

Pods4Rail Final Event

Is a new approach to transport solutions feasible?

Vienna, 24. June 2026



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System Innovation, Design and Technology

Pods4Rail A decentralised automated supermodal mobility system for highly demand-specific transport and versatile purpose (passengers and / or freight)

Challenging traditional notions of transportation design

Adaptable vehicle design for different operational scenarios

Higher utilisation of existing Infrastructure

Lower lifecycle costs

Faster adaption to market demand

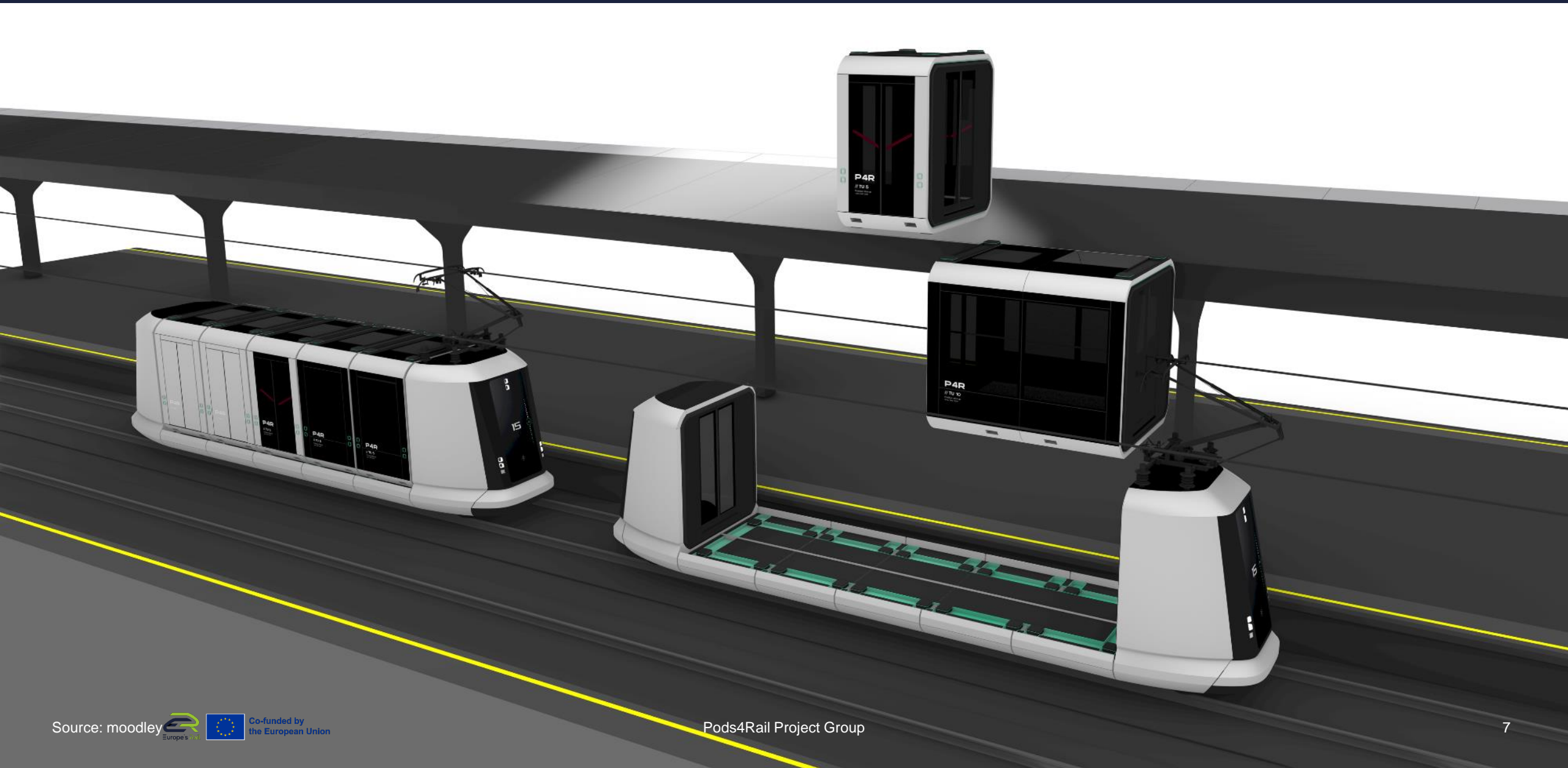
Humans remain in the loop – not as drivers, but as interpreters

Intuitive design for human understanding



From technical feasibility to user acceptance
Designing the POD system to meet user needs and create value for passengers and operators

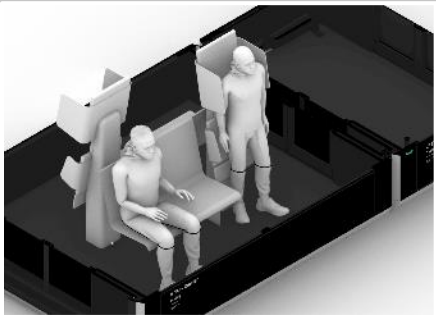
Unified passenger and freight module enabling full decoupling from the CU



Human Factors as a Basis for TU Design

User Experience and Accessibility

Layout, door-window-wall ratio, accessibility and passenger comfort

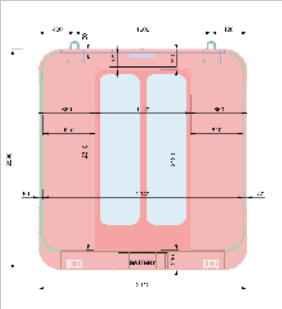
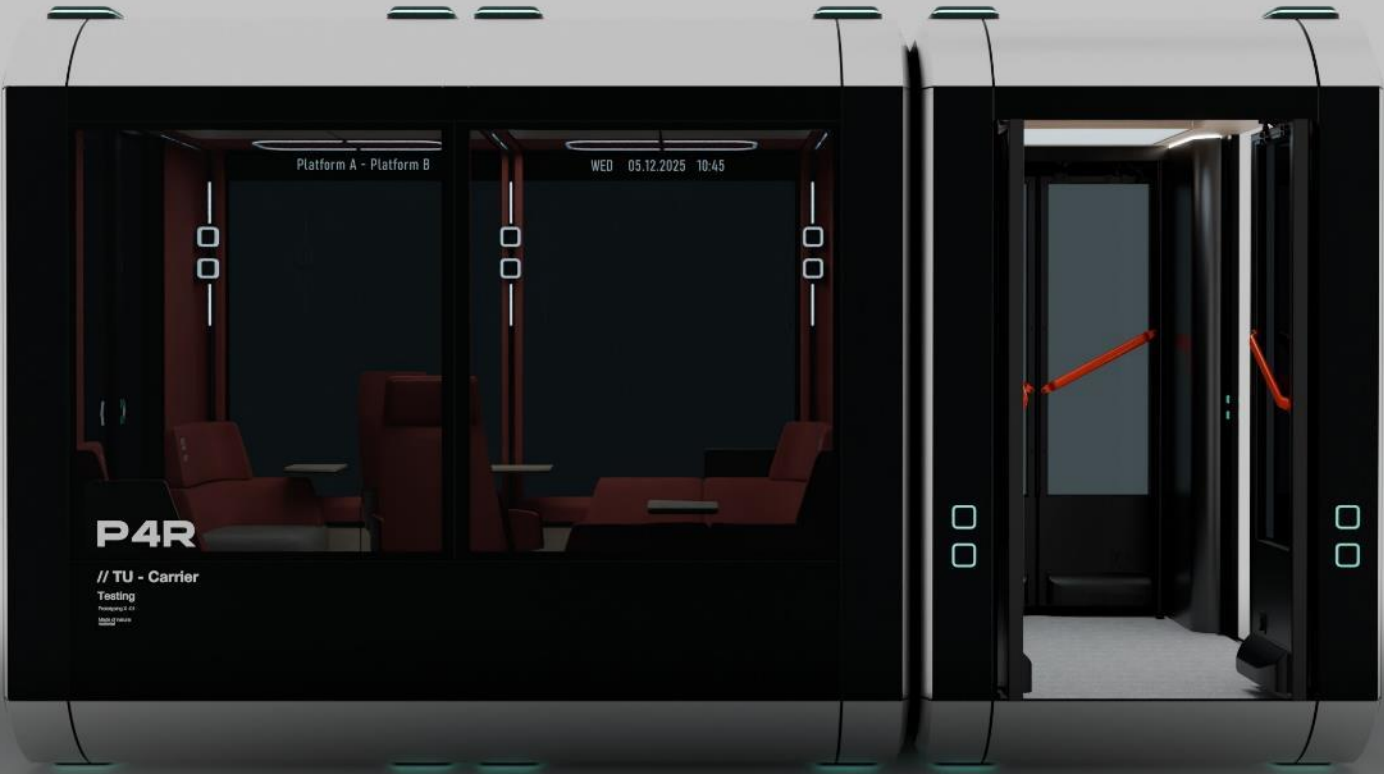


