

The TRAXX Locomotive Platform

Traction for European Railways

Innotrans, 24 September 2008

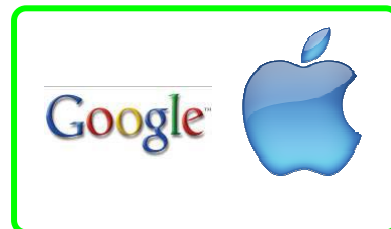
Dan Otteborn, Bombardier Transportation

BOMBARDIER

Innovation matters - with skills and passion

Bad and best practices pinpoint the fundamentals for success

- BT is Number 1 in the business – and we are proud of what we achieved.
- To stay Number 1, innovation in all sectors is vital from now on.
- Innovation is a risk demanding endurance and financial commitment.
- Becoming and remaining the number 1 in a rapidly changing market largely depends on *not innovating* or *innovating*.



BOMBARDIER

Innovation matters - with skills and passion

We need to understand innovation & build on existing BT best practices

Innovation is a **new development** (product, service, process etc.) creating a **sustainable competitive advantage**, an obvious, clear **benefit** for the **customer** and **economic success**.

Permanent Magnet Motor

Gröna Taget



Superior Performance –
Fewer motors –
More efficient



Intelligent efficiency

eco⁴



BOMBARDIER

© Bombardier Inc. or its subsidiaries. All rights reserved.

The TRAXX Platform

Development in line with European liberalization



1997; Railion order of the
BR 185, 400 locos (Germany)



2005; Angel Trains Cargo
TRAXX MS (D-A-B-NL; D-PL)



2006; Renfe Mercancias
TRAXX DC (Spain)



2002; SBB Cargo
TRAXX AC (D – CH)



2005; Angel Trains Cargo
TRAXX DC (Italy)



2007; Veolia / MS Pool
TRAXX MS (D-B-F)



2003; SBB Cargo
TRAXX MS (CH – I)



2005; LNVG & **2006**; CBRail
TRAXX DE (Diesel)



2006; CBRail; **2007**; BLS Cargo
TRAXX MS (D-A-CH-I)



BOMBARDIER

© Bombardier Inc. or its subsidiaries. All rights reserved.

The TRAXX Platform

Four types - optimized for the different freight corridors

<p>TRAXX AC 15 + 25 kVAC</p> 	<p>TRAXX DC 3 kVDC</p>  <p>Italy, Spain, Poland</p> <p>North-South corridors</p>	<p>TRAXX MS 15/25 kVAC & 1.5/3 kVDC</p>  <p>Benelux, Italy, Poland</p>	<p>TRAXX DE diesel-electric</p>  <p>Non-electrified lines</p> <p>1'300 TRAXX locomotives sold 800 TRAXX locomotives in operation</p>
---	--	--	---

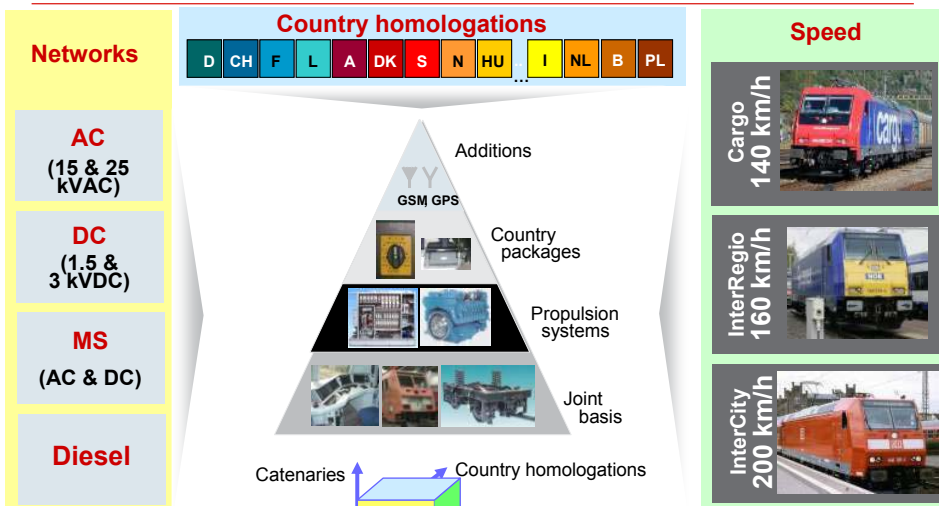
© Bombardier Inc. or its subsidiaries. All rights reserved.



