WHAT ARE THE DRIVERLESS TRAIN OPPORTUNITIES FOR RAIL BALTICA?

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Autonomous trains -
not a science fiction anymore, but a reality and necessity
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OPPORTUNITIES OF ATO

Overall system concept

TMS

Traffic Management System
Coordinates train movements

ETCS trackside

European Train Control System
radio block center and eurobalises
Provides safe movement authorities

Track – train communication

ATS – ATO communications
via ETCS and GSM-R radio

ETCS on-board

European Train Control System
on-board equipment
Ensure safe train movements

ATO

Automatic Train Operation
on-board equipment
Ensure optimum train movements
<table>
<thead>
<tr>
<th>Type of train operation (Grade of Automation)</th>
<th>Setting train in motion</th>
<th>Stopping train</th>
<th>Door closure</th>
<th>Operation in event of Disruption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unequipped</td>
<td>Driver</td>
<td>Driver</td>
<td>Driver</td>
<td>Driver</td>
</tr>
<tr>
<td>ATP with driver (GoA1)</td>
<td>Automatic</td>
<td>Automatic</td>
<td>Driver</td>
<td>Driver</td>
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<tr>
<td>STO</td>
<td>Automatic</td>
<td>Automatic</td>
<td>Driver</td>
<td>Driver</td>
</tr>
<tr>
<td>ATP, ATO with driver (GoA2)</td>
<td>Automatic</td>
<td>Automatic</td>
<td>Driver</td>
<td>Driver</td>
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<tr>
<td>DTO</td>
<td>Automatic</td>
<td>Automatic</td>
<td>Train attendant</td>
<td>Train attendant</td>
</tr>
<tr>
<td>Driverless (GoA3)</td>
<td>Automatic</td>
<td>Automatic</td>
<td>Automatic</td>
<td>Automatic</td>
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<tr>
<td>UTO</td>
<td>Automatic</td>
<td>Automatic</td>
<td>Automatic</td>
<td>Automatic</td>
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ATP – Automatic Train Protection
ATO – Automatic Train Operation
HORIZONTAL DOMAINS

Technology, digitalization and Innovation

Governance, Public Administration, Financial

Networking and partnership capability
What we expect from the outcome of investigation?

**Technology scenarios**
- Candidates scenarios definition, based on rail needs/opportunities assessment, in terms of network, rolling stock, capacity, technology readiness level for on board and wayside, investments plans.
- Definition of solution implementation, technology level integration among specified ATO solutions:
  - remote control shunting
  - driverless for freight
  - full driverless in conventional rail
- Analysis of implemented solutions and technology provider experience at global level, including benefit results.

**Risk & Opportunities**
- Consequences of absence of EU framework Regulatory and safety aspects on railways ATO implementation.
- Technology issues Analysis of implementation level Driverless and Unattended:
  - revealing of obstacles on main line,
  - Crisis management and traffic recovery
  - Radio communication reliability
  - Cybersecurity
  - CSS-Control Command and Signalling with onboard systems

**Big picture**
- List of Components and capabilities at different ATO levels for specific application environment (remote shunting, driverless freight, full scale driverless, etc.)
- Market products comparison and evaluation and preliminary spotting of best in class solution.

**Roadmap to execution**
- ATO transformation plan roadmap for implementation of ATO solution, depending from adopted context, taking in account project sustainability, in terms funding investments, profitability, technology competition

**Alternative solutions investigation**
- Investigation on similar investment solution for onboard train control and signaling, and for wayside components (Interlocking, Control Rooms)

What we expect from the outcome of investigation?
What effect could be caused for the whole Rail Baltica?

- Make Rail Baltica potential ATO - Experimentation Lab in selected routes for EU
- Improve Freight transport system on dedicated lines, from sea to inland
- Modernization of Railways infrastructure investment projects
- Building innovation capabilities in the region railways, potentially to be exported to other regions
- Improving railway market image as highly innovative mean of transport
Which good foreign country practices in autonomous rail applications may be applied in Rail Baltica?

Remote control of shunting locomotives

Driverless freight trains

Driverless metro

Full scale driverless train on conventional rail
What KPIs could be used to measure the performance?

New technology has to be measured on performance, user perception and other implementation comparison base.

KPIs for railways trains performance
- Capacity increase (pax/day, ton/day)
- Punctuality (number of delayed train / alltrains)
- Operational cost reduction (workforce and maintenance costs)

Drivers Perception:
- Support on train control
- Safety and Security perception
- Comfort Increase
- Driving quality

KPIs for ATO
- Energy consumption reduction
- Capacity (number of trains on same line/day)
- Safety (performance of safety technologies)
- Asset utilization (train km/network mk)
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