The Train of the Future

Presented by
Luc J. Roy, CTO Subsystem Platforms
Bombardier Transportation

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The Train of the Future

1 HIGH SPEED AND VERY HIGH SPEED TRAINS

2 NEW TECHNOLOGY TEST TRAINS

3 THE TRAIN OF THE FUTURE

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High Speed (HS) and Very High Speed (VHS) trains Evolution

Understanding the evolution is key to determine the future of rolling stock:

- Technological evolution
  - From locomotive hauled trains to Electrical Multiple Units (EMU) matching power electronics market (in general)
  - VHS speed upgrade (from initial 220 kph to more than 350 kph)
  - High capacity with double decks, coupled units
  - Cross-country capabilities especially in Europe
  - More services to the passengers (mobile, internet, entertainment, information)

- All rolling stock evolution had a significant impact on signaling, rail infrastructure, platform length, power supply ratings and train-to-wayside communications.

High Speed (HS) and Very High Speed (VHS) trains
Introducing new challenges

Introducing a global HS/VHS network like in China recently is a step forward:

- All Chinese cities above 1 million will be linked by HS network by 2015

But:

- New challenges
  - Drivers facing complexity when something failed
    - High reliability and short headway provides no tolerance to major operational issue
  - Signaling equipment diversity
    - Multiple equipment providers create complexity (testing, homologation, operational)
  - Speed reduction from original design specification
    - Trains originally specified up to 380 kph running at 300 kph then later back at 350 kph
  - Wear & tear on rail and catenary infrastructure
    - Life cycle costs (LCC) for rail/wheel and catenary/pantograph at VHS
  - Mixed type of trains with originally based European/Japanese train design
    - Designed differently, it creates some operational difficulties (train recovery, crash norms, drivers training…)

Now it will converge to a unified technical specification for EMU250/350 kph trainsets.

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New technology test trains
The Green train

Understanding the introduction of new technology is key to determine the future of the rolling stock:

For example, Gröna Tåget (the Green train) was a research and development project with the aim to develop a high-speed tilting train concept for the Swedish and Nordic markets. Gains in travelling times and lower operational costs were expected.

- Trial of new technology
  - Energy consumption by using Permanent Magnet Motor (PMM)
  - Assist the driver by using Driver Assistance System (DAS)
    - Punctuality, Energy savings, Reduced wear
  - European Rail Traffic Management System (ERTMS) on board equipment
    - More information available to the driver like text messages, temporary speed restrictions, distance to stations
  - Active system to compensate the roll effort in curves for improved comfort and speed (FlexxTronic WAKO)

Most of the technologies tried on the Green train are now installed in the new generation of trains like SBB TwinDEXX or OMNEO for R2N projects. They will be in service from 2014 and beyond for test trial from 2005-2013.

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Think what will the next generation in the next 10 years ?

… and they need to operate for the following 30-40 years !

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Vision

Most probably, we will see plenty of innovations that will re-invent the way we use trains but within some constraints orienting the design (still see the 2 rails….)

We can foresee two main axis for re-inventing the train by addressing problems with innovative solutions:

1) Each train is a unique IP address (Intelligent train)

2) Operating a new type of train with lower operational costs

The Train of the Future
Each train is a unique IP address (Intelligent train)

- An intelligent train will allow:
  - High connectivity between the train and the wayside
    - Instead of having separate on-board subsystems (On-board signaling, Train Control Management System,…) and wayside (signaling, communications, internet, …etc), all information becomes integrated but segregated for critical functions
      - At your seat personal infotainment with or without your personal information devices
      - At the station exchange between platform and train like visual information
      - While running, infrastructure monitoring and detection by the train of any anomalies
  - Passengers counting for adaptive operation
    - Complete adaptation of train capacity (air comfort, deceleration,…) knowing exactly how many passengers and baggage on board

The new train will be able to evolve considering all changes in information technology.

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Operating new type of train with Lower Operational Costs

- The new type of train will allow:
  - Automatic driving of HS/VHS trains
    - Driver becomes an operator which role is to ensure optimal energy consumption
    - Vision system for detection of any obstruction
    - Combine the information with the infrastructure monitoring and detection by the train
  - Lighter material
    - More use of advanced composite materials for carbody and structural elements
  - Track friendly bogies and catenary friendly pantograph
    - Adaptive technology to protect the infrastructure investment
  - Adaptation to extreme conditions
    - Challenge to operate in severe weather conditions (Snow, cross wind, flash flooding,….)
    - Remember Eurostar December 2009

The new train will be able to operate at lower costs in conditions foreseeing in the future.

Q&A