



NEXUS – FINAL EVENT

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DELIVER AN
**INTEGRATED
EUROPEAN RAILWAY
NETWORK BY DESIGN**



DEVELOP A **UNIFIED
OPERATIONAL
CONCEPT AND A
FUNCTIONAL SYSTEM
ARCHITECTURE** FOR
INTEGRATED EUROPEAN
RAIL TRAFFIC AND
CCS/AUTOMATION



DELIVER A
**SUSTAINABLE AND
RESILIENT RAIL SYSTEM**



DELIVER A
**COMPETITIVE, GREEN
RAIL FREIGHT FULLY
INTEGRATED INTO THE
LOGISTICS VALUE CHAIN**



DEVELOP A **STRONG
AND GLOBALLY
COMPETITIVE
EUROPEAN RAIL
INDUSTRY**

EUROPE'S RAIL:

ONE INTEGRATED R&I PROGRAMME

SYSTEM PILLAR

OPERATIONAL
CONCEPTS

FUNCTIONAL
SYSTEM
ARCHITECTURE

**A SINGLE COORDINATING
BODY FOR THE WHOLE
SECTOR EVOLUTION**

OPEN
INTERFACES TO
OTHER
TRANSPORT
MODES AND
BUSINESSES

SYSTEM
REQUIREMENT
SPECIFICATIONS

INNOVATION PILLAR

*TECHNOLOGICAL AND
OPERATIONAL SOLUTIONS
FOR SERVICES OF FUTURE*

FLAGSHIP
PROJECTS

LARGE-SCALE
DEMONSTRATIONS

EXPLORATORY AND
FUNDAMENTAL R&I

1

**EUROPEAN RAIL
TRAFFIC AND
MOBILITY
MANAGEMENT**

Manage and improve rail traffic at
EU level

Adjust rail traffic management in
function of the mobility demand

2

**DIGITALISATION &
AUTOMATION IN
TRAIN OPERATIONS**

ATO implementation

Digital train operations

3

**SUSTAINABLE AND
DIGITAL ASSETS**

Integrated assets testing &
life-cycle framework

Zero-emission, silent rail system

4

**COMPETITIVE,
DIGITAL, GREEN
RAIL FREIGHT**

New digital customer interaction &
innovative rail freight services

Multimodal and rail freight
innovation integration

5

**REGIONAL RAIL
SERVICES IN LOW
DENSITY AREAS**

New system approach to regional
rail services in low density areas

DEPLOYMENT GROUP

FUTURE SOLUTIONS DEPLOYED IN A COORDINATED AND CONSISTENT WAY AT EUROPEAN LEVEL, TAKING INTO ACCOUNT ALTERNATIVE ROLLOUT SCENARIOS, BEHAVIOURAL AND ORGANISATIONAL CHANGES, SYNERGIES WITH OTHER MODES OF TRANSPORT

- Our vision is to deliver a **fully integrated European railway network** for **citizens and cargo**
- Eliminate barriers to **interoperability** and provide **solutions** for full integration
- **150MN EUR of EU funding** only through its latest calls in 2025 and 2026

High capacity



Flexible



Interoperable



Multimodal



Sustainable



Reliable



Competitive



Inclusive



NEXUS in the Europe's Rail JU ecosystem



Innovation Pillar



Next-gen
technologies
for enhanced
metro
operations

Exploratory
Project



Mobility
management
in multimodal
environment
and digital
enablers



Rail to digital
automated up
to
autonomous
train operation

Flagship Projects



Holistic and
integrated
asset
management
system for
Europe's rail
system

NEXUS contribution to Europe's Rail activities

+ Metro perspective



- Passenger and operator requirements
 - Accessibility
- Operational constraints
- High-capacity urban rail needs

+ Technology exploration



- Automation
- AI and data-driven operations
 - Adaptability
 - Optimisation
- Future train control and GoA4

+ Evidence for future R&I



- Simulation
- Validation in operational scenarios
 - AI use cases
 - Feasibility
 - Transferability



Future Policy-Based Public-Private Partnership for Rail

A mission that centers on **simplifying the rail systems** and operations while enhancing its fundamental capabilities and **reducing its costs**.