Safety and Emergency Situations

Safety equipment, emergency systems and monitoring functions

System Integration and Operations

Interfaces, communication, energy and automation systems



Modularity as the enabler of flexibility and scalability

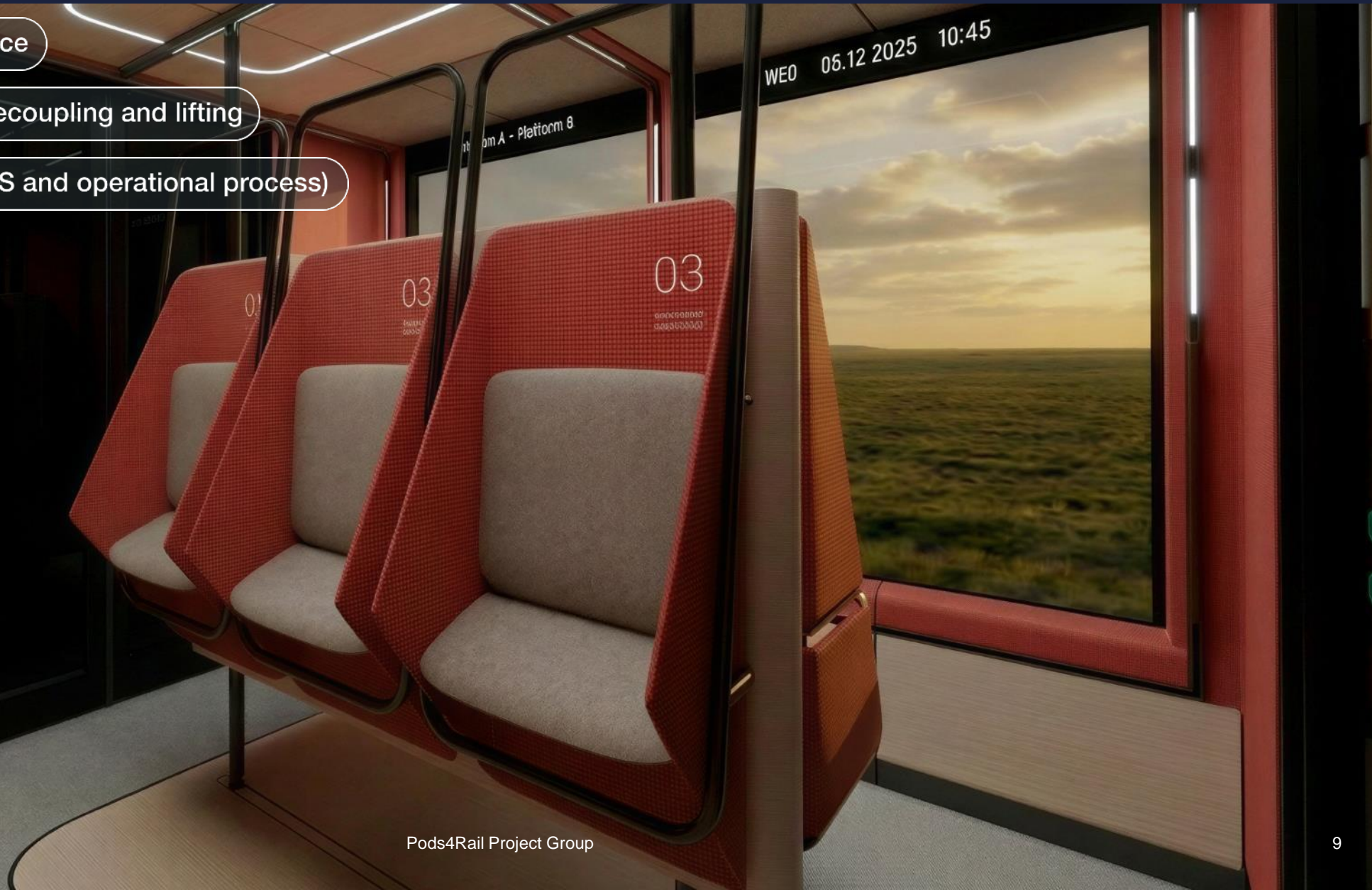
Comfort and sense of space

Perceived safety during decoupling and lifting

System understanding (PIS and operational process)

Accessibility

Luggage storage



Functional decoupling as the core principle

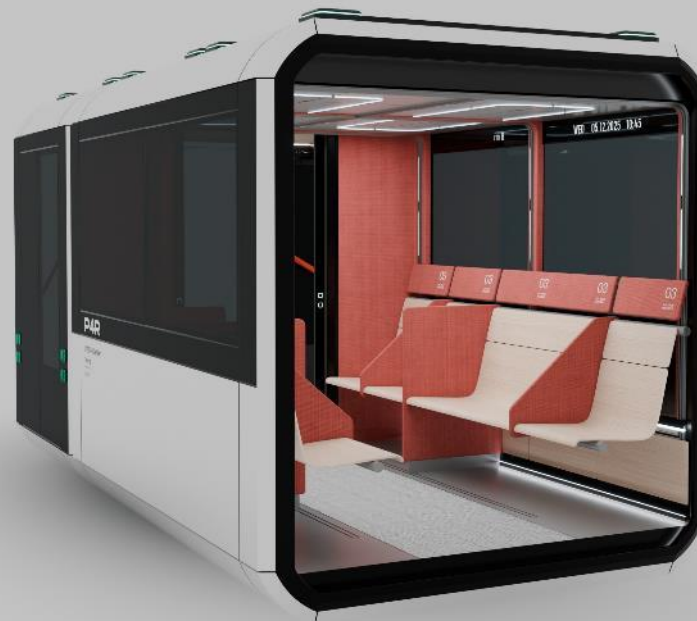
Structural Layer (Level A) Certification-stable secondary structure

The secondary structure incorporates defined load paths, standardised mechanical interfaces and integrated utility rails (power, data, HVAC). It remains unchanged throughout the Transport Unit's service life.



Functional Layer (Level B) Interchangeable interior and technology modules

Different modules can be integrated via plug-and-play interfaces. This enables seasonal or route-specific adaptations and differentiated comfort elements within the same Transport Unit. Modernisation can be carried out without structural modifications.

