European Freight DAC Delivery Programme

enabled by Europe’s Rail

Moving European Rail Freight Forward

Meeting, place, xx month 2022
1. DAC introduction

2. EDDP 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

Courtesy of ÖBB
Processes today – and tomorrow

manual freight wagon coupling

automatic freight wagon coupling

Courtesy of ÖBB

Courtesy of DAC4EU consortium
DAC is more than just a coupler
DAC is a key and unique enabler for numerous applications
DAC is not a stand-alone technology but the backbone for “full digital freight train operations” to achieve the ambitious transformation in European rail freight
This will allow the DAC to enable even more use cases and to generate a max. possible benefit
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 (remote) uncoupling
- Heavier & longer trains (within existing infra limitations)
- Increased payload
- Increased speed via improved longitudinal forces

**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**
- Tail light (train integrity prior OTI function)
- Train end device (intermediate solution?)
- Vital on train integrity (OTI), enabling ETCS L3 moving block operations
- Increased speed via better braking performance
- Multiple loco traction and trains up to 1500m
- Derailment detection

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

**DAC loading & unloading**
- Automatic loading/unloading processes (replacement of hydr/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

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

**Benefits =**
Gains in the processes (time, system time, cost savings, capacity, reliability, quality, safety) + induced modal shift
DAC lays the basis for the logistics challenges of the future – and for rail freight growth

basic requirements

- High reliability and robustness
- High shipment speed
- Competitive costs

value added

- Digital services for our customers
- New logistics offers
- Flexibility and simplicity

pictures source: RCA Group
The apps for the customer’s logistics and for the future

- **Additional displays**, information polling, deep integration into IT systems
- **Telematics and goods monitoring** with highest reliability add customer value
- **Optional signals and workplace illumination** increase work safety
- **Interfaces to customer systems** support customer digitalisation activities
- **Surveillance of high value goods opens new markets**
- **Data analysis for condition-based maintenance** increases productivity further

**Opportunities for digitalisation add real value to customer’s and shipper’s logistics processes**

Pictures source: DB Mediathek
DAC for Full Digital Freight Train Operations

Video Link: Digital Automatic Coupling - YouTube

This project has received funding from the Shift2Rail Joint Undertaking under the European Union’s Horizon 2020 research and innovation programme under grant agreement no. 101046657.
DAC = Digital + Automation + Coupling

- push EU rail freight operations from heavily relying on human factor to 21st century world benchmark
- rail freight automation with DAC is the chance for Europe and the offer to European policy makers
The DAC and automation benefits for EU

- **Capacity**: Smart capacity, more efficient than conventional extension & much faster
- **Productivity**: Reduction of time/efforts (€), increase of system speed and asset efficiency
- **Quality**: Increased flexibility and reliability, innovative customer services and information
- **Worker’s & rail safety**: Automation of manual processes, invest in human capital
- **Economics & employment**: 10+ bn EUR value creation in Europe, better workplaces in rail
- **EU Green Deal**: - 10 to -20 mn tons CO₂ equiv. p. a.

**Interoperability**
- Increasing Infrastructure Capacity
- Increasing Rail Freight Efficiency

**Competitiveness**
- new markets and growth

+ 50% rail freight | - 55% GHG emissions until 2030

**Society & Environment**

**Rail Freight Sectoral**
Implementation: DAC as employment booster

**Material**

- To be produced:
  - 900k – 1 mn DAC (wagons)
  - 450k – 500k automation components (wagons)
  - 34k - 40k hybrid couplers (locos)
  - xx buffer stops, ...

- To be retrofitted:
  - 450k - 500k freight wagons
  - 17k - 20k locos
  - xx buffer stops, ...