BOMBARDIER

The TRAXX Platform

It is modular in three dimensions



BOMBARDIER

The TRAXX Platform

Interchangeable bogies for 140, 160 and 200 km/h



display



140 km/h



160 km/h

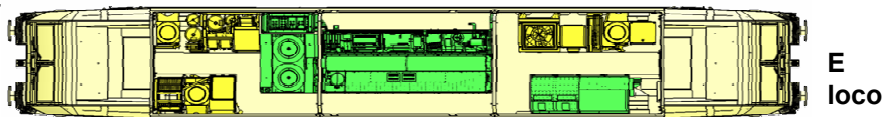


BOMBARDIER

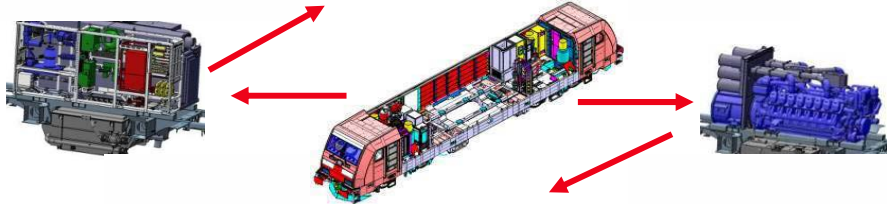
© Bombardier Inc. or its subsidiaries. All rights reserved.

The TRAXX Platform

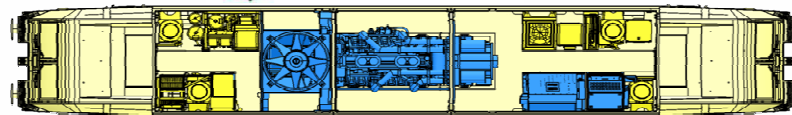
Electric and diesel locomotives within one platform – a world's



E loco



DE loco



- Same carbody
- Same bogie, traction motor and drive system
- Same driver's cab and desk
- Same control and communication



BOMBARDIER

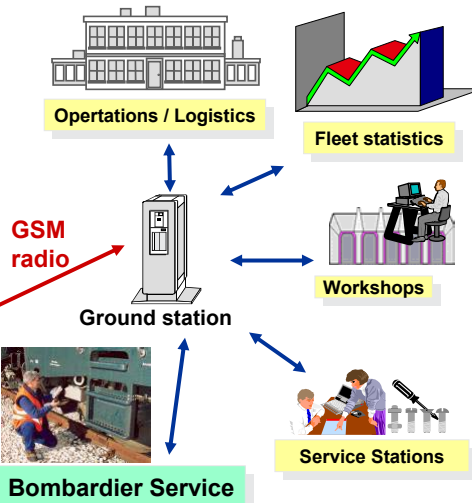
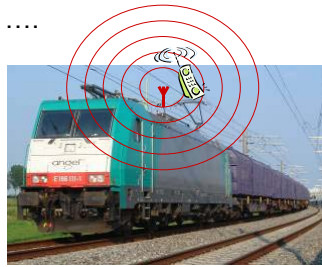
© Bombardier Inc. or its subsidiaries. All rights reserved.

Increasing efficiency of rail transport

By optimizing service and maintenance activities

Possible services, e.g. ...

- variable coverage up to 100 %
- spare parts management
- 24 hour hot line
- fleet management
- engineering, technical support
- training
-



© Bombardier Inc. or its subsidiaries. All rights reserved.