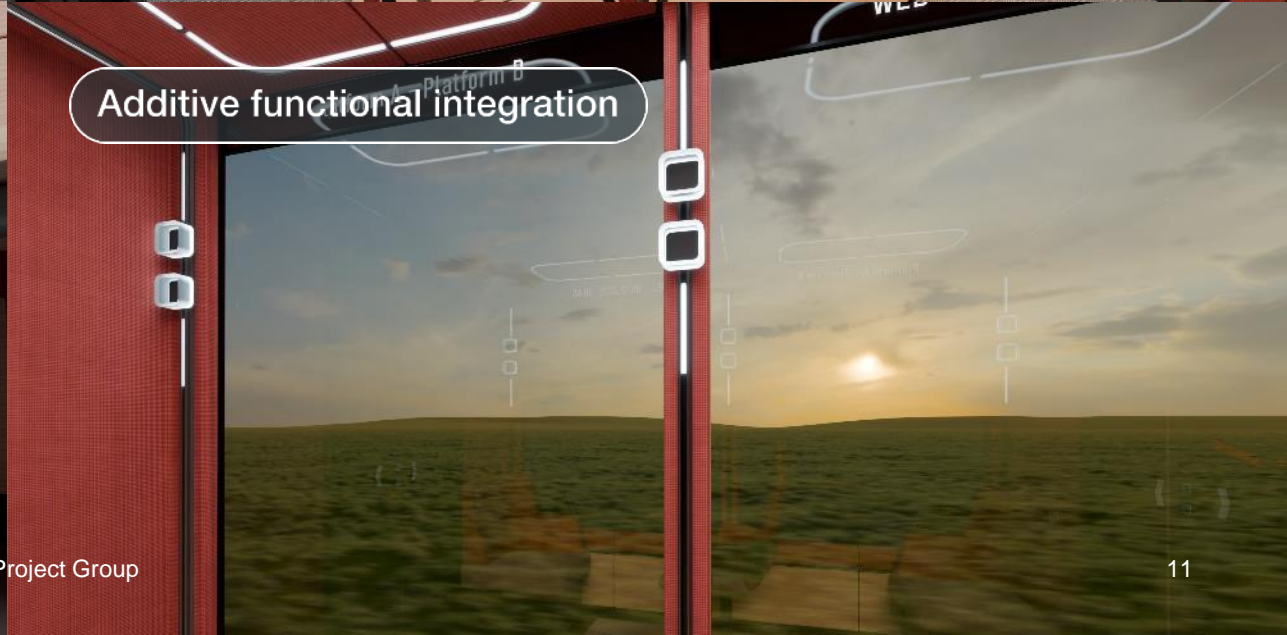
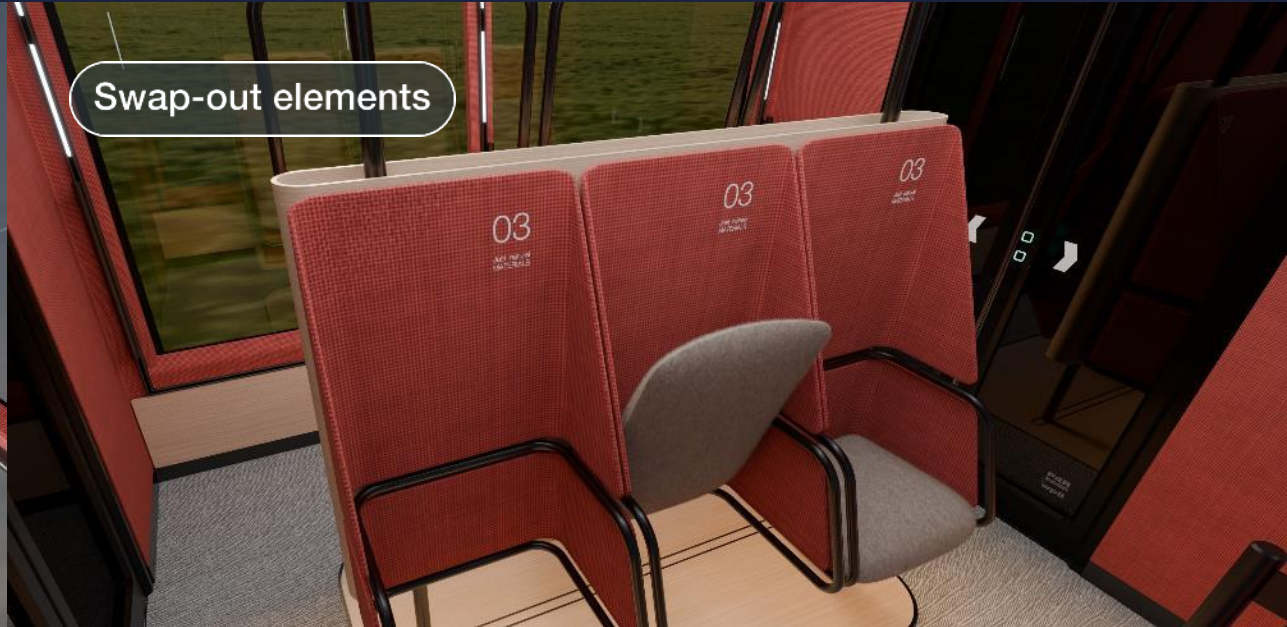
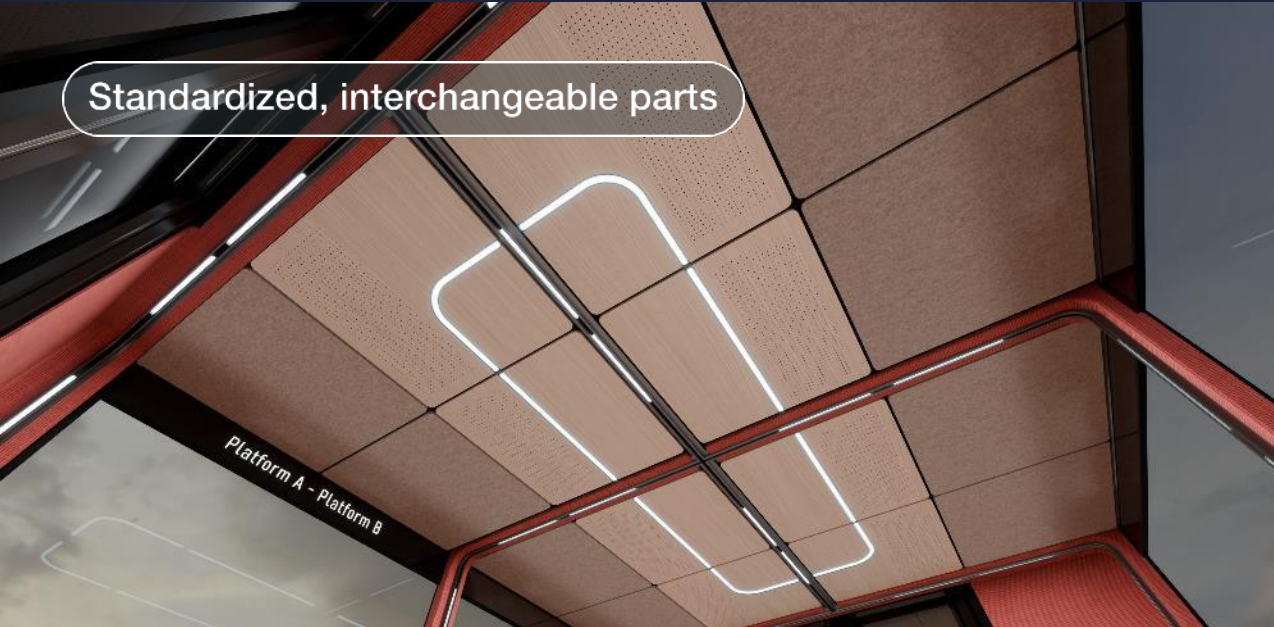


Comfort Layer (Level C) Adaptive and renewable

Surfaces, acoustic elements and design packages can be replaced independently of the underlying structure. This enables brand-specific styling, regional customisation, targeted optimisation for travel quality and lifecycle-based refurbishment without the need for recertification.



