CER

The Voice of European Railways

Position Paper
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Operators' requirements for ATO development

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Summary

Today railway actors (railway undertakings, infrastructure managers, manufacturers, the Agency) agree on the compulsory need to achieve soon harmonized solutions for ATO over ERTMS.

The development of ATO must now be done in an efficient, coordinated and interoperable way on a European scale in order to:

- **Capitalise on the experiences of the forerunners**

- **Reduce the time of development by pooling efforts together**

- **Benefit from economies of scale by developing standardized products**

- **Strengthen the interoperability of rail transport at the EU level**

It is therefore important to agree now on a common ambition for European railways and on the way to achieve it.

Each one, railway undertakings, infrastructure managers, manufacturers, must build its position, identify what are the major stakes and express them, in order to build a common roadmap.

By this position, CER stresses some high level requirements in order to ensure a fast development of ATO and to actually get the expected benefits. A robust organizational framework supporting efficiency and transparency is also a compulsory element for collective progress and should now also be agreed.

Background

Automation, partial or total, of the control of the trains can bring various benefits for the railway undertakings and the infrastructure managers:

- Energy savings
- Higher punctuality, less variation
- An increase of infrastructure capacity and indirectly less investments for IMs
- Less operational costs when higher level of automation are achieved
- Reduced journey times
- Greater flexibility to adapt offer (timetables, rail connection) to the client needs and demands
- Better management of railway traffic in the highly congested nodes
- A higher safety level when safety relevant human factors are replaced by technical systems in the case of high Grade of Automation (e.g. GoA4)

Developing the automation of the railway system could thus increase the competitiveness of the railways and maintain or develop its market share compared to other modes of transport and to support long term strategies for improvement of railway transport capacity.

Taking into account the progresses already carried out or planned by other modes of transport, in particular by the development of autonomous car driving, the short term availability of ATO solutions could even be considered as a condition of the survival of many railway services in the long term.

High level requirements

1. The development of ATO should not negatively affect ERTMS deployment and further long term development

ERTMS deployment on all rail infrastructure remains a common primary objective on a European scale whose benefits in the long term are well acknowledged.

However for various reasons (capacity of investment, maturity of the current equipment…), the deployment of ERTMS is a long-lasting process.

It is thus important to ensure that new functionality/equipment supposed to be developed and deployed in parallel with ERTMS do not hamper the deployment of ERTMS on board and track side. ATO and ERTMS should mutually support their deployment business cases.

The development and deployment of ATO must therefore be defined by fulfilling this criterion. There should be no reconsideration of the specifications in force for ERTMS ATP functionalities.

ATO must be a parallel development, without the need to modify the ERTMS ATP functionalities but still enabling synergies and value when combined deployment of ERTMS and ATO is considered.

In order not to disturb the current deployment of ERTMS and to protect the associated investments, ATO equipment will have to be able to match with on-board and trackside without any modification of ERTMS ATP, i.e. without generating new development cycles and additional costs and without requiring to reconsider the safety demonstration of ATP (i.e. no impact on ERTMS component certificate, no impact on the safe integration of ERTMS on board in the vehicle and with the network, prevent changes affecting rolling stock authorization, operation rules should enable mixed ATO/non ATO traffic).

This high level requirement must be fulfilled not only looking at GoA4 level but also ensuring a fast introduction of GoA2 on existing train and infrastructures (i.e. without or minimized impact on ERTMS, train control and driver ergonomy). Indeed, the GoA4 level includes the automation of some safety functions currently fulfilled by the driver but this should not lead to mandatory changes and extension of the ERTMS ATP functionalities with new functions.

CER is convinced that ERTMS ATP functionalities as defined in B3 specification shall remain stable, even after ATO introduction. In order to confirm that this target is actually reachable, a strong analysis must be performed about the new GoA4 functions, their impact on the ERTMS equipment and the possibility to add the new functions external to ERTMS ATP.

2. The implementation of ATO out of ERTMS must be possible, while supporting a later migration towards ERTMS.

Taking into account the current low level of deployment of ERTMS in some countries and considering the long lead time for the possible deployment perspectives, it seems relevant to enable a fast deployment of ATO functions also out of ERTMS. There are probably sections of the network where a fast ATO deployment is relevant while ERTMS will be deployed later.