Aiming to strengthen the Single Market and deliver a harmonized **Single European Rail Area (SERA)**

Focus on

Agility

Resilience

Competitiveness

Enhanced PPP framework building on EU-Rail foundation:

- Expanded scope including **pre-deployment** activities
- Coordinate pre-deployment to **bridge innovation to market impact**
- **Greater inclusiveness**

Coordinated EU-level
partnership

€3 billion in R&I innovation addressing the need for costly yet essential one-time developments of innovative solutions aiming to transition the diverse existing legacy systems into a new, simplified European rail system.

€15 billion in pre-deployment from the participation of diverse stakeholders across different countries to upgrade their systems and make investments in their network. Procurement activities to enable a first implementation at system level.

Flagship Initiative 1 European simplified and integrated rail system (ESIRS)

Simplifying the system architecture – based on but beyond ERTMS and deployment/update processes - ESIRS promises to **reduce** both **capital** and **operational expenditures** across the European rail system enabling the system competitiveness of densely operated as well as **low density lines**.

SCOPE

- Full trackside CCS system solutions for ETCS only operations based on harmonised operational rules
- Automated operations and modular onboard in both urban and non-urban areas
- Future rail radio communication
- Future rail traffic and capacity management
- Common rail ontology and federated rail data space

MATURITY

Builds directly on outcomes of Europe's Rail Joint Undertaking in the domain of **CCS, TMS** and **digital spaces** – carrying out the necessary pre-deployment activities to test and validate a simplified and more performant operation based on harmonised operational rules

Flagship Initiative 2 The Next-Generation Rail Freight Operations with European Digital Solutions

Transforming European freight operations into a **unified, automated, and data-driven logistics ecosystem**. By **automating processes** across the entire freight chain—from digital yard operations and intermodal transfers to on-train coupling and energy management—the initiative will deliver **faster transshipment, higher line capacity, and significantly lower lifecycle and logistics costs**.

SCOPE

- It integrates **automation, digital coupling, intelligent capacity management, and multi-modal synchronisation** to boost rail's market share, operational efficiency, and environmental performance.
- It eliminates bespoke, nationally isolated freight solutions through harmonised specifications and corridor-level deployment, **ensuring true cross-border interoperability and efficiency**.

MATURITY

This project builds directly on outcomes of Europe's Rail Joint Undertaking work on enabling the **DAC technologies and digital platforms** plus the Pioneer DAC train project. Advanced concept level with ongoing pilots, demonstrations, commercial testing and standardisation activities

Flagship Initiative 3 Resilient and Recoverable Railway System

An integrated approach to **physical, digital, and operational resilience, interlinking climate adaptation, cybersecurity, and civil-military interoperability.**

To ensure that **Europe's rail backbone remains reliable, secure, and sustainable under any operational condition** - delivering continuity of essential transport functions for both citizens and strategic logistics.

SCOPE

- Climate-resilient infrastructure
- Integrated cyber-physical protection systems and active surveillance
- Intelligent asset and health monitoring systems using digital twins, predictive analytics, and IoT
- Minimum viable operations including self-standing operation under massively disturbed conditions in adjacent networks
- Real-time operational resilience management supported by AI, interoperable with Crisis Management Systems

MATURITY

This project builds on outcomes of Europe's Rail Joint Undertaking, having provided the core technologies but not yet the adaptation and focus to resilience

Flagship Initiative 4 Innovative EU High-Speed Rail Corridors

Developing **a harmonised, fully digital** and **climate-resilient high-speed system** that ensures efficient, zero-emission operations across national borders.

Evolve beyond today's fragmented architecture by integrating next-generation digital and clean technologies within a **single European framework**.

SCOPE

- By unifying traffic management, enhancing traction technologies, digital twins, materials innovation, and predictive maintenance, it enables dramatic improvements in reliability, cost efficiency, and energy performance.
- Through corridors implemented as early pre-deployment pilots, the initiative will reduce travel times between major EU capitals, create seamless multimodal links, and strengthen Europe's industrial and technological sovereignty in high-speed mobility.

MATURITY

The flagship builds on outcomes of Europe's Rail Joint Undertaking, notably on **ERTMS**, traffic management systems (TMS), **asset management** and **cybersecurity**.



Thank you for your attention.

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Europe's Rail Members