Innovative slide-in and plug-and-play components

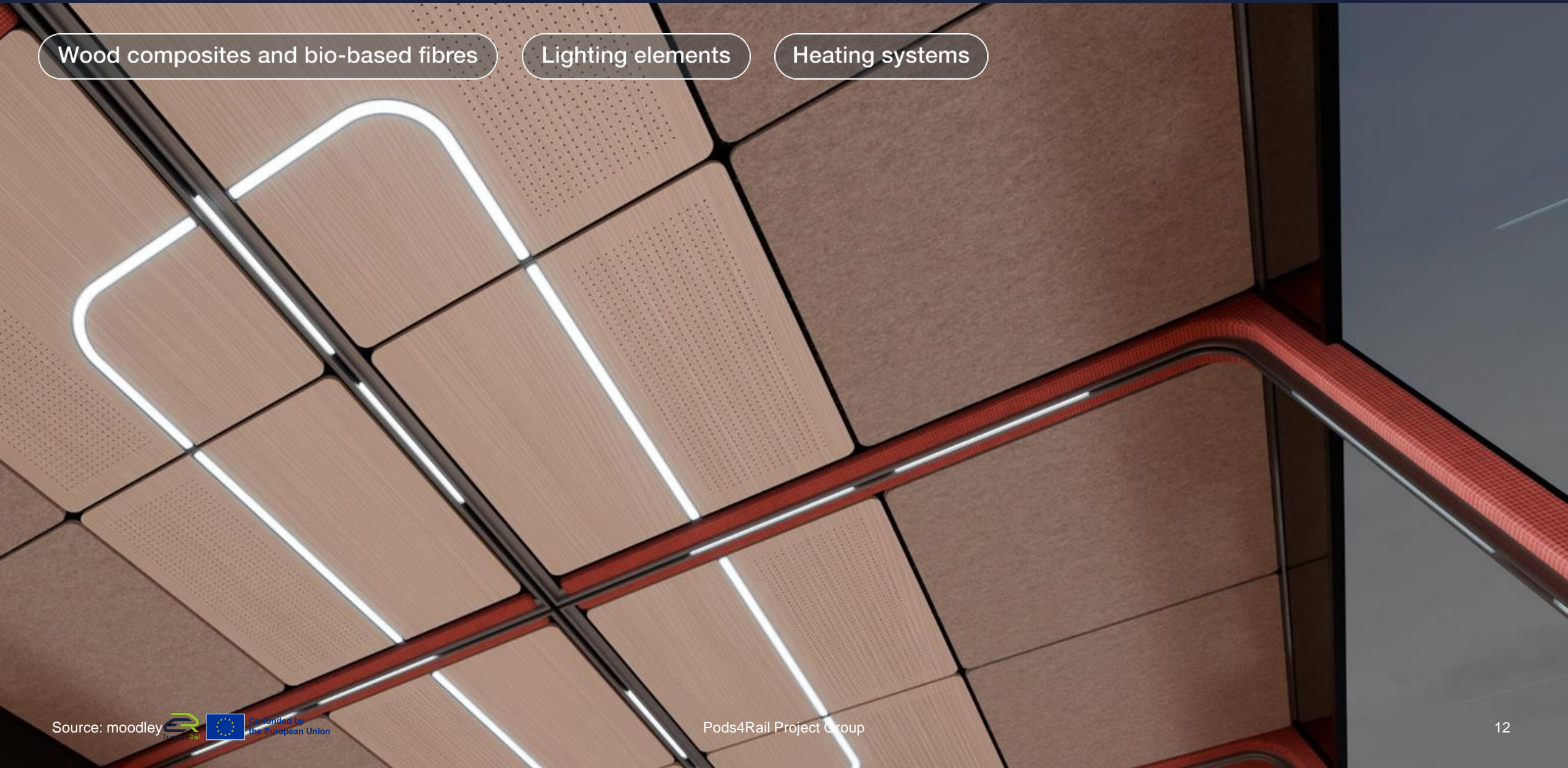


Modular lightweight interior elements in panel construction

Wood composites and bio-based fibres

Lighting elements

Heating systems



Rapidly reconfiguration with AGVs for changing demands

Reuse of components across use cases

Reduced development and integration costs

Faster adaption to operational needs

Full digital-twin compatibility via module-level definition

Streamlined certification through decoupled functions



Software-driven, physically adaptive Transport Unit

Commuter Experience Mode



From daily commuting to immersive and personalized travel experiences

Touristic Experience Mode



Transport Unit - Interface Technologies for System Integration

Mechanical Interface

Secure physical coupling between TU and CU (e.g., twistlock systems).

Electrical Interface

Power transfer for propulsion, onboard systems and auxiliary loads.

Digital Interface

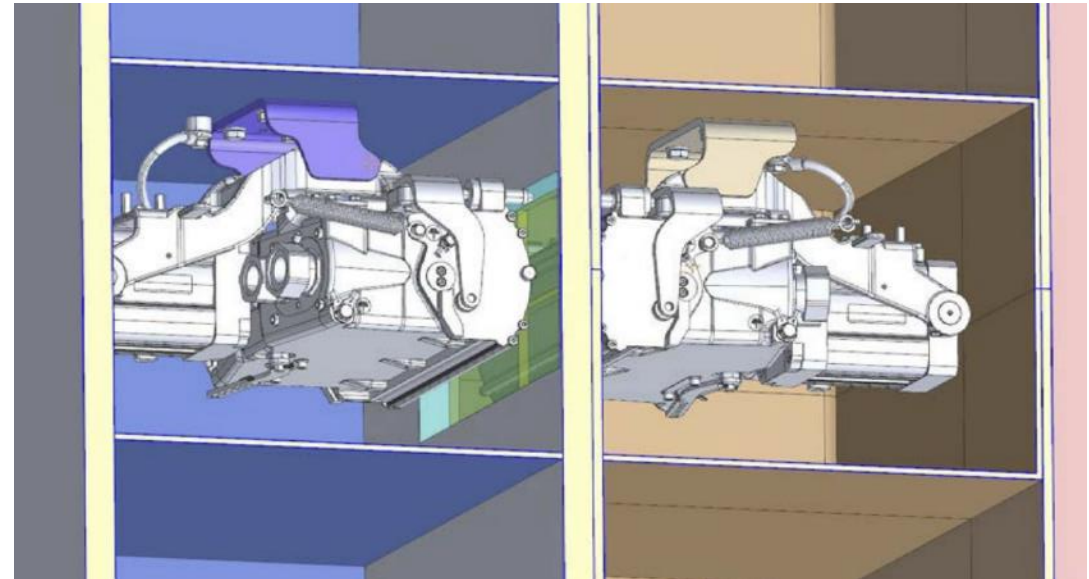
Data exchange for control, monitoring and autonomous operation.

Energy Interface

Charging, energy distribution and regenerative braking integration.

System Interoperability

Unified interfaces enabling seamless cross-domain operations.



Challenge How to achieve standardised, yet domain specific Carrier Units?

Overview of system architecture

Modular skateboard platform

Flat, integrated platform hosting all core subsystems

Standardised TU-CU Interfaces

Unified mechanical, electrical and digital connections

Reusable architectures across domains

Applicable to rail, road and ropeway systems

Multiple TU configurations

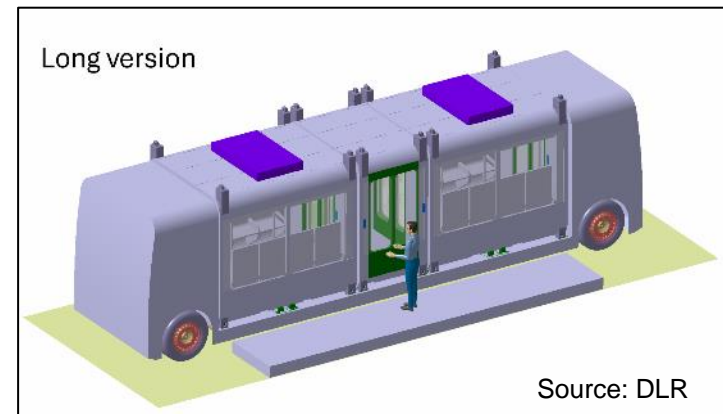
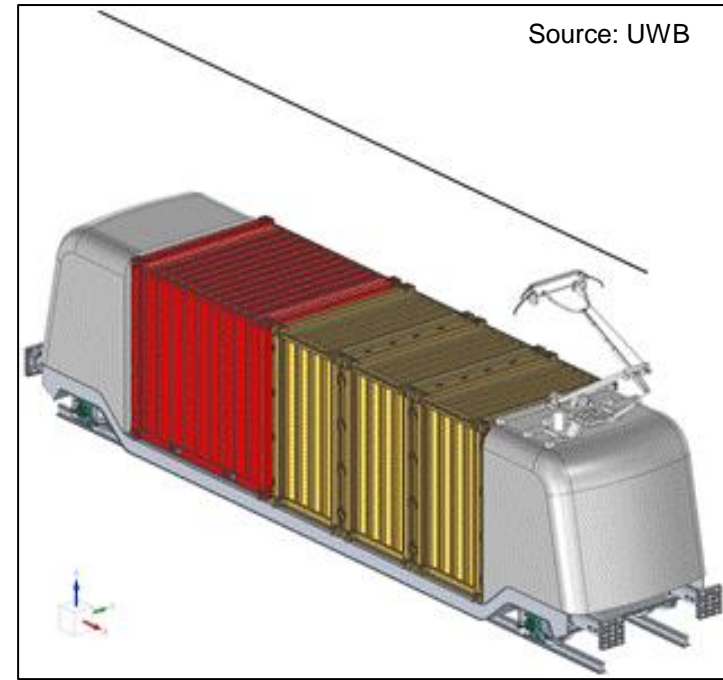
Supports diverse passenger and freight solutions

