

# ENSEMBLE

Enabling safe Multi-Brand Platooning for Europe  
Dehlia Willemsen, TNO, The Netherlands

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# 1

## ENSEMBLE Project Introduction

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# 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:**

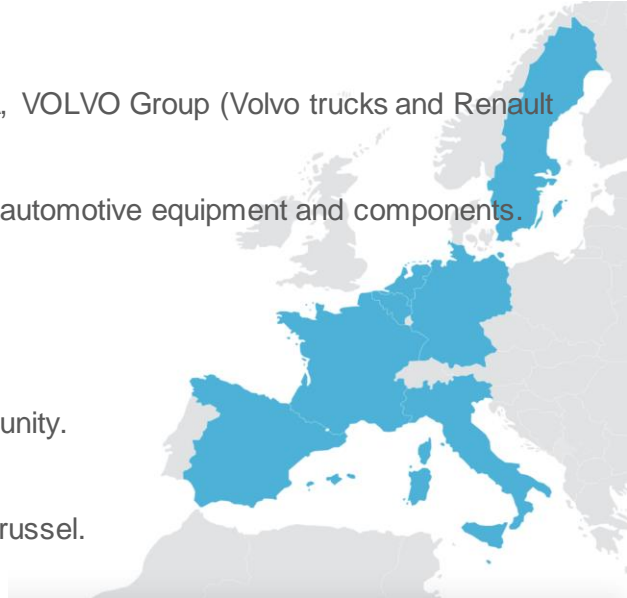
Bosch, Brembo, Continental, NXP, ZF

- **ERTICO:**

Link to the European Truck Platooning Community.

- **Knowledge partners:**

IDIADA, Université Gustave Eiffel, KTH, VU Brussel.



- Innovation Action no. 769115
- 4 year EU project ( June 2018 – March 2022)
- 20 million EUR EC funding
- 19 partners representing the full value chain of the automotive sector

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# Objectives

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

- Aligning and working on standardization of multi-brand specifications
- Implementing Platooning as a support system
- Demonstrating differently branded trucks in one platoon under real world traffic conditions
- Assessing impacts on traffic flow, business models, driver behavior and fuel economy

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# 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
THW ~ 1,5 s	THW ~ 0,5 and 1.5 s
	Driver only in first truck
Quick deployment on road	First intro in confined areas

**ENSEMBLE** Public demonstration has shown the Support function.

**ENSEMBLE** will provide specifications for both functions

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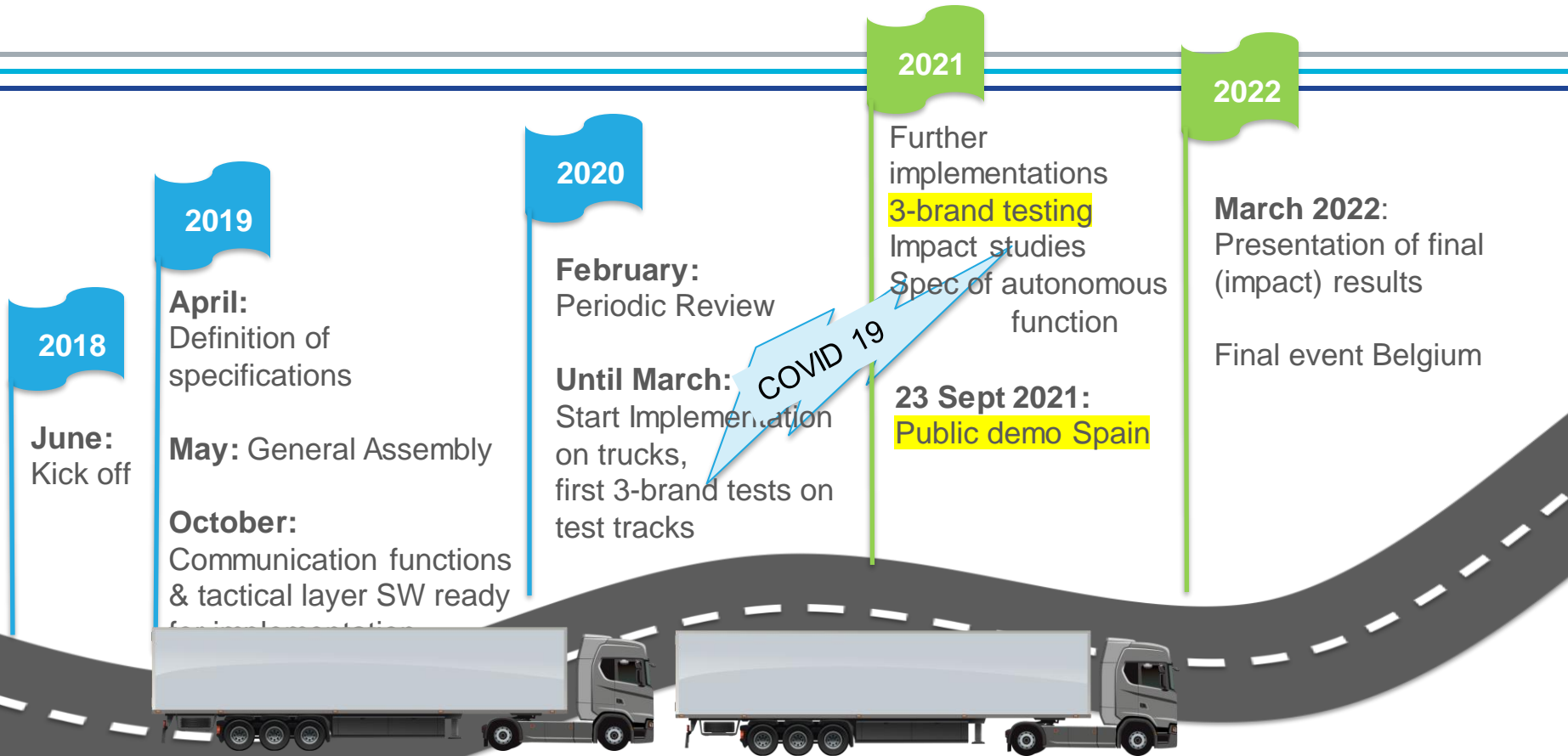


