



ENSEMBLE

ENabling SafE Multi-Brand Platooning for Europe

April 2021

Project in short



ENSEMBLE: Facts & Figures



The ENSEMBLE project is coordinated by TNO in collaboration with:

- **The European truck manufacturers:**
DAF, DAIMLER Truck, IVECO, MAN, SCANIA, VOLVO Group (Volvo trucks and Renault trucks)
- **CLEPA** represents the European suppliers of automotive equipment and components.
- **Suppliers:**
Bosch, Brembo, Continental, NXP, WABCO, ZF
- **ERTICO:**
Link to the European Truck Platooning Community.
- **Knowledge partners:**
IDIADA, Université Gustave Eiffel, KTH, VU Brussel.

- Innovation Action no. 769115
- 3,5 year EU project (June 2018 – November 2021)
- 20 million EUR EC funding
- 19 partners representing the full value chain of the automotive sector



Pave the way for the adoption of multi-brand truck platooning in Europe

HOW?

- Aligning and working on standardization
- Implementing Platooning as a Support Function
- Demonstrating differently branded trucks in one platoon
 - ✓ Under real world traffic conditions
 - ✓ Across (national) borders
- Assessing impacts on traffic safety, throughput and fuel economy

Truck platooning & ENSEMBLE



Truck platooning

The linking of two or more trucks in convoy, using connectivity technology and automated driving support systems (ACEA)



Societal impact

Potential to improve road safety, reduce emissions and increase transport efficiency

An integral *multi-brand* approach is needed to move further



ENSEMBLE's goal

Harmonise multi-brand specifications, realising a Multi-brand V2V communication protocol leading to standards for *multi-brand* truck interoperability