Low-floor and scalable architecture

Optimised for accessibility and adaptable capacity

Links to other flagship projects:

- FP4 WP 5 (Battery and Propulsion) and WP 18 (HVAC),
- FP5 WP 22.3 (self-propelled cargo wagon, bogie)
- FP6 WP 5 and WP 10 (mechanical and propulsion architecture)

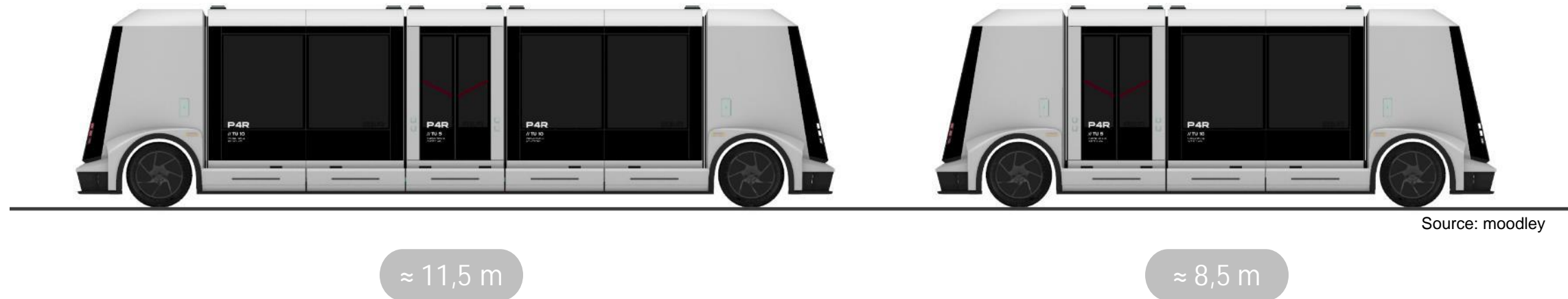


Source: DLR

Road Carrier Unit - Length dimensions

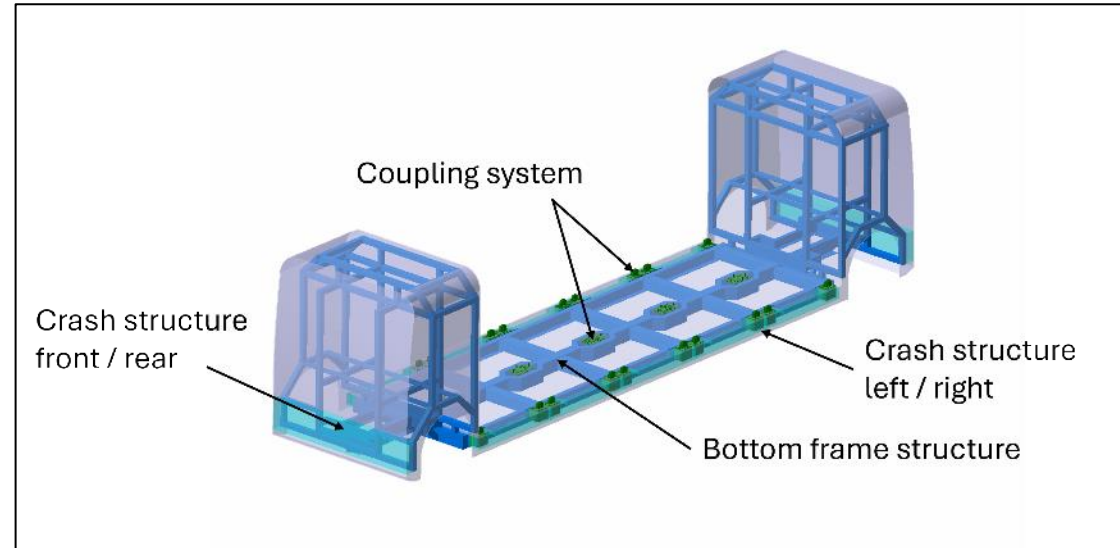
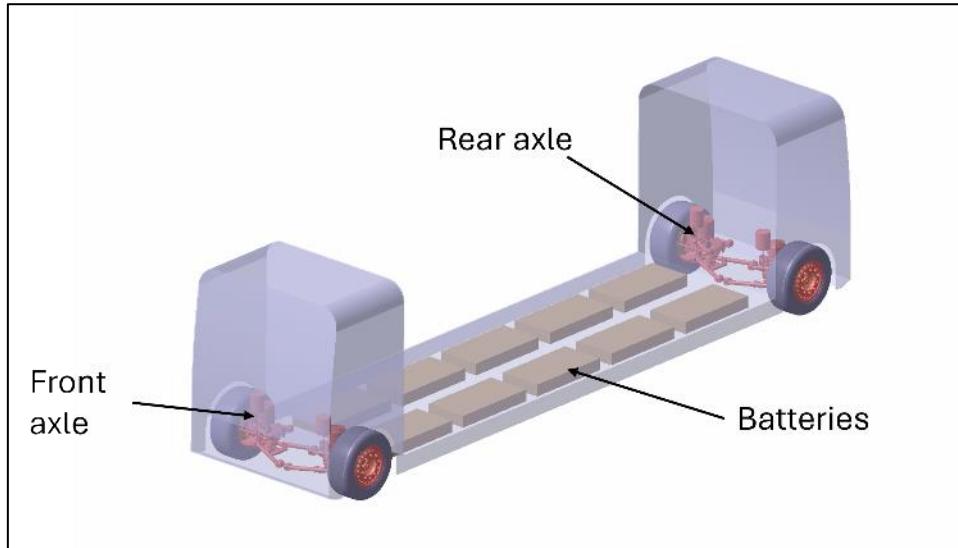
Version 1: High capacity
(e.g., for Public Transport Use Cases)

Version 2: High flexibility
(e.g., for last mile delivery or private
transport Use Cases)

