Areas to be solved before DAC implementation

Contents

A. Migration plan – locomotives

i. Objective:

- **Prepare a realistic and feasible migration plan** (numbers, series, documentation) **for locomotives.** This needs to be solved as a priority before migration of wagons, including solutions for locomotives that cannot be equipped with DAC *(e.g. planned incompatibility until the end of the service life of the locomotives?).*

- The plan should include (in addition to the usual things common to a migration plan, including total numbers of locomotives to be equipped, numbers considered to be equipped, numbers considered to be equipped in the form of simple renewal, etc.) **also the critical number of equipped locomotives that need to be available before the actual wagon migration can begin.** This should be done in sufficient detail (e.g. (i) type of locomotives including the mainline, shunting, etc. ones; (ii) locomotive power; (iii) geographical distribution of the locomotives).

ii. What to consider in the solution

- **Issues relating to locomotives need to be addressed as a priority and as first –** we cannot start with wagons migration without having available a critical mass of locomotives with hybrid couplers.

- **It is necessary** to take into account (to specify the timing in the migration plan) also **the periodicity of large repair interventions on locomotives** (large

interventions **usually take place once every ca 15 years**) – **should the automatic couplers be fitted at a different periodicity, it would result in an additional reduction of railway capacity.** At the same time, the workshop capacities for interventions on locomotives outside the repair periodicity would be very limited (even non-existent), or the capacity could subsequently be missing for standard periodic interventions.

- **Respect the design and technical feasibility of equipping or not equipping of some locomotives** (locomotives that cannot be retrofitted with hybrid couplers for weight, strength, and space reasons).
- **The current production capacity in Europe (EU and non-EU states) is not sufficient even for a simple renewal of the locomotive fleet.** I.e. if some locomotives need to be prematurely taken out of service or scrapped (before reaching their maximum service life) due to inability to be equipped with hybrid couplers, **renewal with newly manufactured locomotives beyond the original simple replacement cannot be considered. This would result in an additional reduction of railway capacity** and thus a major threat to the EU objectives to transfer the freight from road to rail (to double rail freight capacity in 2050, etc.).
- Consider a scenario how to replace locomotives that will not be migrated (so as not to reduce the service capacity and quality of service to customers) while respecting the overall production capacity, see point above.
- **Take into account the complexity and length of the EU approval process,** including all necessary approval tests. For some locomotive series (even if there is the design and technical possibility to equip them), it may not be possible to approve them for all original countries of operation once DAC equipped (also according to the experience in the ETCS implementation).
- **Take into account the need for processing of lower hundreds of pieces of technical documentation and drawings for DAC retrofitting on locomotives**. Without documentation, it is not possible to realize the installation itself, and neither to authorize their compliance with the approved types).
- **Allow sufficient time to rectify any deficiencies discovered during the test operation.**

B. Migration plan – wagons

i. Objective:

- **Prepare a realistic and feasible migration plan for freight wagons** (numbers, series, documentation) following up (synchronized in time) the locomotive part that should be treated as a priority. This should include a solution for freight wagons that cannot be equipped with DAC *(e.g. planned incompatibility until the end of the service life of the wagons?)*
- The plan should include (in addition to the usual things common to a migration plan, including total numbers of wagons to be equipped, numbers with no equipment considered, numbers with equipment considered in the form of simple renewal, etc.) also a breakdown of the wagons by years for individual

"operation" (if there is a need to have planned incompatibility between the "operations"). This should be done in sufficient detail (e.g. (i) type of wagon; (ii) capacities of the wagons; (iii) indicative geographical distribution of wagons).

ii. What to consider in the solution

- **It is necessary to take into account** (to specify the timing in the migration plan) also **the periodicity of major repair interventions on freight wagons** (major interventions / revision repairs **usually take place once in every 6 years) – should the automatic coupler (or preparation) be made at a different frequency, it would result in an additional reduction in railway capacity.** At the same time, workshop capacities for interventions on the wagons outside the repair periodicity would be very limited (or even non-existent), or the capacity could subsequently be missing for standard periodic interventions).

- **Respect the design and technical feasibility of equipping or not equipping of some wagons** (wagons that cannot be retrofitted with automatic couplers for weight, strength, and space reasons).