**Labour**

- To be produced:
  - € 5-6 bn
  - € 2,2 - 2,5 bn
  - € 0,4 bn
  - tbd

- To be retrofitted:
  - € 7,6 – 8,9 bn
  + tbd

- Produced in EU

- Retrofitted in EU countries

**Material**

- € 7,6 – 8,9 bn
- € 1,4 – 1,5 bn
- € 0,1 bn
- tbd

- Labour

- € 9,1 – 10,5 bn
- € 1,5 – 1,6 bn
- tbd

*all numbers indicative and under assessment*
Indicative overall time plan

- **Spec DAC**
  - Draft TSI
  - Operation procedures

- **Test DAC**
  - DAC type decision
  - DAC demonstrator

- **Spec/development**
  - Data/energy system + hybrid loco coupler + additional automation components

- **Migration**
  - Migration scenarios

- **Economics**
  - CBA

**Authorisation**
- Strategy & planning & preparation
- Tests all components & integration
- Staff training & preparation of transformation

**Large scale showcases/demonstrators/commercial pilots (« early deployment »)**

**Economics**
- Large scale showcases/demonstrators/commercial pilots (« early deployment »)
- Tests all components & integration
- Staff training & preparation of transformation

**Staff training & preparation of transformation**
- Large scale showcases/demonstrators/commercial pilots (« early deployment »)
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**Deployment**
- DAC deployment funding/financing
- DAC tendering/procurement
- « Big bang »

**Pre-phase**
- Workshops prep.
- Start of DAC + additional components production
- Start of loco retrofit

**Funding & Financing**
- Fund & Fin scheme
- Fund & Fin installed

**Fund & Financing**
- Fund & Fin scheme
- Fund & Fin installed

**2021**
- Spec DAC

**2022**
- Test DAC

**2023**
- Spec/development

**2024**
- Migration
- Economics

**2025**
- Migration
- Economics

**2026**
- Spec/development

**2027-29**
- Economics

**30+**
- Economics
The main DAC migration challenge resides in the Core Wagonload System (CWS) that cannot be operated in a mixed mode.

<table>
<thead>
<tr>
<th>TRAIN TYPE</th>
<th>WAGON USEAGE</th>
</tr>
</thead>
</table>
| Unit trains      | 1. Unit trains merry-go-round  
                  | 2. Unit trains, wagons switched between ODs                                  |
| Network trains   | 3. Unit trains with empty wagons returning in SWL                             |
|                  | 4. Wagon groups with separate traffic patterns and dedicated wagons          |
|                  | 5. Wagon groups (partially) integrated in SWL, dispatch of empties in SWL     |
|                  | 6. SWL (Single Wagon)                                                        |

Segments that can be migrated step-by-step

Opportunity for temporary migration

SWL = single wagon load

- Core Wagonload System (CWS) with main migration issues
  - Marshalling/shunting yards
  - Customer sidings
- Size of CWS around 210,000 wagons
The segments with dedicated wagon fleets may be migrated step-by-step based on different alternatives.

Source: EDP WP 3
**Retrofitting of locomotives**

1. **“DAC-ready” preparation of wagon fleet (if possible: with “D “ prep)**
   - **Retrofitting of fixed wagon pairs**

2. **Retrofitting of relevant Unit Train wagon fleet | new built DAC wagons**

3. **DAC type 2 retrofit**
   - **DAC-type 4+ upgrade: extension ("D" part of DAC, autom. braketest, etc.)**
   - **Turn inside out**
   - **Dissolving of pairs**
   - **Swap**
   - **Retrofitting of remaining Unit train wagon fleet**

**CWS in SC-only mode**
- (duration: x years)

**"Big Bang"**
- (ideally 2 weeks or less)

**CWS in DAC-type 2+ – only mode**
- (duration: y years)

**Share of CWS wagon fleet**
- 55% 115k
- 35% 74k
- 10% 21k

**DAC 2/4/5 depends on availability of suitable, authorised DAC5 in wagons before / for big bang**

**A big bang migration facilitated by 3 “tricks” is the only operationally feasible option for the Core Wagonload System**
The big bang retrofit and the creation of fixed pairs can be performed in mobile “DACcination” centers