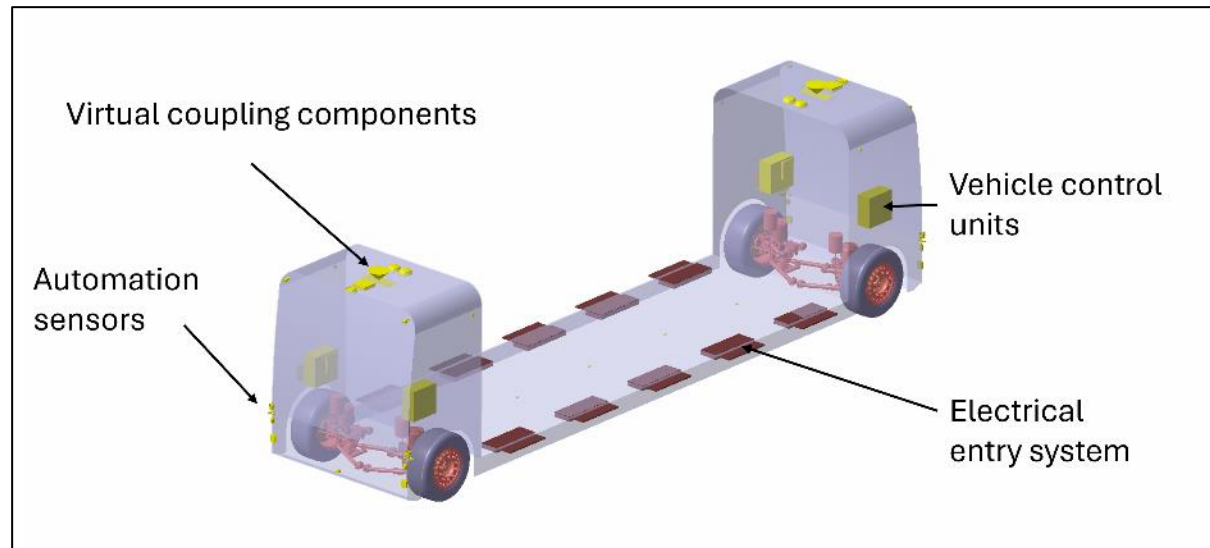


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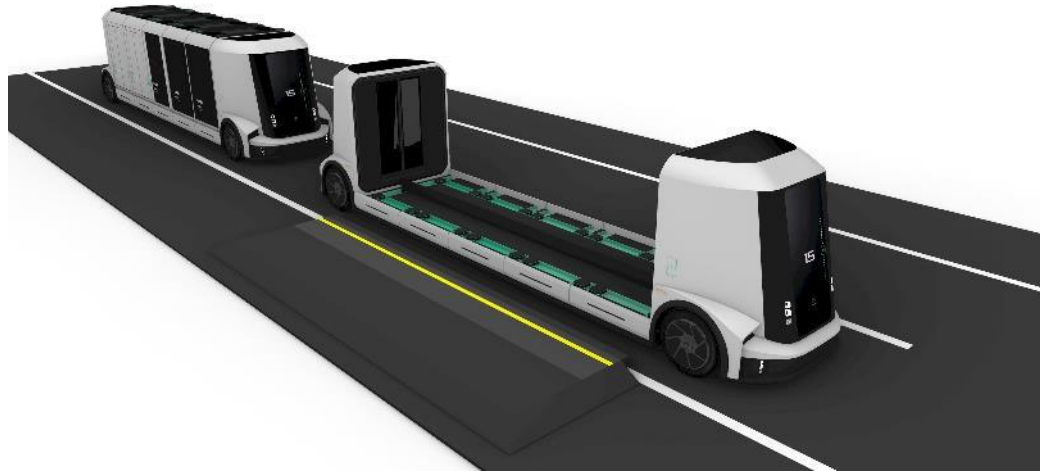
Road Carrier Unit - Main components and distribution



Source: DLR



Road Carrier Unit - Running Gear



Domain-specific connection to the road

Design with standard components for heavy loads and different vehicle dimensions.

Battery-Electric Drivetrain

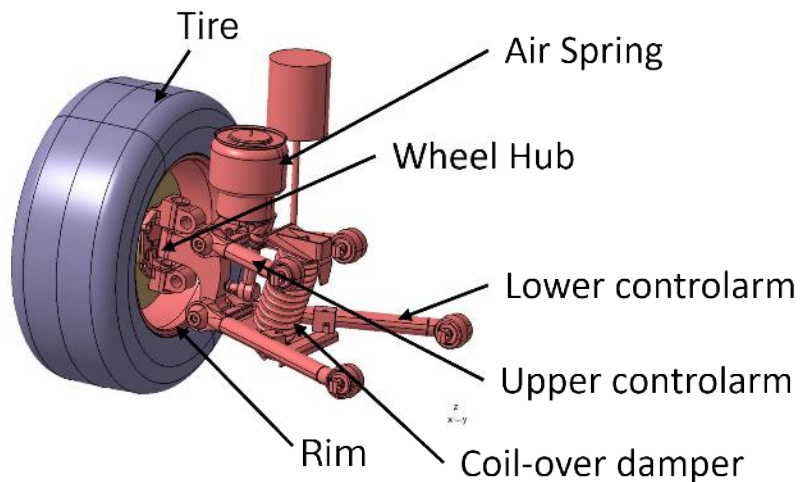
Modular battery packs and wheel hub motors enable tailored energy capacity and support regenerative braking for operational efficiency.

Distributed Drive Propulsion

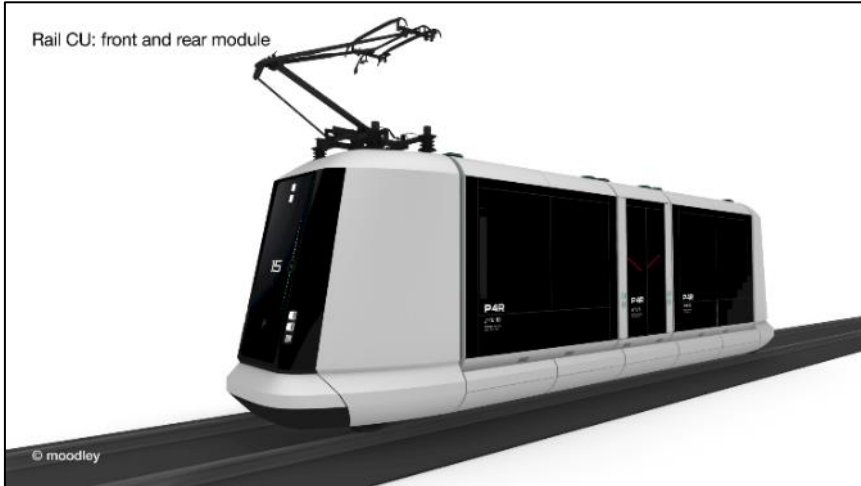
Distributed drives with corner or all-wheel configurations enhance reliability and enable advanced vehicle dynamics control. Steer-by-wire + adaptive suspension

Unified Digital Control Layer

Digital systems integrate control, communication, condition monitoring, and software updates for adaptive operation.



Rail Carrier Unit - Running Gear



Layered and digital-centric architecture

A layered structure separating digital, control and physical systems enables scalability and interoperability, supported by an integrated digital layer with OTA and V2X capabilities for optimisation and real-time connectivity.

Distributed propulsion and advanced running gear

Distributed propulsion with one motor per wheelset provides redundancy and improved traction, while self-steering running gear reduces forces, enhances curving behaviour and improves efficiency.

Modular energy and platform architecture

A scalable battery system adapts to different operations and simplifies maintenance, combined with a skateboard-based modular rail platform enabling flexible passenger and freight configurations.

Is it technically feasible? – Validation

Based on mature technologies

- Built on proven EV and railway system components

Battery-electric architecture validated

- Feasible energy supply confirmed through simulations

Rail energy requirements

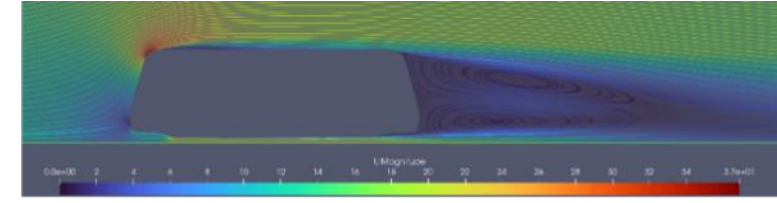
- ≈ 498 kWh in worst-case operational scenarios

Road energy requirements

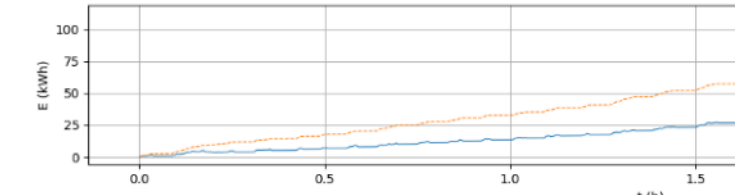
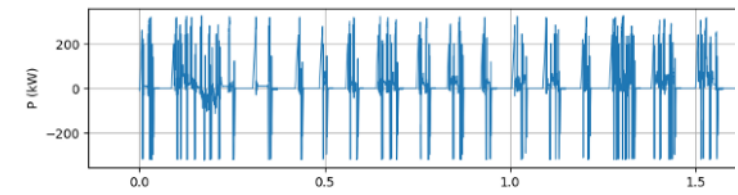
- ≈ 380 kWh in worst-case operational scenarios

Ready for automation integration

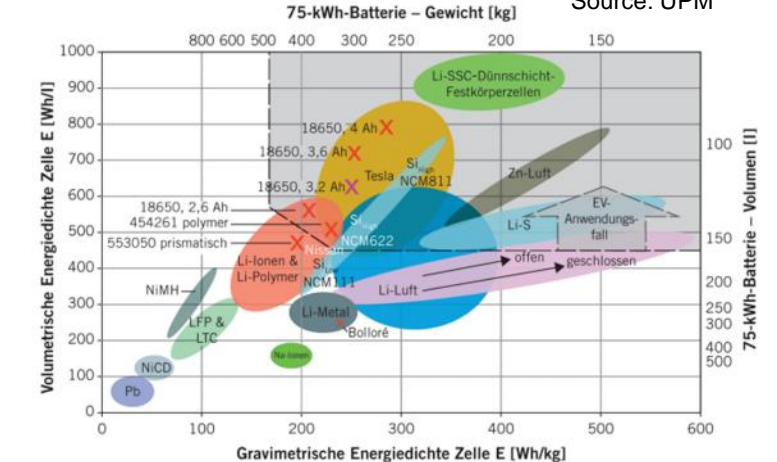
- Compatible with future autonomous and control systems