It is appropriate however that these developments allow and ensure a future migration towards ERTMS, by using as much as possible the equipment designed within the framework of the development of ATO over ERTMS. Thus the proper development of open, standardized interfaces for ATO becomes crucial for railway business case and to further support the stability of ERTMS. In addition, it will be able to support an overall deployment of ATO while contributing to the scale effect on the common equipment.

3. The addition of on-board and trackside ATO equipment must be optional

From a technical perspective, it shall be possible to operate on an ATO line without ATO on board module. It shall also be possible to drive an ATO train on a non ATO line (i.e. in GoA1), except for trains equipped with GoA3/4 only which will only run on ATO route.

4. ATO equipment from various manufacturers must all be interchangeable.

In order to reduce as much as possible the costs of deployment of ATO, all ATO equipment, on-board and trackside equipment, produced by various suppliers, must be interchangeable. (i.e. need for fully defined interfaces: Form Fit Functional Interface Specification (i.e. physical and functional interface document : FFFIS) for ETCS and future rolling stock).

5. ATO will have to be able to run with or without dynamic input from Automatic Train Supervision (ATS).

Automatic train supervision should, with various level of traffic management automation, deliver segment profile (i.e. infrastructure characteristics) and journey profile (i.e. time table) to ATO trains. In particular for GoA3/4, but also for GoA2, the combination ATO+ATS obviously optimizes the benefit of automatic driving by an optimal calculation of the speed of each single train depending on its dynamic situation. The combination between ATO and ATS is thus considered as a target system which will have to be harmonised.

However on some parts of the European rail network there might be opportunities of deploying quickly ATO, whereas a full ATS solution is not supposed to be deployed for the short term.

Thus, it is important that the future ATO system can operate with another source (manual interface, recorded timetables, …) entrusted with assigning its mission.

If this is not enabled by the harmonized solutions, it may limit ATO to provide a simple driving assistance, which would not allow achieving the expected goals for operation performance.

This requirement is essential to decouple development and deployment from IMs and RUs.

6. There shall be GoA2 solutions that can be upgraded towards GoA4 through connected/ disconnected plug and play modules

GoA2 solution cannot be frozen before GoA4 physical architecture and specification are defined. On the contrary, GoA4 standalone solutions shall be possible (i.e. no backup to GoA2 or GoA1 functionalities).

The level of GoA2, being already in operation and available on the market, is naturally the first stage of a collective work to carry out. Nevertheless, for the level of GoA3/4 which is a key strategic objective in the second stage, it is important that the design of futureproof GoA2 solutions is carried out by taking into account the constraints coming from GoA3/4.

Thus, the definition of the useful functional requirement and equipment for operation in GoA3/4 and their integration in the overall railway system architecture must be further developed now. The decisions which will be made on the GoA2 equipment specifications architecture must take into account the reflections and the work which will be carried out in parallel on the GoA3/4 stage.

In general, the solutions shall allow functional increment. The functionality to be provided shall be decided by operators in order to meet timely operation target and ensure independence of RUs and IMs business cases. The overall roadmap shall ensure that functionality, once mature, are harmonized.

Towards robust organization

CER wishes the work, at the European level, to be organized and efficient. Therefore CER suggests that the work is organized on only 3 layers :

- Within the representative bodies to settle common users positions

- Within ATO stakeholder platform working group set by the Agency to ensure transparency of decisions and strategic steering of solutions developed by Shift 2 rail and individual stakeholders.

- Within S2rail to carry out the technical and demonstration work enabling the deployment of harmonised solution in EU.

1. The Agency has an important role to play.

The EU agency for Railways must orchestrate (i.e. enable and coordinate) consistent planning and technical approach between game changers (e.g. synergies to find with satellite, radio evolution…) but also provide a relevant certification framework.

Interfacing ATO and ERTMS must be well addressed in order to split the process for the development in 2 distinct parts and avoid inadequate application of ERTMS change control management and prevent changes on ATO affect ERTMS and vis-versa. As part of its new role to standardise railway spare parts and as authority, the Agency should define a new and relevant certification process to be applied in case of ERTMS and ATO applications, for either trackside or onboard specific applications, that will support clear responsibility for the performance and safety of Automated train operations. An adequate change control management should therefore be considered to ensure that the Agency guarantee ATO interoperability and standardization.

