Europe’s Rail Joint Undertaking
Flagship Project 5 - TRANS4M-R

An update on DAC deployment and future developments

RAIL LIVE 2023, Madrid
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EU-Rail JU – Flagship Project 5

**Workstream Seamless**
- Facilitating **multimodal and intermodal** logistics across borders
- Collaboration of 71 European partners from the whole railway sector

**95 Million € TPC**

**Workstream FDFTO**
- Digitalising and Automating Freight Train Operations
- Demonstrating new technology up to TRL 8

**30% by 2030**
- Increasing the modal split for rail freight

**European Green Deal**
- Part of Europe’s Rail

**FP5TRANS4M-R**
- Innovation Project for European Rail Freight funded by the EU
- The Digital Automated Coupler (DAC) is the central enabler of the project
We are part of EU-Rail JU

... embedded in the EU-RAIL Multi-Annual Work Programme

Network management planning and control & Mobility Management in a multimodal environment

Digital & Automated up to Autonomous Train Operations

Intelligent & Integrated asset management

A sustainable and green rail system

Digital Enablers

Innovation on new approaches for guided transport modes

Regional rail services / Innovative rail services to revitalise capillary lines

Sustainable Competitive Digital Green Rail Freight Services

Transversal Topic

FA1 - TMS+

FA2 - ATO+

FA3 - Assets Mngt

FA4 - Green Solutions

FA5 - Freight

FA6 - Regional services

FA7 - new approaches

+ Exploratory Research and other activities

Exploratory Research and other activities
We are part of EU-Rail JU

... and part of the Innovation Pillar

System Pillar

Single European Rail Area (SERA)

Essential Elements

• Regulation/standardisation for uniform European technical equipment.
• Functional uniform system architecture - implementation of DSD at European level
• DAC

50 Mio. € Funding

Innovation Pillar

User Centric F&E

Flagship Areas (FA)

1. European Rail Traffic & Mobility Mgmt.
2. Digital & Automated Train Operations
3. Integrated assets management
4. Zero emission & silent rail system solutions
5. Competitive Digital Green Rail Freight
6. Regional rail services
7. New Mobility Solutions

550 Mio. € Funding

EU-Rail JU Executive Director

Governing Board

EU

Industry
Figure 4 FP5-TRANS4M-R Work Package Structure
The challenges for EU rail freight

Capacity

+ 50% rail freight
- 55% GHG emissions
by 2030

from bottleneck
to green backbone

Productivity

from manual intervention
to automation

Quality

from paper
to digital
DAC for Full Digital Freight Train Operations

- more than just a coupler
- key and unique enabler for numerous applications
- allowing more use cases to generate a max. possible benefit
- the backbone for "full digital freight train operations" in order to transform European rail freight
Use cases: DAC core system and DAC applications (Full Digital Freight Train Operations)

**DAC core system**
- Automated coupling & manual uncoupling and digital backbone
- Recording of train composition
- Automatic (in-train and remote) uncoupling
- Heavier & longer trains (within existing infra limitations)
- Increased payload
- Increased speed via improved longitudinal forces

**DAC train preparation**
- Automatic brake test & calculation of brake capacity
- Automated technical wagon inspection

**DAC telematics** (wagon & goods monitoring)
- Predictive / preventive maintenance
- Detection of cargo condition
- Cargo surveillance, intrusion alarm
- Wagon data & loading information on mobile device

**DAC shunting**
- Automated parking brake
- Draining of auxiliary air tanks
- Automated air valve
- Rear view camera for train driver
- Proximity detection
- Sound signals when train in motion

**DAC train run**
- **Train integrity**, enabling ETCS L3 moving block operations
- Increased speed via better braking performance
- Multiple loco traction and trains up to 1500m
- Derailment detection

**DAC loading & unloading**
- Automatic loading/unloading processes (replacement of hyd/pneum components, electro-mechanical actuators for bridge plates, automated cargo securing, heating elements for defrosting, ...) via ext. energy supply
- Illumination for worker’s safety & interior

**Use cases:**
- DAC core system
- DAC applications
- DAC train preparation
- DAC shunting
- DAC train run
- DAC loading & unloading

**Benefits: gains in the processes (time, system time, cost savings, capacity, reliability, quality, safety)**

+ induced modal shift
## All DAC-related activities

<table>
<thead>
<tr>
<th>Europe’s Rail Flagship Project 5</th>
<th>EDDP</th>
<th>EC/ERA</th>
<th>Europe’s Rail System Pillar</th>
<th>ESOs</th>
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<tbody>
<tr>
<td><strong>FP 5 FDFTO sounding boards</strong></td>
<td><strong>development/follow-up of migration roadmap, sector-wide coordination, risk management, prep. of decision-making</strong></td>
<td><strong>EC/ERA</strong></td>
<td><strong>Europe’s Rail System Pillar</strong></td>
<td><strong>ESOs</strong></td>
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<td>Dac/”full digital freight train operations”</td>
<td><strong>Technology (mirroring &amp; sector feedback)</strong></td>
<td><strong>Fleet Analyses &amp; rtf Engineering (rtf readiness)</strong></td>
<td><strong>Funding &amp; Financing plan</strong></td>
<td><strong>TSI revision</strong></td>
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<td><strong>Operational Procedures (mirroring &amp; sector feedback)</strong></td>
<td><strong>Infrastructural &amp; IT adaptations</strong></td>
<td><strong>Retrofitting plan (traffic &amp; customer sidings analysis, operational plan)</strong></td>
<td><strong>Investment plan &amp; procurement framework plan</strong></td>
<td><strong>EU</strong></td>
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<td><strong>Placing into service plan (safety, workforce training, rulebooks etc.)</strong></td>
<td><strong>Retrofit capacity plan (workshops, workforce, components)</strong></td>
<td><strong>Other regulatory &amp; legal framework plans</strong></td>
<td><strong>CBA (updates)</strong></td>
<td><strong>technical development</strong></td>
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<td><strong>DAC migration roadmap</strong></td>
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Challenges for operators