Source: UPM



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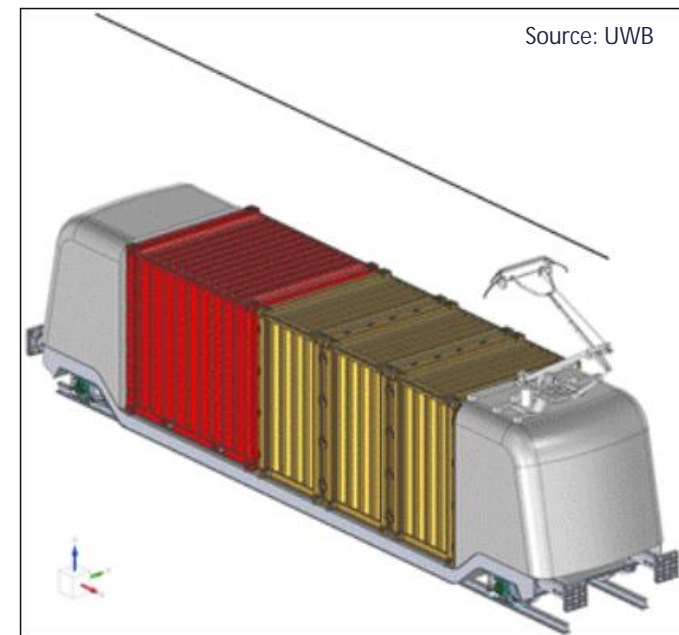
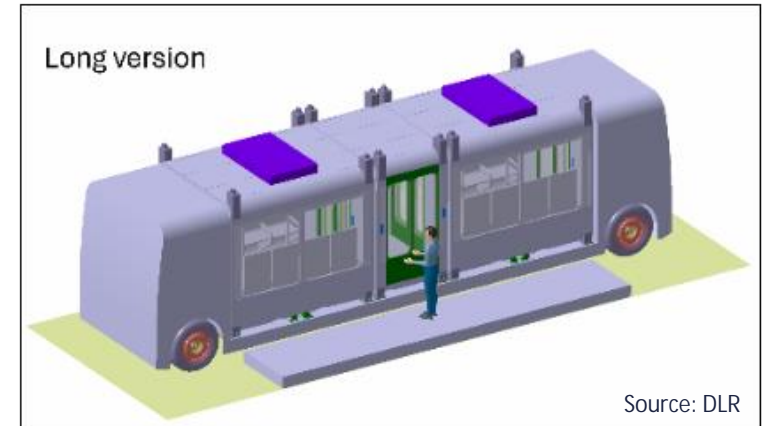


Source: Birke

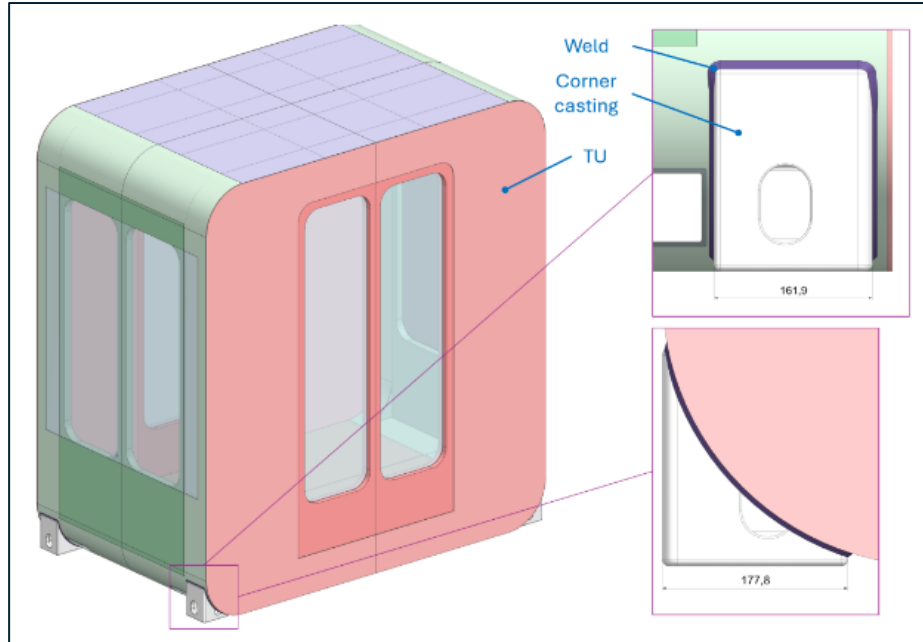
Challenge How should the handling
be carried out?

Connection between different transport domains

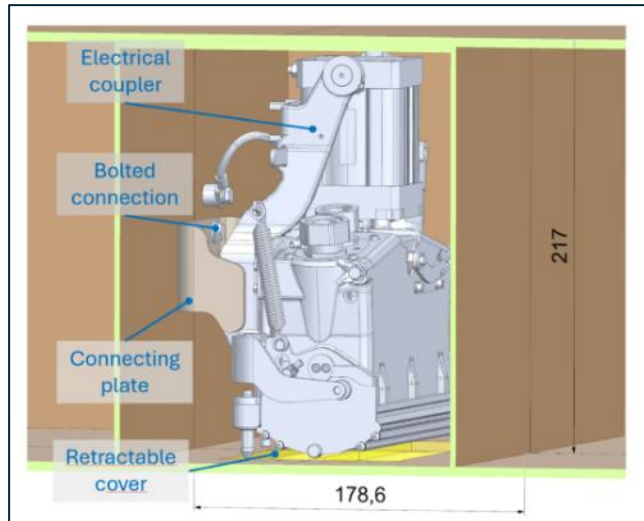
- Connects rail, road and ropeway transport domains
- Enables automated transfer of Transport Units
- Uses standardised mechanical, electrical and digital interfaces
- Builds on proven intermodal freight handling technologies
- Supports passenger and freight operations



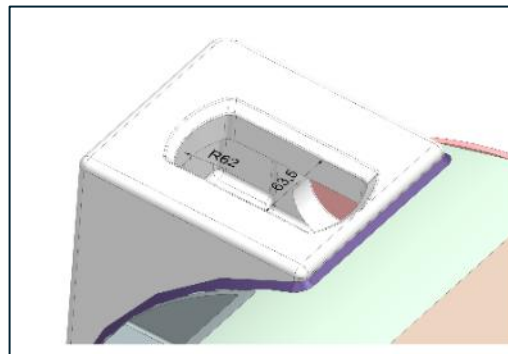
Standardised TU-CU Connection Mechanism



- ISO-based automated twistlock coupling
- Mechanical, electrical and communication interfaces integrated
- Sensor-based lock verification
- Automatic power and data connection after locking
- Designed for rail, road and ropeway applications



Source: UWB



Possible handling operations and transfer scenarios

Warehouse → Carrier

- TU retrieval from storage
- Automated loading
- Connection to CU

Other transfer scenarios

Rail ↔ Road Transfer

- Automated decoupling
- Crane transfer
- Re-coupling to new carrier

Ropeway Integration

- Overhead gripper connection
- Safety verification
- Autonomous departure



Possible transfer systems analysed and evaluated

| TU State | Possible Equipment |
|-----------------------|---------------------------|
| Empty TU | Reach stacker |
| Empty TU | Top-lift spreader |
| Cargo-loaded TU | Crane |
| Passenger-occupied TU | Crane with spreader |
| Automated terminal | AMR / autonomous vehicles |

In-depth analysis and further development are necessary.