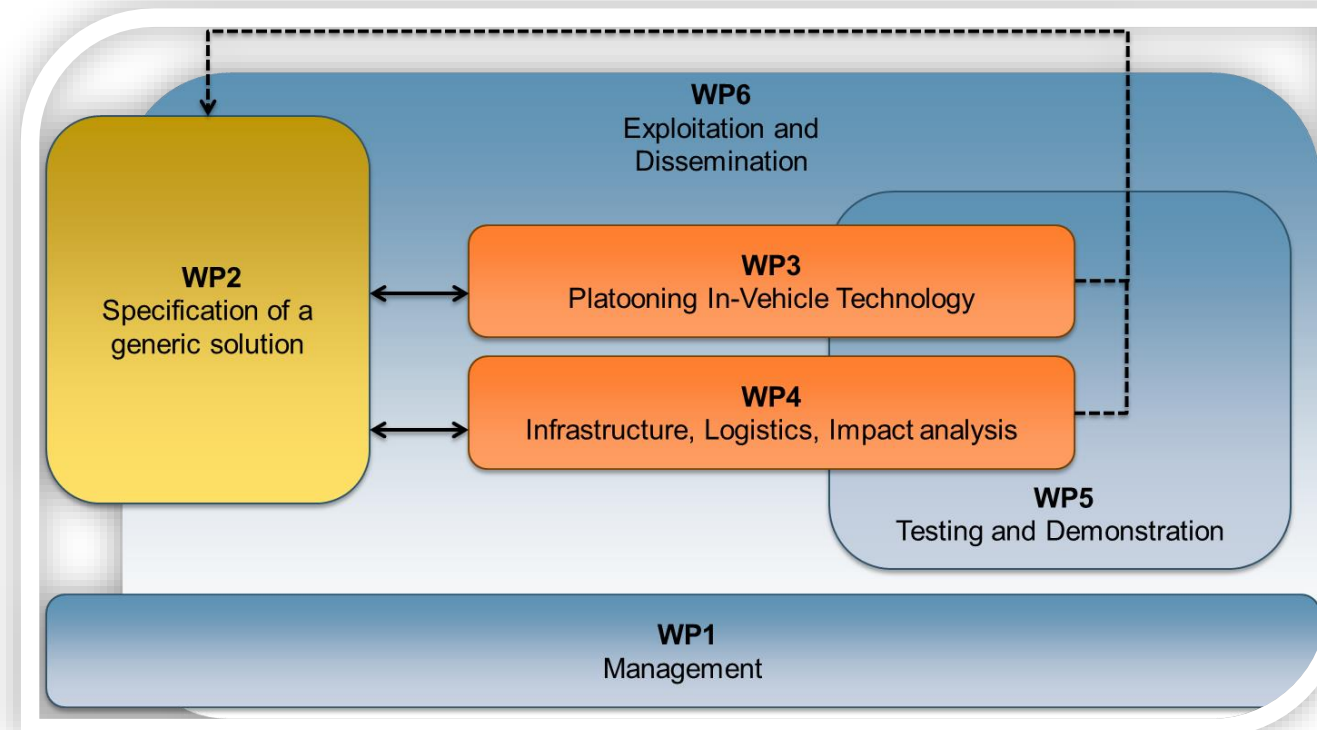


Platooning Levels

ENSEMBLE defines two ways of platooning & will implement and demonstrate one of them

Project organisation

- WP2 Specification of a generic solution
 - define the specifications for the whole multi-brand truck platooning concept
- WP3 Platooning In-Vehicle Technology
 - implement defined system of WP2 in demonstrator trucks
- WP4 Infrastructure, Logistics, Impact Analysis
 - impact assessment
- WP5 Testing and Demonstration
 - with the demonstrator trucks of WP3
- WP6 Exploitation and Dissemination
 - standardisation



Support vs Autonomous Function



Platooning as Support Function	Platooning as Autonomous Function
Driver responsible	Driver out of the loop
Longitudinal support	Both longitudinal and lateral control
Coordinated speed, gap and braking	ODD still to be defined
Following distance ~ 1,5 s	Following distance ~ 0,5 and 1.5 s
	Driver only in first truck
Quick deployment on road	First introduction in confined areas

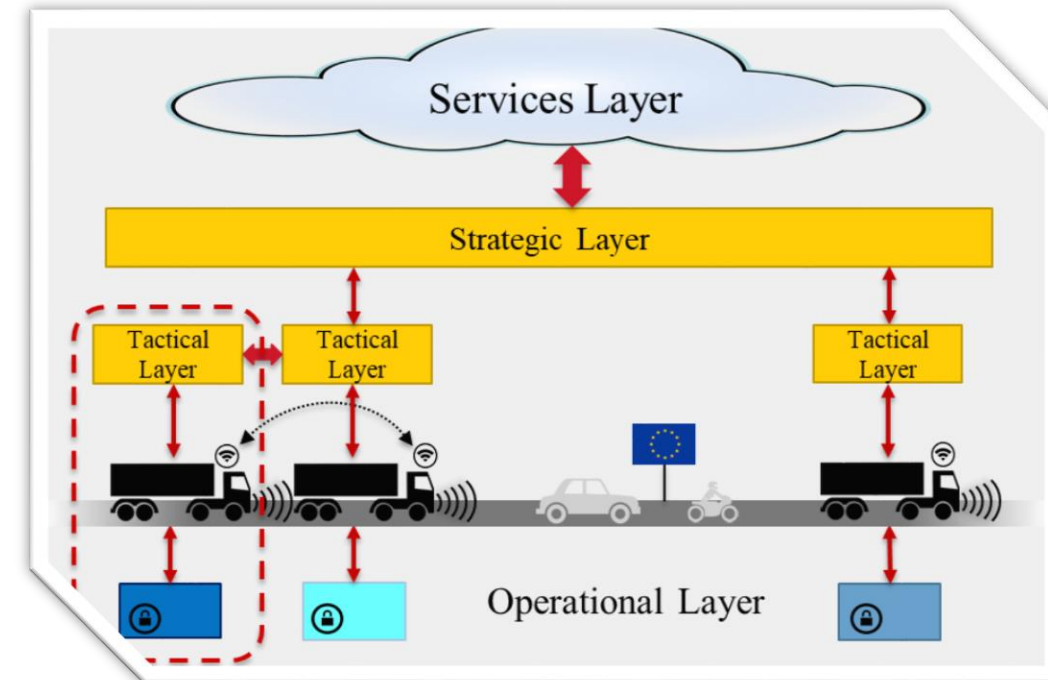
ENSEMBLE final demonstration will show the Support function.