- **The current production capacity in Europe (EU and non-EU states) is not sufficient even for a simple renewal of the wagon fleet,** i.e. if wagons need to be prematurely taken out of service or scrapped (before reaching their maximum service life) due to inability to be equipped them with automatic couplers, **renewal with newly manufactured wagons beyond the original simple replacement cannot be considered. This would result in an additional reduction of railway capacity** and thus a major threat to the EU objectives to transfer the freight from road to rail (to double rail freight capacity in 2050, etc.).

- Consider a scenario how to replace wagons that will not be migrated (so as not to reduce the service capacity and quality of service to customers) while respecting the overall production capacity, see point above.

- **Take into account the complexity and length of the EU approval process,** including all necessary approval tests. For some wagon series (even if there is the design and technical possibility to equip them), it may not be possible to approve the wagons at all.

- **Take into account the need for processing of higher hundreds of pieces of technical documentation and drawings for DAC fitting on wagons**. Without documentation, it is not possible to realize the installation itself, but neither to authorize their compliance with the approved types).

- **Take into account the time required for a long-term verification (ideally 2 years) of the entire DAC system** (and reliability, **without any requirement to shorten the period of the maintenance cycle**) in real operation (i.e. during transportation of goods – loaded wagons, incl. loading and unloading) and during routine handling of wagons – i.e. loading and bumping of wagons at the speed of up to the 12 km/h as required for DAC, full-fledged shunting at marshalling yards, etc.

- **Allow sufficient time to rectify any deficiencies discovered during the test operation.**

C. Sharing of solutions (including prototypes) for retrofit of individual series and types of locomotives and freight wagons = central technical solution for retrofits

i. Objective:

- **To prepare a feasible procedure** (scheme) **how to share (transfer) technical and administrative solutions (including prototypes, approvals, etc.)** for retrofitting of individual series and types of locomotives and freight wagons. This means, in particular, **a common solution for one type of wagon / locomotive across the whole sector, so that prototyping of the same type is not carried out separately in several countries** (leading to unnecessary costs) as it is currently the case with the ETCS.

- The procedure and scheme should include finding a way to cover the costs of a common (pan-European) solution (central EU funding / cost sharing among all owners **in Europe**).

- The procedure and scheme should include a solution for all series and types occurring **in the European railway area** (EU and non-EU states).

ii. What to consider in the solution

- Should the search for solutions (incl. prototyping, approval, etc.) be left to the individual carriers and owners of locomotives and wagons as in the case of the ETCS, **the same unsatisfactory situation would arise as with the ETCS = everyone seeks their own solution, everything takes several times longer, incompatible solutions may arise, manufacturers / suppliers invoice for prototyping several times, and owners / carriers thus carry unnecessary extra costs.**

- **Should the search for retrofit solutions be left to individual carriers / owners, any coordination towards a single implementation date is completely unrealistic –** such a large number of companies cannot be coordinated, and realistic and achievable dates for migrations cannot be set – chaotic incompatibility and non-implementation would result.

- Leaving it up to the individual carriers / owners to find solutions for each series and type of locomotives and wagons would only benefit the manufacturers and suppliers (their getting paid multiple times for prototyping). On the other hand, **sharing solutions (and ideally central funding from the EU) is beneficial for the whole railway sector as there are no multiple costs.**

D. Uniform standard and coupling compatibility = technical coupling solution

i. Objective:

- **Prepare only one, uniform and final Technical Specifications** (TS) including digital and electrical parts **for locomotives as a whole** (i.e. not only a hybrid AC itself) **to allow compatibility and interchangeability between all**

manufacturers (TS ERA/TD/2025-02/RSYS for DAC in LOC & PAS TSI now in preparation – needs to ensure they meet the target).

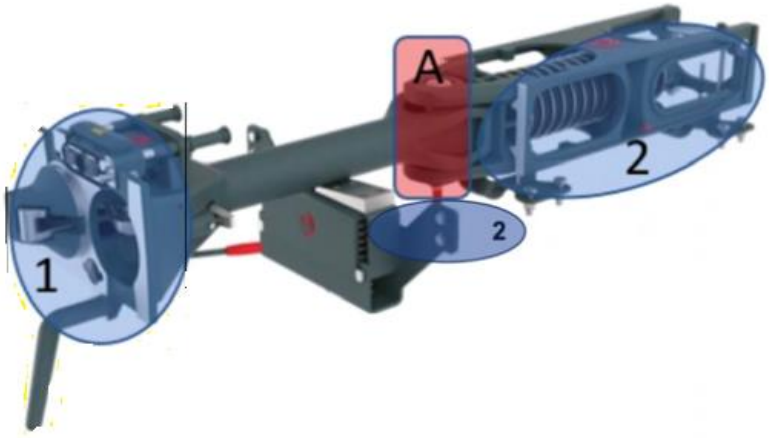
- **Prepare only one, uniform and final TS** including digital and electrical parts **for freight wagons as a whole** (i.e. not only an AC itself) **to allow compatibility and interchangeability between all manufacturers** (TS ERA/TD/2025-01/RSYS for DAC in WAG TSI now in preparation – need to ensure they meet the target).