Source: UWB



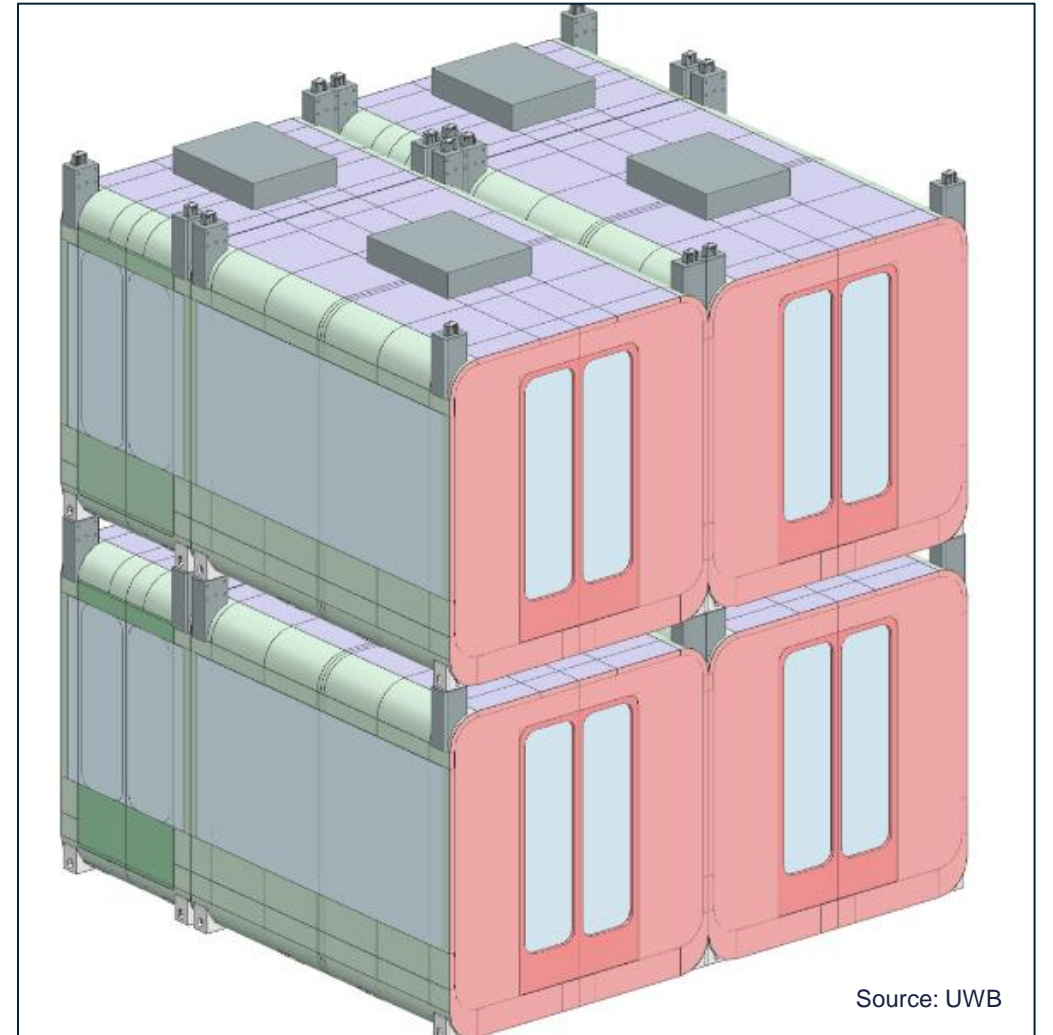
Rotary telescopic forks, available on <https://www.afb-gmbh.de/en/products-en/rotary-telescopic-forks>



Autonomous mobile robots (AMRs), available on <https://seegrid.com/autonomous-mobile-robots/>

Storage and Stacking Concept

- Empty Transport Units can be stacked
- Corner castings integrated into roof structure
- Dedicated storage yards at service centres
- Improved storage density and logistics efficiency
- Adapted structural design required compared with freight containers



Source: UWB

System Impact Seamless transitions
across transport modes through
simple and fast handling

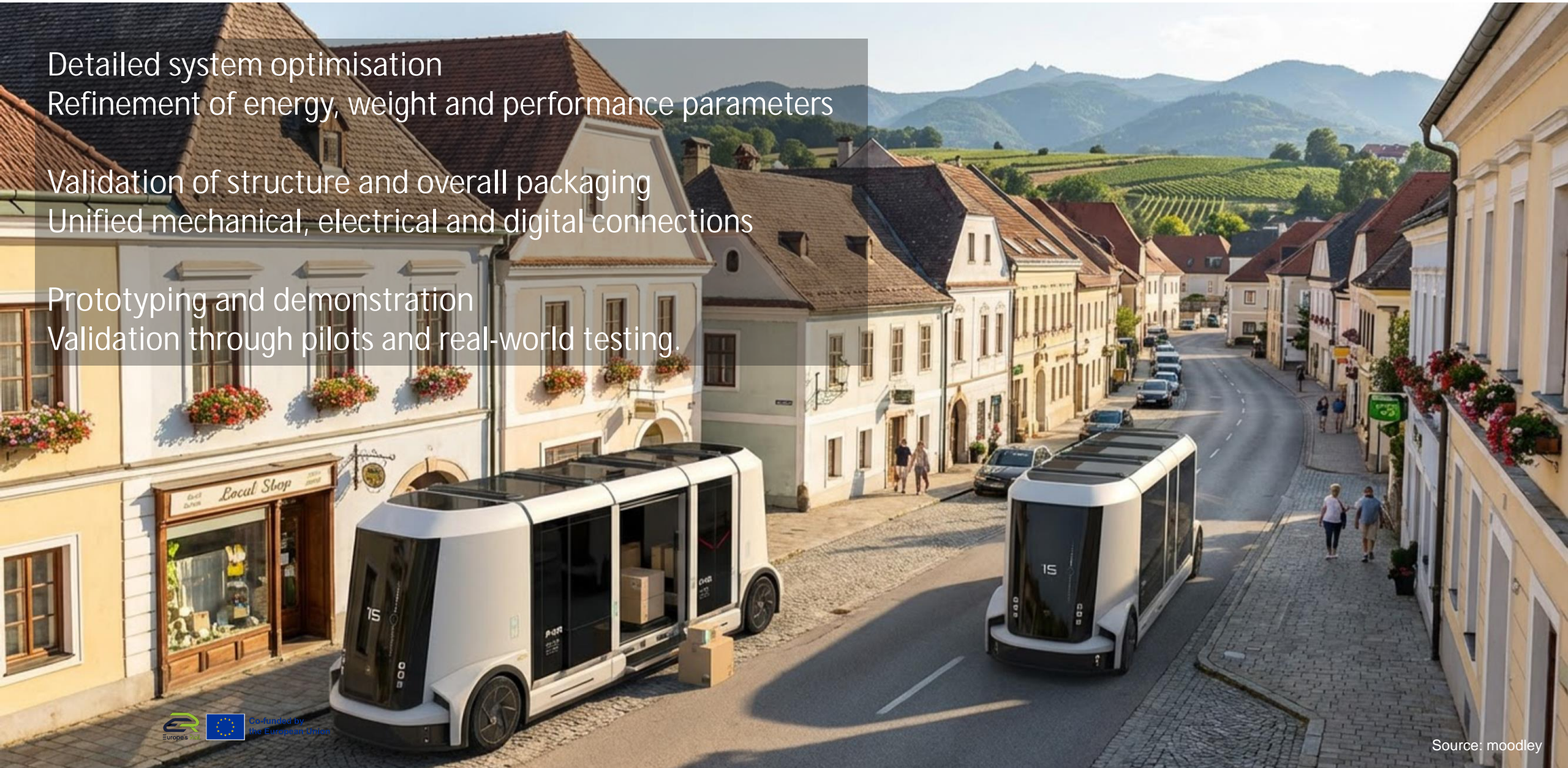


Conclusion

- A unified system architecture
Vehicle concept enables physical supermodal integration
- Technically robust and feasible
Based on mature technologies and validated system design
- Modularity as key enabler
Flexibility for multiple use cases and configurations
- Cross-domain interoperability
Seamless integration across rail, road and ropeway
- Strong foundation for implementation
Concept ready for further development and demonstration

Pathway to bring Pods4Rail to deployment

- Detailed system optimisation
- Refinement of energy, weight and performance parameters
- Validation of structure and overall packaging
- Unified mechanical, electrical and digital connections
- Prototyping and demonstration
- Validation through pilots and real-world testing.



Thank You for Your Attention!



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Co-funded by
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07 July 2026



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