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The Voice of European Railways

Position Paper
Brussels, 25 May 2016

Building an ATO roadmap

A solution for automated train operation (ATO) is a Railway sector need that will improve the overall and local performance of the rail system. Development must now support positive business cases on actor level.

On 10th May 2016, during the 2nd RU dialogue plenary meeting, the European railway agency (ERA) proposed perspectives on Automated train operation (ATO). CER welcomes the presentation made by ERA and strongly supports the principles proposed. It is indeed essential to aim for quick wins based on existing information and experiences.

The ability to manage interoperability and a plug and play module are key for ATO business cases. Strict principle for compatibility and evolution must be adopted. Open functional and physical interface (FFFIS) of ATO module over ETCS shall be part of ATO specification. It must provide a technical solution that will facilitate upgrade of ATO without impact on ETCS on board equipment.

A roadmap must now be agreed to design an affordable (i.e. cost effective) ATO that deliver quick and long term value for railways. The design should support cost objectives agreed at Sector level.

Value expected for ATO on heavy rail

ERA has well identified that there are many values to be expected from ATO (see slide 2 in annex).

In addition, CER believes that :
- No staff on-board or driverless operations economics need to be evaluated, scope by scope. Idem for adaptation of driver staff volume to traffic. The system however should provide for increased levels of automation.
- Social and human factors should be taken into account; automation is relevant when it is more effective and safe than the human. The human still has a central role to play for the monitoring / remote control / management of degraded conditions.
- Technology is developing with ATO being normal operating practice in CBTC and developments in road transport. It is important that ERTMS has ATO to be available with the potential to increase level of automation to driverless GoA3 and unattended GoA4.

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Guiding principles

The application cases and success conditions are now well addressed in ERA perspective. ERA has well identified that there are many values to be expected from ATO (see slide 3 in annex).

There are indeed application cases for all kinds of railway operation. It is still important that common principles for the migration will be investigated right from the beginning. Migration strategy shall support early return on investment and ambitious innovation.

It is important within this process to define ATO main guidelines for development:

- ATO development is and must be kept compatible with ERTMS specifications
- ATO should be an add on and should not prevent access to the network in respect of interoperability;
- ATO onboard sub-system should be separated from the ERTMS train control sub-system and dialogue one each other via a clear interface specification (FFFIS), allowing a "plug-and-play" approach and enabling different suppliers to provide ERTMS and ATO sub-systems, in order to increase competition and facilitate migration/upgrade of existing and future ERTMS trains;
- Interface between traffic management and ATO must be further investigated to define appropriate real time management of infrastructure and timetable data needed for automated operation. ATS (Automatic Train Supervision), as track side traffic management layer, must be developed autonomously from ATO. Fully defined ATS - ATO interfaces (FFFIS) is a key driver for performance, evolution of capacity and interoperability; it shall be further developed. ATO combined with dynamic path allocation will create better response for freight and opportunities of new offer concepts for passengers (e.g. demand responsive time-table).
- All ATO developments must be SERA (Single European Railway Area) interoperable