- After vehicles have been made "DAC ready", the big bang retrofit needs to be as quick as possible
- Benefits of mobile DACcination centers:
  - Creation of temporary additional retrofit capacity
  - Retrofit close to customer/marshalling yard to reduce long transport times to/from the workshop
- Center can be used for building of fixed wagon pairs pre/post big bang and for big bang retrofit
- Demonstration/testing planned for this summer at DB Cargo
- approx. 150 locations required all over Europe
DAC migration/deployment: summary

**Principles:**
- No compatibility between screw coupling and DAC
- No hybrid couplers for wagons
- Migration period as short as possible (2026-2030)
- Scope: in principle all wagons to be retrofitted (actual number considering productivity gains)
- Locos to be retrofitted before migration with hybrid loco couplers
- Preparatory measures for production of DAC and retrofitting capacities before migration
- Aligned and available funding / financing & regulation (e.g. TSI= for synchronised migration in Europe)

**“Instruments”/methods/tools**

*to make migration/ deployment operationally/technically/economically feasible:*
- Block trains, closed systems, etc.: migration in continuous step-by-step approach
- Mixed/network traffic: migration in “Big Bang” approach (max. preparation, min. migration time)
- "DAC-ready": prepare wagons during regular maintenance and then DAC “plug and play conversion” during Big Bang
- Temporary fixed wagon pairs (to be turned inside out @ Big Bang)
- Large wagon pool for exchange wagons during workshop stay (funded)
- Scrapping bonus
The overall migration path will be a serial migration of unit/block train fleets with a mixed/network system fleet big bang at the soonest possible point in time.

* CWS: Core Wagonload System

** Share of SC wagons in CWS would strongly impact the economic viability of CWS operations and DAC business case benefits
Challenges/uncertainties:

- Fleet data wagon & locos (type and size and technical status)
- Foreseen actual fleet in use (productivity 2030)
- Special types: Retrofit technically complex/not possible
- Additional Operational costs
- Limiting factors: capacity of industry, workshops, wagon availability and workforce (!)

Next steps

- Draft migration roadmap for deployment until 2030: June 2022
- Consultation of partners across Europe on migration roadmap
- Create basis for development of migration plan (starting 2023)

support needed

- gathering fleet data
- analysing operations & WS capacities
- promote "smart" & short migration
Implementation: DAC funding/financing to ensure business case

<table>
<thead>
<tr>
<th>costs</th>
<th>benefits</th>
<th>business case</th>
<th>propositions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPEX</td>
<td>capacity, productivity, quality</td>
<td>huge benefits but small margin business</td>
<td>Observation time for return on cost &lt;10 years</td>
</tr>
<tr>
<td>OPEX</td>
<td>beneficiaries: RUs, IMs, WKs, socio-economic</td>
<td>benefits do not yet lead to business case by itself</td>
<td>CAPEX funding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>safeguarding a good balance between funding/financing</td>
<td>Additional OPEX funding</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>distribution of costs/benefits between actors</td>
</tr>
</tbody>
</table>
DAC introduction

EDDP structure
The EDDP structure

- Programme Managers
- Eight different Work Packages (Leader + co-Leader each)
- Two decision-making bodies

European DAC Supervisory Board

European DAC Programme Board

European DAC Programme Manager

European DAC Programme Coordination

WP1 Manager  WP2 Manager  WP3 Manager  WP4 Manager  WP5 Manager  WP6 Manager  WP7 Manager  WP8 Manager

WP1  Technology, Standards and Operation
WP2  Testing, Demonstration & Pilot projects
WP3  Migration Plan
WP4  Infrastructure, Rail System Capacity and Green Deal
WP5  Costs, Business Case and Financing
WP6  Communication and Dissemination
WP7  Intelligent Rail Freight (future additional automation)
WP8  Authorisation strategy for retrofit of wagons & locos

European DAC Programme Manager

Executive Director
Europe’s Rail Programme Office

系统的&创新Programme Board

Europe’s Rail Governing Board

European Union (EC), ED & Founding Members
Observers: SRG Chair, SC Chair, ERA

SP Steering Group

Deployment Group

ADVISORY BODIES

WP1 Manager  WP2 Manager  WP3 Manager  WP4 Manager  WP5 Manager  WP6 Manager  WP7 Manager  WP8 Manager