ENSEMBLE will provide specifications for both functions

Design and Implementation Platooning as a Support Function



- Use cases:
 - *Engaging to platoon: join from behind, merge in between by single vehicle*
 - *Platooning: steady state, follow to stop, emergency braking, I2V interaction, system status, cut-in, cohesion request*
 - *Disengaging platoon: leave and split*
- Specifications: for the common parts of platooning: ‘tactical layer’
- Requirements: for the OEM specific parts: ‘operational layer’



Implementation (WP3)



- Review of use cases and specifications/requirements
- Common functionality, that is required for multi-brand platooning was developed: reference implementation
- Each OEM is developing one or more instrumented trucks that are capable of performing and demonstrating mono-brand platooning and readily prepared for platooning with a truck of at least one other truck OEM partner
- Continuous feedback to WP2 on the use cases and specifications/requirements:
 - change requests
 - issue list

Testing and Demonstration (WP5)

- Definition of methodology and test plan; data acquisition plan and KPI's
- Validation of the implementations via physical tests on test tracks:
 - 'mono-brand' testing : first each OEM test with own truck
 - 'dual/triple-brand' testing: smaller groups test with each other
 - 'multi-brand testing': finally, all come together
- Multi-brand platooning testing on public roads
- Feedback to WP2 on use cases, specifications and requirements



Results till now



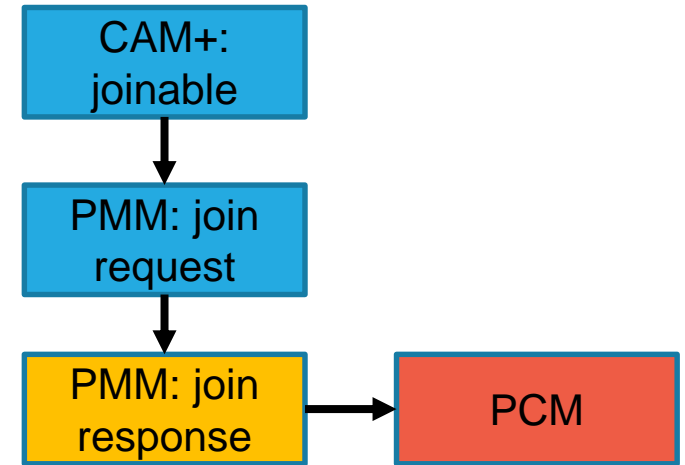
- Requirements review from EU projects (D2.1)
- Description of use cases and Level A platooning (D2.2) *update in M30 (D2.3)*
- Specifications of white label truck (D2.4) *update in M30 (D2.5)*
- Specifications of intelligent infrastructure communication (D2.6) *update in M30*

- Detailed design of the unbranded tactical layer (D3.1)
- Operational ITS-G5 V2X communication software (D3.2)
- Generic open-source RCP level reference implementation of the tactical layer (D3.3)

- First version demonstration and test plan (D5.1)

Platooning as a **Support Function**

- Use of already standardised lower layer protocols in ETSI TC ITS
- Use available message types and signals, where necessary new ones are introduced
- Involved messages: CAM + 'joinable', Platoon Management Message (PMM) and Platoon Control Message (PCM)
- Protocol logic: joining, platooning, and leaving derived from use cases
- Signing and verifying messages: available security framework for cooperative intelligent transport system (C-ITS) in Europe
- ENSEMBLE develops and extends the already available security concept with encryption of platoon application data using symmetric keys



(badly interrupted by COVID-19)

- Triple-brand testing: functional testing of the implemented systems
 - DAF, DAIMLER and IVECO: communication bench test
 - MAN, SCANIA and VOLVO: first test in March 2020
 - DAF & IVECO and SCANIA & VOLVO: this week
 - Multiple combinations: security bench tests, week last week and this week
- Multi-brand testing: full testing of the implemented systems, includes e.g. security implementation
 - rescheduled to May & June

Outlook



Outlook



- ENSEMBLE works on defining multi-brand truck platooning
 - Support Function: being implemented for testing and demonstration
 - Automated Function: being defined
- This includes:
 - Use cases, specifications and requirements
 - Message set and protocol
 - Security implementation
- Working towards standardisation: ETSI and ISO
- Final demonstration: 23 September 2021





Thank you for your attention



ENSEMBLE

platooningensemble.eu

Consortium leader
Marika.hoedemaeker@tno.nl