X2Rail–1
ATO over ETCS (up to GoA4)

Valenciennes, 15th November 2017
What is ATO over ETCS?

Performances
- Suppression of reaction time due to the driver (from ETCS safety curves)
- Reduced dispersion in the travel times
- Reduced margins included in Theoretical Time Tables
- Reduced operational headway
- More trains per hours on the same infrastructure

Quality of Service
- Better punctuality
- Greater comfort impression

Operation Costs
- Reduced energy consumption
- Reduced train fleet and staff to operate a line for a given operational headway
### Grades of Automation

<table>
<thead>
<tr>
<th>Grade of Automation</th>
<th>Train Operation</th>
<th>Setting train in motion</th>
<th>Driving and stopping train</th>
<th>Door closure</th>
<th>Operation in event of disruption</th>
</tr>
</thead>
<tbody>
<tr>
<td>GoA 1</td>
<td>ATP with Driver</td>
<td>Driver</td>
<td>Driver</td>
<td>Driver</td>
<td>Driver</td>
</tr>
<tr>
<td>GoA 2</td>
<td>ATP and ATO with Driver</td>
<td>Automatic</td>
<td>Automatic</td>
<td>Driver</td>
<td>Driver</td>
</tr>
<tr>
<td>GoA 3</td>
<td>Driverless (DTO)</td>
<td>Automatic</td>
<td>Automatic</td>
<td>Attendant</td>
<td>Attendant</td>
</tr>
<tr>
<td>GoA 4</td>
<td>Unattended (UTO)</td>
<td>Automatic</td>
<td>Automatic</td>
<td>Automatic</td>
<td>Automatic</td>
</tr>
</tbody>
</table>

**Legend:**
- ATP: Automatic Train Protection
- ATO: Automatic Train Operation
- DTO: Driverless Train Operation
- UTO: Unattended Train Operation

**GoA1+ C-DAS over ETCS**
Activities

Shift2Rail

ETCS Baseline 3

AoE System Requirements (GoA2)

EEIG – ATO over ETCS Operation Concepts (Up to GoA4)

Product development phase (limited to GoA2)

Test Bench Demonstrator (limited to GoA2)

Pilot Line Demonstrator (limited to GoA2)

ATO over ETCS (up to GoA4)

Feasibility Study

ATO over ETCS Specification work (up to GoA4)

Product development phase (up to GoA4)

Test Bench Demonstrator (up to GoA4)

Pilot Line Demonstrator (up to GoA4)

Quick Win

Ten-T

NGTC

AoE System Requirements (GoA2)

EEIG – ATO over ETCS Operation Concepts (Up to GoA4)
Example of Energy Savings in GoA2

Intercity trains

Different driver behaviours on same journey...

Speed profiles

Cumulated Energy Consumption

... lead to potential consumption of up to 15%
Example of Energy Savings in GoA2
Local trains

Different driver behaviours on same journey...

Speed profiles

... lead to potential consumption of up to 42%

Cumulated Energy Consumption
The first GRANT is limited to 2019 (blue part).
Involvement of the Agency

WP4 Meetings participation
  – in order to validate overall consistency
  – taking part in the review process of all ATO documents
  – to approve potential impact on the CCS TSI (Annex A)

Guidance from the Agency on how the S2R development will link with the Change Control Management process through EECT meetings.

AoE architecture: to be agreed with The Agency
Conclusion

– ATO over ETCS (up to GoA4) will permit
  • To increase transportation capacity without huge infrastructure investment
  • To reduce energy consumption
  • To reduce operation costs

– GoA2 already permit to achieve quick wins with limited impact on ETCS

– The involvement of the Agency is required
  • to validate the interoperability and interchangeability of the ATO solution
  • to master the impact on ETCS
Challenges

- ATO must be a business case for the actors involved
- Border to be defined between Train Protection (ETCS) and ATO
- Impact on ETCS (e.g. ATO Icon or mode)
- Making the rail infrastructure ready for ATO (e.g. provide all relevant data, manage obstacles at tracks)
- Interoperability
- Retrofitting (especially for GoA4)
- Migration
Guiding Principle

- Use existing information/experience as input
  * UNISIG-EUG activity (Cr 1238)
  * Experience from ATO users (e.g. SNCF)

- Align EU funded activities (e.g. Shift2Rail IP2 project)

- Ensure interoperability

- ATO (GoA2) functions shall be functionally decoupled
  (safe train operation functions shall be ensured by the train protection (safety) system (ETCS) and automation functions (GoA2) shall be ensured by the ATO-system)

- ATO usable for urban rail, high speed services, rail freight services, and mixed traffic lines

- Plug and play
  only when a market exists/parties involved will invest
ATO must be interoperable,

- It must be possible to operate in ATO GoA2 over the whole network,
- It must be possible to have mixed operation (ATO and non ATO) on ATO lines,
- Minimum impact solution on ETCS on-board for GoA2 must be possible too,
- GoA2 train to be able to operate on a GoA4 line,
- GoA4 lines must be able to manage GoA2 trains,
- ATO is not safety relevant, the system safety is guaranteed by ETCS (GoA4?),
- TSI CCS part for ATO should be optional,
- The migration plans towards GoA4 system should be developed preserving max investment already made (stepwise approach).
• ATO (GoA2) planning EECT
• Review of
  • ATO SRS (Ss125)
  • FFFIS ATO on-board – ATO trackside (Ss126)
  • FIS (FFFIS) ATO on-board – ETCS (Ss130)
planned to be finalised by March 2018

• Decision where to put
  • TSI CCS Annex A
  • Application guide
  • Voluntary “standards”
  the documents (Ss125, Ss126, Ss130, Ss......) will be taken afterwards

• TSI CCS Annex A impacted documents
  • ETCS SRS (SS026),
  • ETCS Driver Machine Interface (ERA_ERTMS_015560)
  • .........

• TSI OPE Annex A (OPE rules) needs to be updated as well
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