Open issues

ERA has recognized the main point proposed by the railways: considering the different issues to be solved ATO can not be seen as a single work-stream delivering over the short term a *complete and perfect* solution.
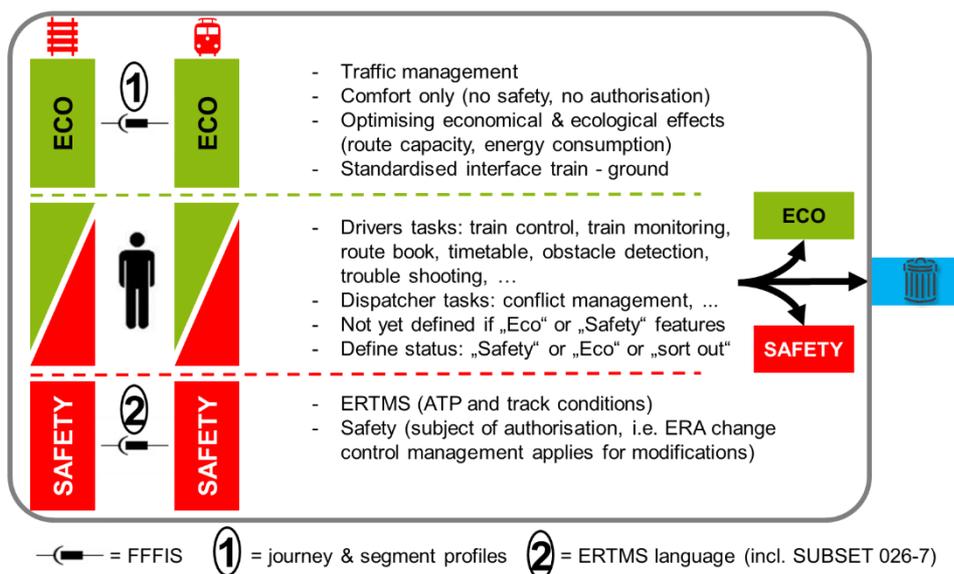
CER has identified several issues that will need to be addressed to reach good business case and increase rail efficiency :
- Obstacle on tracks in case of driverless GoA 3 and unattended GoA 4
- Cyber Security
- System resilience, conditions for traffic recovery after an incident and crisis management
- Reliability of CCS on board: ERTMS and ATO have direct impact on operation performance.
- ATO specific radio communication needs (much higher than ETCS's)
- Roles and responsibilities for the development and management of optimised speed profile for ATO trains.
- Open interfaces (FFFIS solution made available for standard integration of ATO module with ERTMS and train)
- Odometry accuracy, stopping accuracy, recognition of adhesion conditions

Common approach to safety is needed to determine the technology strategy and business case. Structuring the applications in the following levels will facilitate ATO equipment upgradability:
- ATO traffic management functionalities are not safety relevant.
- ATO GOA2 module is a support to driver and automate some of its action. ATO integration over ERTMS is only a question of physical and functional interface definition and does not question the safety case of the rolling stock, the infrastructure or the automatic train protection.
- For driverless or unattended operation (GOA3/4), safety related functions will require automation (e.g. driver control tasks) but this should neither impose redesign of ATO nor change to ETCS.

ATO over ETCS: Economy and Safety features
for driverless/ unattended driving (GoA 3/ 4)

ECO / ECO
- Traffic management
- Comfort only (no safety, no authorisation)
- Optimising economical & ecological effects (route capacity, energy consumption)
- Standardised interface train - ground

- Drivers tasks: train control, train monitoring, route book, timetable, obstacle detection, trouble shooting, …
- Dispatcher tasks: conflict management, ...
- Not yet defined if „Eco" or „Safety" features
- Define status: „Safety" or „Eco" or „sort out"

ECO

SAFETY

SAFETY / SAFETY
- ERTMS (ATP and track conditions)
- Safety (subject of authorisation, i.e. ERA change control management applies for modifications)

—◼— = FFFIS   ① = journey & segment profiles   ② = ERTMS language (incl. SUBSET 026-7)

Conclusion

CER welcomes ERA proposal to meet quick wins with ATO.

