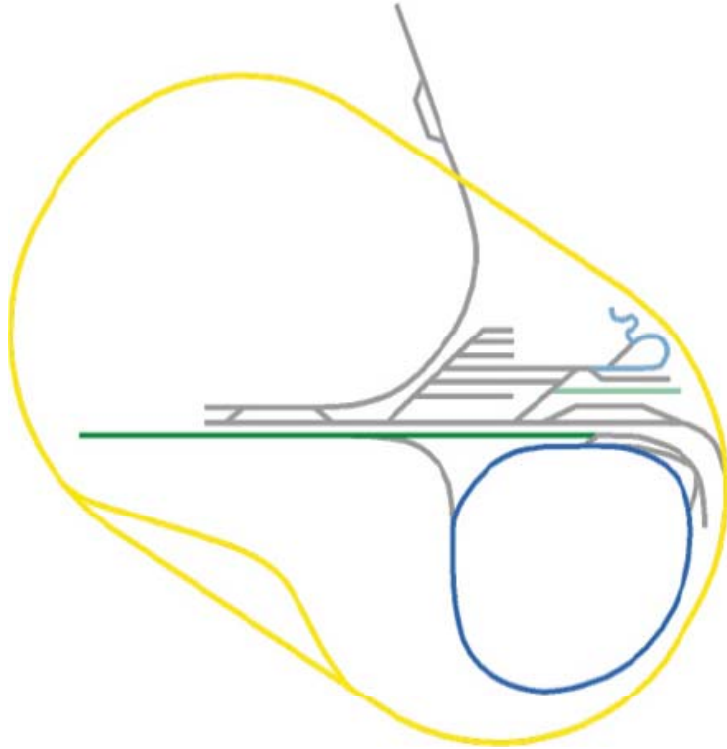


*Analysis of
eye movements*



Filling in questionnaires

EUDDplus In field tests Wildenrath



Test oval T1

Length: 6.082 m
Max. speed: 135/160 km/h

Test oval T2

Length 2.485 m
Max. speed: 85/100 km/h

Test track T5

Length 410 m
Max. gradient: 40/70 ‰



Test features:

- 4 weeks in November/December 2009
- 17 drivers from CZ, H, A, CH, I, SLO, F, B, NL, D
- Loco with wagons → 200 m long freight train
- 6 scenarios (normal operation, incidents, gradient)

EUDD*plus* **in-field tests Wildenrath**

Comprehensive organisational measures before the field tests

- ▶ Clarification of technical and operational feasibility and organisational questions with the test centre operator
- ▶ Familiarisation with the technical and operational rule of the Wildenrath test centre
- ▶ Contact to train operating companies regarding availability of test drivers, clarification of aspects regarding insurance
- ▶ Organisation of additional facilities and personnel staff: wagons, signals, pilot driver, auxiliary services of the test centre, clarification of aspects regarding insurance
- ▶ Project acting as a kind of „train operating company“ for 30 days and a mileage of 4,000 km!

EUDDplus **In field tests Wildenrath**

Freight train running on the large test ring T1
(Scenarios 0, 1, 2 - normal operation, maximum speed: 120 km/h)

- Locomotive PRIMA II
- 9 empty 4-axle container-carrying wagons, types Sgns/Sgnss
- Train length: 192 m
- Train weight: 263 t
- Braking percentage: 103 %



EUDDplus **In field tests Wildenrath**

Flexible signalling was necessary to simulate 50 to 60 km long trips on the 6 km long test ring T1.

- 6 LED screens steered by GSM-R at km 0.3 / 1.5 / 2.5 / 2.9 / 3.2 / 5.4
- 6 rail contacts gave the impulses for switching of the next signal on the same position.
- Use of the same signalling principles than in SIMUFER tests for the MODTRAIN project:
 - Main and distant signals
 - Announcement and begin of speed restrictions
 - Announcement, begin and end of neutral sections
 - Announcement, begin and end of power supply transitions
 - Begin and end of cab-signalling