- **Only trainsets meeting the TS, i.e. complying with the main dimensional, strength, weight and functional requirements should be allowed to the test operation** of the 100 pre-deployment trains. Otherwise, a new (follow-up) test operation is imminent due to the possible need for a radical redesign of the DAC because of the main TS requirements.

ii. What to consider in the solution

- **A uniform type of coupling head in connection dimensions, including electrical and data parts** and, **if possible, also the suspension,** needs to be introduced for operation on vehicles **to keep maintenance costs as low as possible.**

- The front part of the automatic coupling from the interface A needs to be of a uniform type for all locomotives in Europe (EU and non-EU countries). For reasons of non-uniform coupling space on locomotives, try to keep the number of suspension designs as low as possible.



- **Incorporate the requirements for the design of the electro-pneumatic (EP) brake into the TS.** None of the TS proposals submitted so far address this.

- Include in the TS the need for a version for explosion-proof design and design for transportation of dangerous goods.

- **Basic TS parameters** need to be approved prior to long-term test operation of the DAC, otherwise correct testing cannot be performed (tests to be performed against an approved and valid basic standards).

E. Legislation, documentation

i. Objective:

- Finalize document ERA1209/200 – **a blueprint for easier approval of vehicles during migration to DAC** and follow this up with the necessary amendments to today's legislation (fourth railway package, ERA's general safety statement).

- **Modify the Fourth railway package as soon as possible in line with the ERA1209/200 proposal, i.e. to legalize the newly introduced concept of "retrofitting vehicles"** to circumvent EU Regulation 2018/545 by using a general safety statement.

ii. What to consider in the solution

- With simplified approval procedures, it is **not acceptable to transfer the responsibility for safety to the owner of the wagons and locomotives / carrier** and shift the burden of this safety assessment to them.

- Thoroughly consider whether a general safety statement can be made with significant design differences – see for example the introduction of LL brake blocks where "generality" was used, and which subsequently led to a large increase in wheel damage due to the 20-30% exceeded braking performance on wagons with the LL blocks.

- As current ENs (European Standards) do not cover the DAC on freight wagons, there is a need to revise or develop standards related to DAC (e.g. EP brake, frame headstock layout, electrical standards, etc.).

- Count with a sufficiently long warranty period on the DAC, to establish liability for delays, etc., arising from a manufacturer's fault.

- **Reduce the risk of non-approval of the vehicle as much as possible as non-approval would result in catastrophic impact on the whole project.**

Added in March 2024:

- It shall be thoroughly noted that the Article 5(10) of the Directive 2016/797 of the EP and of the Council on the interoperability of the rail system within the EU ("IOP Directive") also foresees that, **when requirements are changed in the context of a TSI revision, the new TSI text will ensure compatibility with subsystems already placed in service in accordance with the previous TSI wording.**

- It is also clear from paragraph 17 of the preamble of the IOP Directive that **the implementation of the DAC should not require additional costs from the carriers, but that the TSIs should ensure backward compatibility of the DAC with the conventional coupling system,** i.e. the screw coupling (UIC) system. This obviously implies the legal possibility of parallel use of the conventional screw coupling and the DAC, at least until the end of the depreciation period of the screw coupling equipped vehicles at the time of the entry into force of the amendment to the TSI governing the DAC.