BOMBARDIER

Reducing the environmental impact of rail transport

ECO4 = Energy, Efficiency, Economy, Ecology

- **Low energy consumption**
 - High power efficiency
 - Maximum power regeneration
 - Low loco mass
- **Low noise emissions (inside and outside)**
 - Well below levels of TSI Noise
 - No macro slip noise due to disc brakes
- **Low waste; low wear & tear**
 - Oil free compressor
 - Only 440 kg critical waste over 30 years
 - Transformer cooling with bio-degradable oil
 - Long wheel life – typically 1 Mio. Km in Germany
- **93% of all material is recyclable**



Transformer with bio-degradable oil



Oil free compressor

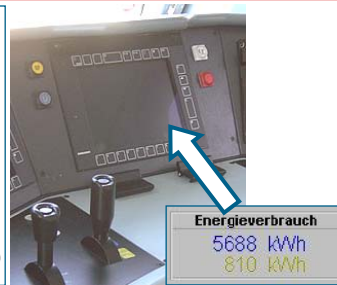
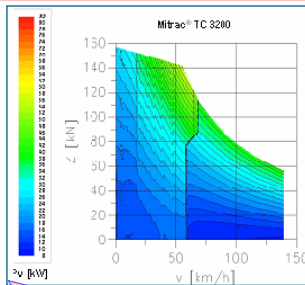
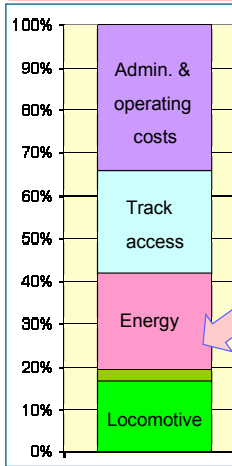
© Bombardier Inc. or its subsidiaries. All rights reserved.



BOMBARDIER

Increasing the efficiency of rail transport

By minimizing operating costs



Energieverbrauch
5688 kWh
810 kWh

Energy savings through ...

- **Regeneration of braking energy!**
 - 10% savings on average in Germany
 - >25% savings on average in Switzerland
- **Adapted driving style - up to 20% savings!**
 - Display of energy consumption to the driver
- **Locomotive design with high power efficiency!**

Total cost of operation
(Rotterdam – Italy)



BOMBARDIER

© Bombardier Inc. or its subsidiaries. All rights reserved.

Cross-border technologies

New solutions for enabling interoperability through Europe



Crash according to EN 15227

The features:

- Increased safety
- Lower repair costs
- Facilitation of homologations



Running at low catenary voltages

The features:

- Stability of catenary network
- High reliability
- EN 50163 fulfilled



Solving interference & track circuit issues

The features:

- Switchable Indusi electro-magnet
- Track circuit compliance in France



Triebfahrzeugkategorien:

Triebfahrzeugreihe	Bewertungsziffer (m-d)	Klassifizierung
Elektrolokomotiven		
DB 152	1 115	Kategorie C
DB 182	1 036	Kategorie B
DB 185	1 019	Kategorie B
DB 189	1 051	Kategorie C

Low track forces

The features:

- Reduced track access costs, e.g. in Austria
- Lower LCC



BOMBARDIER

© Bombardier Inc. or its subsidiaries. All rights reserved.

Cross-border technologies

Integration of national automatic train protection (ATP) systems



Simply adding ATP systems does not work!

TRAXX driver's desk for the corridor
Rotterdam – Milano (D-A-CH-I-NL)



Central ERTMS display

© Bombardier Inc. or its subsidiaries. All rights reserved.



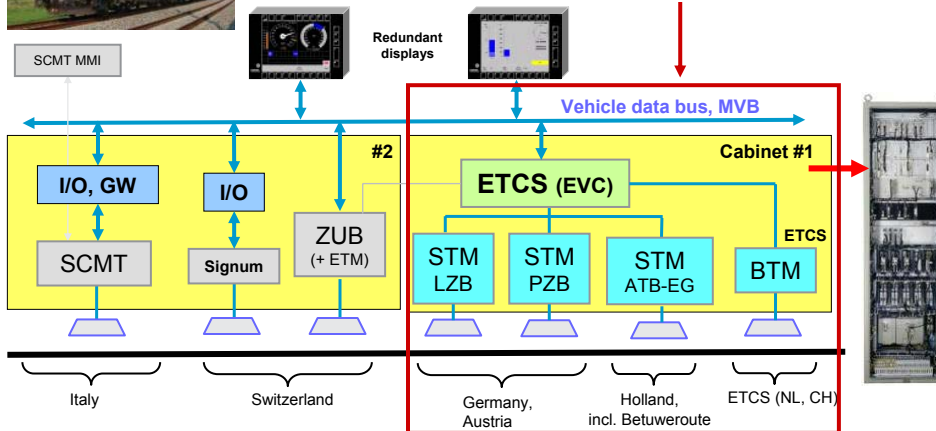
BOMBARDIER

Cross-border technologies

Integration of national automatic train protection (ATP) systems



The national ATP systems are connected with STM's (Specific Transmission Systems) to the central ETCS computer