- **Standardisation of operational processes**: “Use case” and standardised operating procedures at European level.
- **Migration Fleet of different types of wagons and locomotives in EU**: Installation effort and testing of solutions for wagons and locomotives.
- **Training of the staff**: new competences and new operating processes.

Milestones achieved

- **Publication of the Preliminary Target Operational Procedures**: New operating procedures integrating FDFT technologies.
- **Opening of the Train Test Lab**: Wagons and Technologies available for testing in the railway environment.
- **Functional architecture**: first definition of the new system to be used in demonstrators.

**Next milestones** include the finalisation of the Safety Assessment, publication of the specifications and conclusion of the development phase.
The cost benefit analysis is aligned with guidelines from European Commission: “Guide to cost-benefit analysis of investment projects” from December 2014.

“CBA is an analytical tool to be used to appraise an investment decision in order to assess the welfare change attributable to it and, in so doing, the contribution to EU [...] policy objectives. The purpose of CBA is to facilitate a more efficient allocation of resources, demonstrating the convenience for society of a particular intervention rather than possible alternatives.”

In a CBA, two scenarios are compared:

- A baseline scenario, which is not a do-nothing scenario, but rather the most realistic scenario without the investment
- A project scenario (with possible variants), which is considering the investment
## DAC CBA update: Main results per technical package

<table>
<thead>
<tr>
<th>Tech package</th>
<th>Start</th>
<th>Duration</th>
<th>Big bang</th>
<th>Variable</th>
<th>Results 2028-2057 (mEUR)</th>
<th>Results 2028-2037 (mEUR)</th>
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Selection also depending on availability of deployment-ready, reliable “D” products at start of migration

Package 4 benefits and costs require further elaboration

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**Main conclusions for all technical packages based on the current findings:**

1. DAC project is very beneficial from a societal perspective (30y)
2. For a positive business case (10y), public financial support is required
Interpretation of results

• It is **NOT a completed CBA**, as the work of other work packages which are used as an input for the CBA are not finalised yet. Open points and data to be reviewed, complemented and validated

• Information was typically fragmented and incomplete. Despite continuous efforts, **data quality can be improved**. Feedback is warmly welcomed.

• The transport forecast is partially based on a policy goal: **the doubling rail of freight by 2050. It presumes an average annual growth of ~2.3%**. Important factor to properly interpret results.

• The **CBA does provide an insight into the direction and magnitude** of what DAC implies for the rail sector
Key points to be integrated and/or considered qualitatively

Using updated insights, the CBA may become more positive or negative. All depends on how the new numbers relate to those used today

- 14 use cases (e.g. derailment detection, see appendix) have not been assessed. Nor have their associated component costs been considered due to data gaps.

- Update cost assessment of final DAC design
  Update assessment of coupler costs

- Time savings and conversion factors – values depend on how successfully the railway system as a whole adapts to DAC. A topic of ongoing discussions.

- Final assessment of DAC maintenance
  Final assessment of DAC reliability

- Update implementation cost assessment based on final implementation plan, including e.g. staff training costs

- Final assessment administrative and possible authorisation costs
DAC – Enabler of future rail freight
Complex wagon system architecture

Source: FP5 - TRANS4M-R - Del 3.1: System Req Spec FDFT
Challenges for the industry

- **System safety**: the automation of processes and procedures currently carried out by specialised personnel will require an adjustment of the Safety Integrity Levels in various areas (software, hardware) with an impact on the costs of the DAC system.

- **Reliability and availability**: increased complexity of the train system intrinsically reduces the reliability and therefore availability of the train itself; the restoration of availability will require the adoption of redundancies in some areas with an impact on the costs of the DAC system.

- **Maintenance**: the need for fleet software updates over the life of the system will require standardised, cloud-based download methods. A European body in charge of authorising and synchronising software update actions in harmony with the various ECMs must be established.

- **Interoperability of the interfaces**: collaboration for the definition, specification and standardisation of functional interfaces (data, communication protocols), mechanical, electrical, pneumatic needs to take place.

- **Supply chain**: production and logistics capacity capable of supporting the migration plan.
The prerequisite for the system development?

Stable specification

Focus on the DAC set of train functions for full deployment

• DAC coupler incl. energy/data system
• Train composition/wagon order detection
• Automated brake test
• Train integrity & train length determination
• Automated uncoupling (uncoupling in-train from loco)

Next actions

• Freezing the baseline specification enabling completion of the development within FP5 - TRANS4M-R timeframe
• Setting up the change management process
And then? Demonstrators planned

- Train Test Lab (WP 14)
- Demo Trains for FDFTO (WP15 - WP18)
- Automated Shunting in Flat and Hump Yard (WP 20 + 21)
- European Checkpoints (WP29)
  Seamless Showcases (WP33 – WP34)
It is becoming real!
Thanks!

https://rail-research.europa.eu