



Nordic Seminar on  
**Railway Technology**  
2024 | Stockholm, Sweden

# Innovative Initiatives of Italian Railway State Group for Sustainable Mobility

Luca Beccastrini – Ferrovie dello Stato Italiane, MOST Coordination

Mario Tartaglia – Ferrovie dello Stato Italiane, Head FS Research Centre



# Ferrovie dello Stato Italiane Group

MEF Ministry of Economics  
100%



Over 120 subsidiaries





# MOST Principles

CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE

## A mobility that is ...



### ... "Greener"

Small-scale solutions, new power solutions, combustible hydrogen and electric



### ...Safer

Digital solutions favouring predictive strategies for the reduction of accidents



### ...More flexible

Systemic digital transformation of public and private transport



### ...More accessible

Technological integration and inclusion through digital innovation



### ...More competitive

Increase synergy between universities, companies and institutions



### ...More collaborative

Identification of priorities and strategies for development of research and industrial applications



# MOST Affiliates

CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE

Through collaboration with 24 universities and 24 large companies, it has the mission of implementing modern, sustainable and inclusive solutions.



- 13 Italian Regions involved
- Spoke-Leader



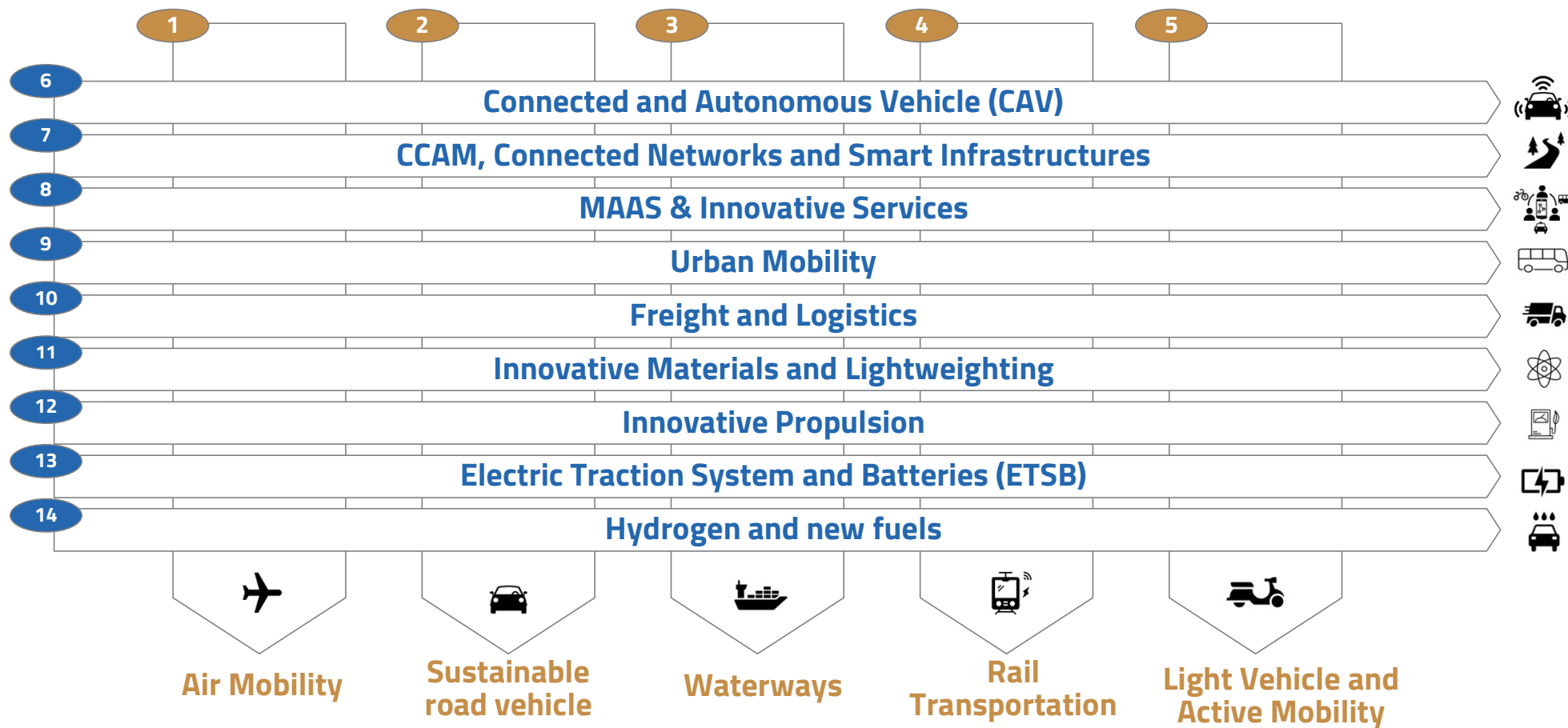


**MOST**  
CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE

# Hub and Spokes

## CARRIERS

## TECHNOLOGIES





# The Spokes FS has joined

Spoke 4



## Rail Transportation

- ✓ Increase of capacity of railway transport
- ✓ Decarbonisation and energy efficiency
- ✓ Digitalization of railway transport
- ✓ Innovation in freight transportation



Spoke 7



## CCAM Connected networks and smart infrastructure

- ✓ Smart Infrastructures for CCAM
- ✓ Resilience of networks and asset management
- ✓ Zero-carbon refuelling/recharging infrastructures



Spoke 9



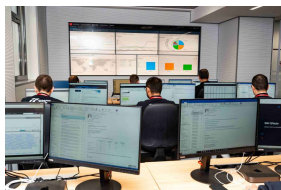
## Urban Mobility

- ✓ Smart Urban Mobility Management
- ✓ Sustainable Urban Mobility Services
- ✓ Infrastructures and Terminals for mobility