BTM = Balise Transmission Module used to read ETCS signals



BOMBARDIER

© Bombardier Inc. or its subsidiaries. All rights reserved.

Cross-border technologies

Today a large number of antennas are needed (D-A-CH-I-NL: 25 antennas)

Swiss Signum
(4 antennas)



ETCS & LZB (5 antennas)



SCMT & ATB-EG (4 antennas)



German Indusi
(2 antennas)



ETCS radar (one antenna)



Swiss ZUB 262 with ETM (3 antennas)



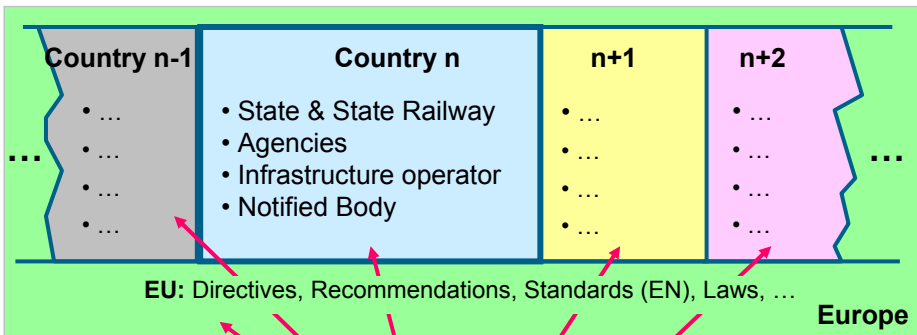
© Bombardier Inc. or its subsidiaries. All rights reserved.



BOMBARDIER

Cross-border homologations

Cross-acceptance, EN Norms and TSI pave the way forward



The solutions:

- Cross-acceptance
- TSI
- EN standards
- Standardization
- New technologies

© Bombardier Inc. or its subsidiaries. All rights reserved.



BOMBARDIER

The TRAXX Platform covers the needs of economic traction

- **TRAXX locomotives fulfill the requirements of European operators**
 - Technical performance & functionality for European corridors
 - Standard and proven product
 - Short delivery schedules
- **High reliability and availability**
 - Service proven components and systems
- **High economical benefit over life time**
 - Large customer base provides opportunities for co-operations (in train operation, maintenance, spare parts)
- **Strong market acceptance all over Europe**
 - Liquid market for buying, selling, leasing or renting
- **The operator has a choice of standard locomotive types based on the same technology for the networks: AC, MS, DC, diesel**
 - Flexibility today and in the future



BOMBARDIER

© Bombardier Inc. or its subsidiaries. All rights reserved.

STM's potential and possible roadblocks

- **STM's have been and still are seen by several suppliers as a strategic tool in order to maintain their position in regards to their legacy APT systems**
- **The consequences of this strategy are severe and creates problems for every one as follows:**
 - Specifications for STM were not at the highest priority meaning that they finished rather late.
 - The technical solution for connecting STM's to the main ETCS computer might not be the optimal
 - Rolling stock supplier must in many case develop their own STM even for competitors legacy system, Expensive , difficult and long development and approval time.
- **On contrary to the above STM's should be seen as a commodity/component offered to everyone in need on fair and equal conditions.**
- **Originally it was stipulated that the Infrastructure manager should make sure that STM's were available on equal conditions when needed.**
- **To my knowledge only the Swedish infrastructure manager BV have taken on this challenge**



BOMBARDIER

© Bombardier Inc. or its subsidiaries. All rights reserved.

The TRAXX Platform

The European solution for State, Private Railways & Leasing Companies

1'300 TRAXX locomotives sold
800 TRAXX locomotives in operation

BOMBARDIER

Thank you for your attention!



BOMBARDIER