EUDDplus

In field tests Wildenrath

Instruction of train drivers at the training simulator



Test loco Alstom PRIMA II during shunting procedure



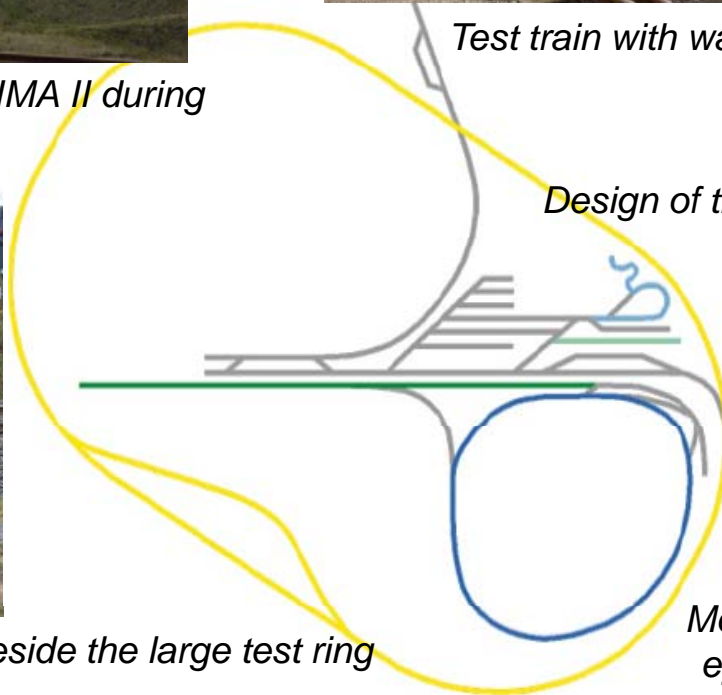
Test train with wagons



Design of the EUDDplus-drivers' desk



Additional signals beside the large test ring



Measurement of eye movements



EUDDplus- In field tests Wildenrath

Data collection and analysis

Objective data

- Luminance measurements in the drivers' cabin
- Measurement of drivers' eye movements
- Recording of driving data
- Observation of drivers' behaviour



Subjective data

- Evaluation of ergonomical aspects of the drivers' desk and the displays, of the interactions with hard- and software functions by questionnaires
- Evaluation of stress and strain by rating scales
- Drivers' comments during the test runs at the locomotive and at the simulator

The drivers' conclusion regarding quality, comfort, beauty and usability was a general positive one.

EUDD*plus* **LCC analysis**

- ▶ 12 % savings regarding LCC are possible, if 70 to 90 units are considered to be produced without adaptations (small production runs)
- ▶ The funding costs for development within the projects EUDD, EUCAB and EUDDplus will be amortised with the 2000th unit (earlier for bigger production runs)
- ▶ The maximum saving potential is to be seen with bigger production runs (> 100 units) is to be expected with 30%.

On the way towards standardisation

- Conformity check against Technical Specifications for Interoperability (CR TSI Loc&Pas RST) demonstrated a conformity of nearly 80% for *EUDDplus*
- Adjustment of *EUDDplus* testing programme with TSI was very helpful
- Results of *EUDDplus* on the basis of EUCAB and UIC leaflet 612 expand into the common Technical Recommendations of UIC and UNIFE for drivers' cabs (TecRec N°100_002)
- The integration of the *EUDDplus* specifications into European standards (TSI, EN) gives the crucial impulse for acceleration of authorisation processs and for cross acceptance procedures between the member states.





Date: 07/06/2010

N°100_002

Technical Recommendation

Driver Machine Interfaces

in the scope of TSI High Speed and Conventional Rail

Approved	Signature	Name	Date
UNIFE		Eric Fontanel	04.06.2010
UIC		Emilio Maestrini	01.06.2010

Published by: UNIFE and UIC

Milestones

Dissemination during EUDDplus

*Kick-off Meeting
 Munich August 2006*



*Intermediate Seminar
 Brussels, September 2009*



*Final
 Conference*



*UIC, Paris
 January 2010*



Public Demonstration Day, Testcenter Wildenrath, December 2009



Dissemination Activities *EUDDplus*

- ▶ Presentations , e.g. at the Euro Zel 2010 Railway Congress in Žilina (SK) and at the 9th World Congress on Rail Research (WCRR 2011) in Lille (F)
- ▶ Articles, e.g. in EURAILmag #21, ETR – Eisenbahntechnische Rundschau 9/2010, RTR – Railway Technical Review 3/2010
- ▶ *EUDDplus* Project documentation video
- ▶ InnoTrans 2010: Presentation of the *EUDDplus* training simulator and project poster
- ▶ TSB Workshop Rail Transport Technologies, 7 December 2010



Thank you for your attendance!