F. Infrastructure

i. Objective:

- **Prepare a realistic plan of the modifications and costs that the implementation of the DAC will cause to the** infrastructure / at the infrastructure manager's side (both due to the existence of DAC on vehicles and locomotives, and due to realization of DAC benefits on the infrastructure side).

ii. What to consider in the solution

- **Verification of mutual interference between the DAC and interlocking and signaling systems;** in case of a non-compliance, to ensure sufficient resources for the modification of the DAC or the infrastructure equipment.
- Number, technical, constructional, and administrative solutions for potential **modification or replacement of buffer stops.**
- **The issue of recalculation and cost evaluation of potential geometric modification of marshalling humps** (probably a much longer and smoother elevation to the top of the hump will be needed). As it was observed with the test train in the Czech Republic in summer 2022, with a certain tension in the group of wagons to be uncoupled, it is not possible to do the uncoupling operation even manually. It needs to be taken into account that the same problem will occur when remote uncoupling from the driving vehicle or the control tower is performed, and that there will be no staff present to determine a more suitable place for uncoupling. A CCTV installation at the hump may thus, for example, prove necessary to monitor the flank of the wagon rake to help the remotely uncoupling person better judge the right uncoupling spot.
- Develop **the digital gates for train technical inspection and get funding and building permission to install them.**
- After evaluation, these **facts need to be reflected back in the CBA calculation.**
- Asses the need for modifications to the infrastructure to realize some of the extra benefits of the DAC (longer and heavier trains, etc.). All infrastructure modifications (including the digital gates) will have to be approved by the respective Infrastructure Manager.

G. Calculation of Cost Benefit Analysis

i. Objective:

- **Carefully elaborate an objective and realistic CBA calculation.** Given the immense (mainly cost and safety) implications of any potential error in the analysis, it is necessary to have an **independent opposing opinion / analysis elaborated.**

ii. What to consider in the solution

- This is an extremely sensitive area as **incorrect assumptions can have an irreversible impact on the entire European rail freight sector.** The event will be closely monitored by the media as it involves the use of significant public funding.
- **Decisions on large investments (including significant public funds) depend on the CBA.**

- **Use the real cost of the couplers and additional equipment** (batteries etc.) **in the CBA** and also consider the need for modifications to the vehicles (many vehicles are not DAC-ready and finding a technical solution including subsequent modifications can incur significant additional costs). The price quoted so far for one (D)AC (not clear whether it is including an electric device) is €5,000. However, based on experience in Switzerland, the estimated total cost for the highest, fully-fledged level of the DAC, including installation on a vehicle, can probably reach up to between 40,000 - 45,000 Eur. At the same time, take into account higher costs for explosion-proof versions and versions for wagons carrying dangerous goods.
- The evaluation of the CBA calculation can only be carried out after all the data required for the calculation have been determined, including essential diagnostics. For example, for locomotives, there is only a minimum of data available so far and therefore the CBA calculation uses the value "0" for most locomotive data.
- Decide whether it is possible to calculate only one CBA when wage differences between European countries (EU and also non-EU) are quite remarkable.
- In the CBA calculation, on the benefits side, to **count only the operationally (and thus economically) usable time savings** from individual technological operations.
- In the CBA calculation, consider the time savings for a brake test or technical brake inspection only after all problems have been resolved. For example, it is not possible to state that the brake test issue has been resolved when it has not yet been determined how the brake blocks or the functionality of the handbrake will be checked. In summary: **Uncertain benefits cannot be included as this would bring too much investment risk in.**
- In the calculation of the CBA, on the benefits' side, consider the growth of transported volumes based on the real commercial conditions of the free transport market.
- Take into account how to support wagon and locomotive owners during the return on DAC investment period.
- Take into account that **reductions in investment costs on the coupling** (savings on quality, lower DAC level, lower TRL, reluctance to accept redundant / backup solutions and higher element resilience, etc.) **may prove themselves in higher maintenance costs and lower system reliability.**

H. Funding

i. Objective:

- **A viable funding model without negative impact on vehicle owners, service offer, customer satisfaction, meeting societal demands for transportation.**

ii. What to consider in the solution

- Inflation.

- Global economic downturn.
- Conflict in Ukraine or anywhere else.
- Energy cost issues.
- Sustainability issues and climate impact – production / scrapping of both conventional couplings and potentially entire vehicles.
- Sufficient external EU / states funding, including non-EU countries.
- **Loans are not a solution for such a poorly profitable sector.**
- The **€11 billion demand communicated towards the society so far is likely underestimated** – there is a need to look for additional solutions to increase this amount.

