ETCS Migration and the Impacts on Railway Transport Markets

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Content

- Railway research at the German Aerospace Center (DLR)
- Initial situation
- Opportunities and threats of ETCS migration
- Market considerations, macro-economic benefits
- LCC as crucial economic figure
- Development and evaluation of migration scenarios
- Conclusions
Holistic view on operational, economical and safety aspects of train automation

- Interoperability
- Safety
- Operating procedures and evaluation
- Economical evaluation, migration and LCC
- GALILEO applications
- Validation and testing
Initial situation regarding interoperability

- Interoperability of railway transport in Europe is affected by several technical and operational obstacles
  - Track gauges
  - Braking curves
  - Electrical power supply systems
  - Height of station platforms
  - Maximum track gradients
  - Etc.

Most significant lack of standardisation – more then 20 CC-Systems lead to fragmentation of the European railway landscape…
# Automatic train protection
## National system deployment

<table>
<thead>
<tr>
<th>Country</th>
<th>Share of not equipped track km and vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Track km [%]</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>85</td>
</tr>
<tr>
<td>Poland</td>
<td>39</td>
</tr>
<tr>
<td>France</td>
<td>12</td>
</tr>
<tr>
<td>Germany</td>
<td>10</td>
</tr>
<tr>
<td>Luxemburg</td>
<td>5</td>
</tr>
<tr>
<td>Netherlands</td>
<td>4</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0</td>
</tr>
<tr>
<td>Italy</td>
<td>63</td>
</tr>
<tr>
<td>Spain</td>
<td>11</td>
</tr>
<tr>
<td>UK</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: UIC 2004
International rail transport
Share within overall traffic volume

<table>
<thead>
<tr>
<th>Country</th>
<th>Share of international transport in overall railway traffic volume</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freight Traffic [&gt;]</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>7</td>
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<tr>
<td>Poland</td>
<td>30</td>
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<tr>
<td>France</td>
<td>40</td>
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<tr>
<td>Germany</td>
<td>50</td>
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<tr>
<td>Luxemburg</td>
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<td>Switzerland</td>
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<td>Italy</td>
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<td>Spain</td>
<td>20</td>
</tr>
<tr>
<td>UK</td>
<td>6</td>
</tr>
</tbody>
</table>

Source: UIC 2004
ETCS – different technical and functional levels
Providing technical interoperability

<table>
<thead>
<tr>
<th>v supervision</th>
<th>Data transmission</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>spot</td>
</tr>
<tr>
<td>Level 1</td>
<td>✓</td>
</tr>
<tr>
<td>LS</td>
<td>✓</td>
</tr>
<tr>
<td>Level 2</td>
<td>✓</td>
</tr>
<tr>
<td>Level 3</td>
<td>✓</td>
</tr>
</tbody>
</table>

Functional Requirements:
- High-speed lines
- Rail freight lines
- Feeder lines
- Low-density secondary lines
Migration of ETCS – motivation and opportunities

- EU Directives 96/48/EG und 2001/16/EG
- Interoperability / impacts on railway operation and macroeconomics
  - Market for signalling systems
  - Harmonisation and standardisation of technologies
  - Barrier-free access to the European railway infrastructure
  - Seamless cross-boarder traffic
  - Decrease of transport time
- Operational performance of European railways
- RAMS aspects / increase and harmonisation of the safety level in Europe
- Microeconomic impacts, LCC

RAMS: Reliability, Availability, Maintainability, Safety
Migration of ETCS – barriers and threats

- High invests for the track and train-side ETCS equipment
- Capable national CC-Systems (in some countries…)
- Migration process – cost and time
  - National legacy systems with their long life cycles
  - Expensive parallel equipment during the migration period
- Certification process – cross acceptance
- Operational Interoperability
- European subsidies for IM and TOC
- Positive economical effects realised mostly in a long term period

RAMS: Reliability, Availability, Maintainability, Safety
ETCS - main conditions for the success

ETCS as technological platform

- Optimal migration
- Low LCC
- Efficient cross-border operation
- Macro economic aspects
ETCS as a driver for global optimisation

To increase performance and competitiveness compared to road, various issues are to be addressed on defined corridors.
Simplified LC model for railway operations control

\[ LCC = A_0 + \sum_{j=1}^{n} (M_j + O_j \times \frac{1}{(1+d)^j}) + D_n \]

Ca. 30 - 35 Years

- Subsidies
ETCS implementation
Macro economic benefits

- Less CC on-board equipment on international trains
- Increase of efficiency for TOCs
- Low-barrier access to the rail infrastructure
- Increase of competition

- Decrease of transport prices
- Modal-shift

- Increase of safety level through harmonisation of train control systems in Europe
- Economies-of-scale through modification of markets

- Macro-economic benefits
ETCS migration on strategic and operational level
Conclusions

- ETCS aims to provide technical interoperability of European railways
- Basis for operational interoperability still has to be carried out
- European and national subsidies are necessary to accelerate the deployment of the system
- In order to improve efficiency and competitiveness of the railway system, ETCS has to address following issues
  - Improvement of operational performance – ETCS as driver for global optimisation
  - Micro and macro economical benefits, sustainable decrease of LCC
  - Optimal migration strategies
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