# The Projects ongoing in spoke 4

- Development of **Cybersecurity Protocols** for on-board train energy measurement devices and for the integrity of track-on-board data transfer
- Resilient algorithms to support railway circulation in the event of disruption events (**Optimizer**)
- Use of **VTOL Drones in BVLOS (Beyond Visual Line of Sight) mode** for inspections of the railway infrastructure
- Analysis of the **performance of trains powered by hydrogen and battery**
- Prototype development for **new full-battery train**
- **Reversible active power substations** and use of renewable energy for railway infrastructures
- **Safe Freight Train** - Integrated and modular monitoring system for freight wagons and design of new portal technologies for train inspection and diagnostics





# Cyber Security Energy Meter

The need to create an energy fiscal meter for rolling stock is an objective implemented by all the states of the European Union according to the requirements stated by **the Commission Regulation (EU) N° 1302/2014** concerning the Technical Specification for Interoperability relating to the rolling stock subsystem of the rail system in the European Union and Directive (EU) 2016/797 and as part of the UIC/CER Sustainability Strategy.

The UIC/CER Sustainability Strategy has two primary objectives:

- **Climate Protection**
- **Energy efficiency**

Target 2030 - 50% reduction in CO emissions from train operation compared to 1990 consumption

Target 2050 - European Railways will have to work to halve the energy and CO<sub>2</sub> consumption due to train operation.

To achieve these optimizations, the technical **solution of the Energy Meter** is expected to be accompanied by a fiscal reporting system **“You can save only the energy you measure”**.

Based on these reasons and to pursue cyber threats that could occur in the transmission between train and ground receiver of sensitive data relating to the consumption of rolling stock, the FS Group was involved to study how to secure the EMS system in order to minimize the risk from cyber threats that can compromise **integrity/origin, availability and confidentiality**.



# Bimodal Full Battery Train

 **TRENITALIA**



HYBRID

The Italian railway network is made up of 16,670 km of lines, of which 4,627 km are non-electrified. Currently, 100% of the railway lines in Sardinia Island and Val d'Aosta Region are not electrified.

In Trenitalia the full-electric bimodal train solution is being advanced. The bimodal train can be defined as a vehicle characterized by two different traction modes. A further development of this configuration, the subject of experimentation in the MOST context, is the full-electric bimodal configuration in which the train engines can be powered both via pantograph and on-board batteries.

# VTOL Drones in BVLOS Mode



To inspect railway sections, especially in sections that are not easily accessible, to reduce interruptions of operation and recovery times following anomalies, an experiment is underway which involves the use of **VTOL drones in BVLOS (Beyond Visual Line of Sight) mode**. These drones allow travel even over long distances at high speed.

To make the diagnostic and maintenance procedures of the railway infrastructure more efficient, we aim to test the use of these drones to inspect the rail track and infrastructure to verify the state of the embankments and the railway superstructure, as well as the state of the areas close to the line to avoid possible landslides.

In perspective also the state of technological and electric traction systems.

# Reversible Active Power Substations

A photograph of a high-voltage electrical substation. The scene is dominated by a complex arrangement of metal structures, including tall vertical poles and horizontal cross-arms. Numerous insulators, which are stacks of dark, cylindrical discs, are suspended from these structures. Some insulators have orange-colored components at their top or bottom. The background shows a clear blue sky with a few wispy clouds. In the distance, other parts of the substation and some utility poles are visible. The overall impression is one of a large-scale industrial facility.

To increase the energy efficiency of the 3 kVdc System, studies are underway at a rather advanced level, for the accumulation of excess train braking energy and its subsequent return, when required by railway traffic. Otherwise this energy would be wasted and dissipated due to thermal effects.

In some projects, electrical substations equipped with dynamic voltage control may be envisaged, in order to space the electrical substations further apart. This would, for example, allow us to avoid the construction of plants in tunnels



# Safe train

Some examples of intelligent freight wagons have been studied and equipped with sensor systems to solve specific technical problems (wheel defects, braking system malfunction, etc.) but without the integration of data of subsystems. Furthermore, to date, the majority of the fleet is still made up of wagons without any instrumentation useful for monitoring any dangerous situations.

An integrated and modular monitoring system has been studied to be on board freight wagons and a portal for the inspection and diagnostics of trains has been implemented.

The future prospect of a communication and power backbone that runs over the entire convoy using the DAC, paves the way for the use of new monitoring technologies.

The innovative idea of this task is therefore the design of a modular integrated monitoring system capable of significantly improving the safety of freight trains.

A line of white Melex shuttles parked on a gravel path. The shuttles are small, four-wheeled vehicles with a canopy and clear plastic side panels. The word "melex" is visible on the top of the canopy. The license plate of the shuttle in the foreground is ZA 993ZH. In the background, a person is walking on the path, and a building is visible.

# Tuss - the Ultimate Sharing Service

The project aim to test an experimental transport service that integrates car-sharing and car-pooling in a last mile service to and from the Sesto Fiorentino Railway Station.

Travelers book a ride to and from the Rail Station via an APP and are either picked up (at an agreed time and place) by a vehicle already on the move. They could receive an indication to drive a vehicle with which to pick up other travellers along the route. path.

The Rail Station is the main hub of the service. Vehicles always pass through the Station to concentrate travellers both in space (the station) and in time (the train to catch or get off), thus facilitating ride sharing.



Nordic Seminar on  
**Railway Technology**  
2024 | Stockholm, Sweden

# Tack!

“Innovative Initiatives of Italian Railway State Group  
for Sustainable Mobility”