WP1: Technology, Standards and Operation
WP2: Testing, Demonstration & Pilot projects
WP3: Migration Plan
WP4: Infrastructure, Rail System Capacity and Green Deal
WP5: Costs, Business Case and Financing
WP6: Communication and Dissemination
WP7: Intelligent Rail Freight (future additional automation)
WP8: Authorisation strategy for retrofit of wagons & locos
EDDP – the European DAC platform

as per 21/06/22

84 DIFFERENT ORGANISATIONS (04/22)

> 232 PARTICIPANTS

20 DIFFERENT COUNTRIES

ORGANISATIONS BY TYPE

<table>
<thead>
<tr>
<th>RUs/IMs</th>
<th>IMs</th>
<th>WKs</th>
<th>INDUSTRY</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>3</td>
<td>16</td>
<td>17</td>
<td>35</td>
</tr>
</tbody>
</table>

w/o US, UK

USA: 2 observers
EDDP Governance – Supervisory Board
EU DAC Governance – programme and WPs

Programme Management

Mark Topal-Gökceli (ÖBB)  |  Jens Engelmann (railiable)

WP 1  |  WP 2  |  WP 3  |  WP 4  |  WP 5  |  WP 6  |  WP 7  |  WP 8
Technology, Operations and Standardisation  |  Testing & Demonstrators & Pilot Projects  |  Migration  |  Rail System Capacity and Green Deal  |  Costs, Business Cases and Financing  |  Communication and Dissemination  |  Intelligent Rail Freight  |  Authorisation strategy
EDDP overview

Open European DAC Delivery Programme enabled by Europe’s Rail

- For the **successful and effective implementation** of the Digital Automatic Coupler for European rail freight
- Offers a **unique European platform** for such cooperation and collaboration → **Strong platform:** 65 organizations, 230 participants, 19 countries
- **Bringing all DAC related initiatives together**

EDDP as of Q3/22

ERJU FA 5 and ERJU SP take over specific tasks

- **ERJU FA5-FDFTO** project (Full Digital Rail Freight Operations): development of technology, testing, demonstration
- **ERJU (system pillar)**: further activities regarding OPE procedures, standardization/TSI
- **EDDP**: focus on deployment plan based on migration scenarios and CBA as well the funding/financing needs

→ **remaining** as the **open platform** for
  → **cost-benefit** issues
  → **migration**
  → increase **acceptance** and commitment by all actors involved

EDDP since 09/20
On-going connected activities

**DAC4EU BMVI**
Project officially started after receiving € 13mn from German Government in June 2020 [DB / DB Cargo, SBB Cargo, Rail Cargo Group, Ermewa, GATX Rail Europe, VTG]. Couplers from four different manufacturers under DAC mechanical, pneumatic, electrical and communication tests, implying a freight train formation of 12 wagons coupled with DACs. Dynamic testing until July 2021. Demonstrator train in Europe (24 wagons) with selected DAC type in phase 2.

**DAC Winter Tests**
All DACs are tested under winter conditions, including telematics in winter 2020/21, organized by Trafikverket with the aid of Green Cargo and enabled by Shift2Rail. A train formation will be tested in marshalling yards and in circulation through different places in Sweden. Possible phase 2 is industrial business case in a real environment.

**IP5 Shift2Rail**
FR8RAIL II DAC Type 4 Prototype final Test Bench Tests completed. FR8RAIL IV under study and pre-approved, will support DAC Trafikverket tests.

**ERA**
Has started the TWG Freight for the TSI Revision 2022. Sector is expected to deliver the necessary input to ERA for the adoption of the DAC in the respective TSIs that regulate interoperability and railway approvals / authorizations in EU.

**CEN**
WG for developing a new standard for “Automatic Coupler for Freight”

**Political supports:** Berlin declaration ministries of transport, MoU of major Freight operators & keepers
A single entry point for all Europe and beyond


Would you like to participate to the programme which is open for all?

Click on the button below to fill in the application form.
Any questions?

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