To ensure proper development and get all value, it is important to build a European roadmap that enables harmonized vision and ensures timely mitigation of ATO program risk :
- ☐ Balanced approach and foster from European Institutions between rail and road
- ☐ Research and financing support / support to pilot projects
- ☐ Legal framework
- ☐ Technical framework (ERA) including authorisation issues
- ☐ Needed radio spectrum provisions (no interference, sufficient performance, security, interoperability)
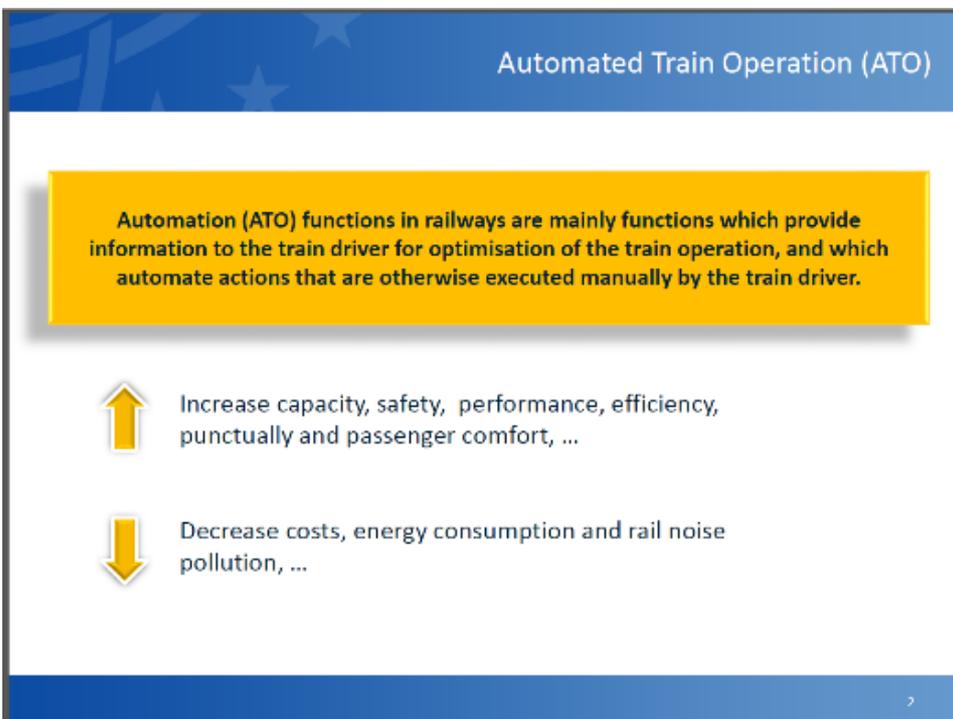- ☐ Migration concept facilitating the introduction of mature technologies and supporting rail economic performance.

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Perspectives on
Automated Train Operation (ATO)

2nd RU Dialogue Plenary Meeting
Brussels, 10/05/2016
Jens ENGELMANN, Head of Corporate Management and Evaluation Unit

European Railway Agency
An agency of the
European Union

Automated Train Operation (ATO)

Automation (ATO) functions in railways are mainly functions which provide information to the train driver for optimisation of the train operation, and which automate actions that are otherwise executed manually by the train driver.

Increase capacity, safety, performance, efficiency, punctually and passenger comfort, ...

Decrease costs, energy consumption and rail noise pollution, ...

Guiding Principles

Plug and play
only when a market exists/parties involved will invest

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

Ensure interoperability

ATO (GoA2) functions shall be **functionally decoupled**
- safe train operation functions via train protection (safety) system (ETCS)
- automation functions (GoA2) via ATO-system

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

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

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Diagnosis

ATO implementation (up to GoA4) is available for metros and mass transit

Within the railway sector, the implementation of ATO functionality is expected to evolve in 2 phases

Phase 1
•ATO (GoA2) program with non-safety related automation functions ('quick-wins' before 2018/2019)

Phase 2
•ATO (GoA3/GoA4) program with focus on autonomous ATO functionality (potentially including safety related functions and use of sensors) with implementation at longer term (synchronised with S2R development)

The ATO business case might be different for the different market segments (mass transit/freight/mixed/ high-speed) and between IMs and RUs

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Potential for Quick Wins

ATO (GoA2) program with non-safety related automation functions
(validation by prototypes before 2018/2019)

Key Actions:

1. **Functional breakdown in function of business/market interest (IM/RU) in order to investigate the required regulatory framework**
Business cases for main lines (high-speed; freight corridors and mixed traffic lines)
Identification of safe and non safe ATO functions
Regulatory (implementation) framework to allow RUs to develop GoA2 apps. on-board

2. **Feasibility study of the different ATO system concepts**
IM sends info via ETCS communication channel or other means of communication;
RU is sending the ATO information

3. **European harmonized system concept - develop standards for interchangeable ATO components (interfaces between ATO and ETCS for GoA2 (based on IP network))**
Plug and play but also allowing integrated solutions

Note: to be synchronised with S2R activities/outputs

About CER

The Community of European Railway and Infrastructure Companies (CER) brings together more than 70 railway undertakings, their national associations as well as infrastructure managers and vehicle leasing companies. The membership is made up of long-established bodies, new entrants and both private and public enterprises, representing 73% of the rail network length, 80% of the rail freight business and about 96% of rail passenger operations in EU, EFTA and EU accession countries. CER represents the interests of its members towards EU policy makers and transport stakeholders, advocating rail as the backbone of a competitive and sustainable transport system in Europe. For more information, visit www.cer.be or follow us via Twitter at @CER_railways.