The NSAs network must get involved at the beginning of the roadmap. While safe operations should be ensured by the ATP functionality, NSAs may still have a role to play to achieve a harmonized approach to the re-allocation of safety related tasks of driver and traffic manager. The Agency should involve NSAs to support the definition of adequate safety design targets for ATO components.

Furthermore the operational concepts and harmonisation of automated train operation must be elaborated via the existing Operation Harmonisation Working group organised by the Agency.

CER is convinced that to ensure that Shift 2 rail WP4 follows a useful path, a representative from the agency should participate on a permanent basis to S2R meetings (work package and steering committee meetings) and disclose all necessary elements that will support the achievement of harmonized and interoperable solutions.

2. Shift2Rail must become the adequate place of collective work on the development of ATO

S2R has an important role and work for expressing the full range of perspectives and supporting convergence of the various points of view must be carried out. It must also be held within a framework which allows a sufficient collective effort to reach the objectives.

CER recognizes and supports the Shift2Rail IP2 WP4 activity on ATO development. It is undesirable to spread energies in multiple places of discussion on the topic of ATO.

The current schedule of WP4, the repartition between GoA2 and GoA4 and the list of subjects to be discussed, might be adapted according this organization.

3. CER will set up relevant network of experts for companies preparing implementation

As a matter of fact only few Railways are directly represented in Shift2rail, whereas the development of an interoperable and optimized ATO/ATS system, is a key requirement for all the European Infrastructure Managers and Railway Undertakings in Europe. CER members will therefore work within the framework of a dedicated network of CER experts to duly describe the users' requirements applicable to ATO (and ATS). To define those requirements, CER members may still consider or organize input from technical platforms such as UIC, EUG, EULYNX… Users' requirements will be regularly acknowledged and approved by all members, notably through the organization of gate reviews.

The CER members which are involved in S2R will bring the CER position in the S2R dedicated work structure for ATO.

Planning

Each CER member will have its own planning regarding its own functional targets. But in order to develop ATO in a coordinated way on a European scale, it is necessary to share a common planning for the work that must be done together. The WP4 Shift2Rail planning should be the basis to build this common planning.

The following planning was proposed during the Shift2Rail ATO kick off meeting:

Task	2016	2017	2018	2019	2020	2021	2022	2023	2024
IP2 - TD2 ATO Management									
ATO over ETCS - GOA2 Specification									
ATO over ETCS - GOA2 Product Development									
GOA2 Reference Test Bench Demonstration									
GOA2 Pilot Line Demonstration									
ATO over ETCS - GOA3/4 Feasibility Study									
ATO over ETCS - GOA3/4 Specification									
ATO over ETCS - GOA3/4 Product Development									
GOA3/4 Reference Test Bench Demonstration									
GOA3/4 Pilot Line Demonstration									

Some tuning is now needed to achieve a common planning reference for all stakeholders and technical platform:

- **It is essential that short term solutions are made available (even if their upgradability might not be ensured) and longer term solutions are defined and developed up to GoA4.** If the solutions for GoA2 seem to have relevant timelines, the specification for GoA4 must be delivered earlier. Actually, with the current planning, specifications for GoA4 would be defined in 2021, which is to late regarding market issues, especially for freight. GoA3/4 feasibility should enable to deliver a first draft on architecture and specification. **CER would expect specification by end of 2018, including FFFIS preserving ATO upgradability (e.g. from GoA2 to GoA4) and providing full interchangeability.**

- In general, as foreseen in longer term vision for ERTMS specification, gate reviews structuring the design of ATO solutions are necessary to provide transparency and efficiency. It is essential to quickly agree on the major phases of ATO development and plan the corresponding intermediate reviews. The gate reviews shall ensure that developed solution are acknowledged and agreed by all potential users (i.e. RUs, IMs). They should also help to reduce risks, increase maturity and enable cooperation between the various actors involved. **CER propose to organise gate reviews to agree on ATO program plan (early 2017), on the specification (beta SRS + FFFISs by end 2018), on the first proof of concepts (2020 ?) and on an harmonised ATO tender template that will enable best economic conditions for the implementation of ATO (2022 ?).**

- Engineering process shall follow CENELEC process phases 1 to 5 and apply the principles of model based system engineering.

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.