I. Physical retrofit

i. Objective:

- **To resolve the unified coupling in such a way that it is based on the needs of users – wagon owners / carriers** – and minimize the need to adapt it to the manufacturers.
- **Sufficient capacity of manufacturers** and assembly workshops need to be secured.

ii. What to consider in the solution

- Take into account the need to create hundreds of pieces of documentation and drawings for the DAC deployment (see areas above).
- Any concession in unification will result in problems for the system in the future.
- **Set up a system to prevent vendor "lock-in",** i.e. future limitation of users due to a patented or otherwise restricted solution.
- The clear need to prevent formation of a producer's monopoly.
- Support the entry of new manufacturers into the DAC market at any time during implementation or throughout the DAC life cycle.

J. Pop-up (mobile) workshops for retrofitting

i. Objective:

- **Set up a system and processes for so-called "pop-up" (mobile) workshops** for the potential implementation of the Big Bang (including clear rules who establishes them, who operates them, how they will be financed, on what basis access to them will be allowed (i.e. the issue of service facilities according to the relevant EU legislative, etc.).

ii. What to consider in the solution

- **Ensure non-discrimination by the state (ideal solution)** – and determine how accessibility, time slots for foreign wagons, wagons registered in other Member States or in non-EU countries will be addressed.
- **Operators of these workshops will have to hold an ECM and have non-discriminatory access to all documentation and drawings,** in particular the approved technical design **for any type and sub-type of wagon operating throughout Europe.**
- Take into account possible variant solutions – settings in case of "Big Bang", and settings in case of “non-Big Bang”.
- Management of wagon dispatch and delivery to pop-up (mobile) workshops, prioritization, cost invoicing.
- Staff issues – timely recruitment and training of staff **must not affect routine maintenance and repair, or the handling of the day-to-day operational situations.**
- Ensuring the support of labour offices after the “Big Bang” and mass redundancies of the employees.
- Environmental impact of pop-up (mobile) workshops.

K. Miscellaneous – functionality

i. Objective:

- **All identified deficiencies discovered during the two-year test operation must be corrected prior to approval, mass production of the DAC, and installation.**

ii. What to consider in the solution

- Resolve operational processes also in case of fault conditions and incidents not only on the wagons but also in transport (replacement of a brake pipe sealing ring, replacement of an electrical / data connector, removal of a wagon from the train for technical or commercial reasons without the help of a shunter, technical and commercial inspection of wagons, conducting a brake test on all wagons without the presence of a wagon inspector, procedures in case of defects, etc.)
- **Compliance of vehicle coupling noise levels with relevant environmental standards. (Crucial parameter as non-approval would result in catastrophic impact on the whole project.)**
- Clear and fixed ("frozen") final system architecture **(problems from the ETCS implementation must not be repeated,** i.e. what will be approved to go into production must not be changed for a certain number of years).
- Finalize protection of the uncoupling mechanism against **unauthorized manipulation** (both manual and cyber security).
- Protection of the power supply sockets from an **electric shock.**
- Protection of DAC head ends, connectors and vents against moisture and dirt ingress into connectors, brake pipes, protection against snow, ice...).

- Selection of sufficiently durable electrical and data connectors with backed-up PINs, properly calculated lifetime, easy replaceability of these elements in case of damage or failure (including the necessary redundancy of cables, connectors). **Near-military endurance is desirable.**
- Battery power sources – proper **dimensioning and cost estimate** (early input to the CBA).
- Detection of the vehicle with a fault in the air pipeline, power supply or data line; **troubleshooting in general.**
- **Safe detection of train integrity** in the event of a wagon with a fault on the air, electrical, or data lines in the train set.
- Completely **safe concept for securing parked vehicles and then reliable release of brakes** and check after parking when they are inserted back in the train.
- Fully **resolved "Prevent Coupling"** position and its switching back to its standard position.
- Before the start of the long testing period, **emergency coupling needs to be resolved to be used in case of coupling failure, breaking of a train, etc.** – to unblock the mainline from wagons left beyond the point of the failure (a damaged wagon).

L. Miscellaneous – reliability

i. Objective:

- **Absolute reliability of the coupling when the vehicles run into each other** (except in case of their deliberate non-coupling – the "prevent coupling" position).
- **Sufficient reliability of electrical and data connection, safety redundancy of the elements.**
- **Reliable protection of brake pipe terminations from foreign objects, particles, and moisture.**

ii. What to consider in the solution

- **Compensation** for any potential increased maintenance costs should be incorporated in the CBA.