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# Where are we?



# 2

## ENSEMBLE Technical Implementation

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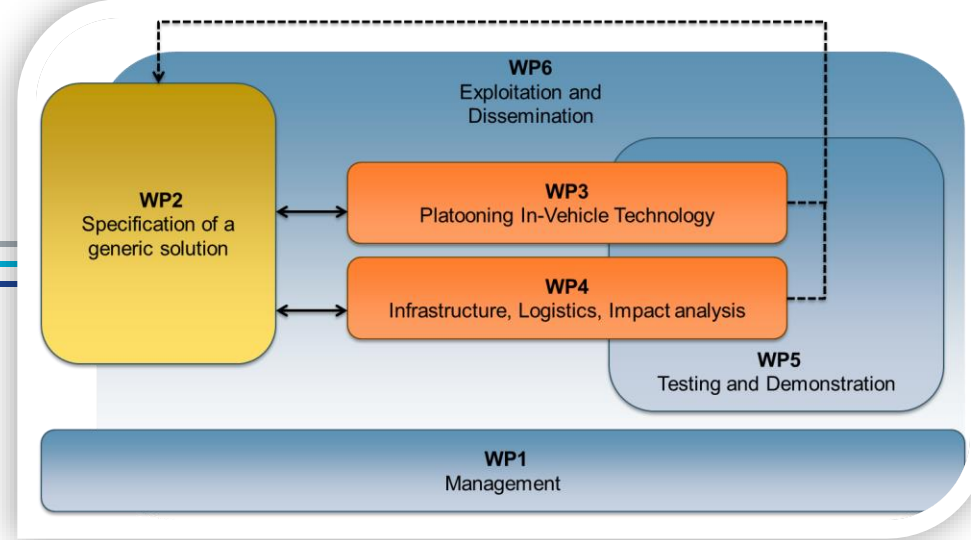


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# Objectives

- Design and Implementation of the Platooning Support Function
- Technical evaluation of the generic multi-brand platooning solution
- Validation of the implementations via physical tests on test track
- Multi-brand platooning testing on public roads
- Demonstration of the multi-brand platoon solution on public roads



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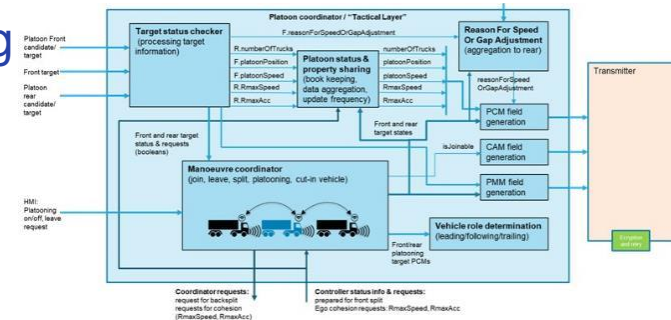


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# Approach

- Reference Implementation: common functionality only
- Verify Specifications and Requirements:
  - ◆ Issue list for details of implementation
  - ◆ Change request list for Specs and Reqs
- OEM specific implementations & mono-brand testing
- Dual/triple/quadruple-brand testing
- Multi-brand testing



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# Examples of alignments

- Join at large distances
- Leave by braking
- What to put in 'PlatoonID' field?
- Join timeout: how long to wait for the join response and starting receiving the platooning (PCM) message?



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## ENSEMBLE Achievements & lessons learnt

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# Main achievements

- Use cases, Specifications and Requirements: *Many hours of aligning, specifying and implementation*
- Technical implementation: *More aligning and detailing*
- Testing: *mono-, dual-, triple-, and 7-brand*
- Public Demo: *Multi-brand platooning works in real life*

*! Many public deliverables can already be found on our website!*

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# Testing

- Functionality first
- Signing & Verification and Encryption 'optional'/'later'
- Examples of tests performed
  - ◆ Join from behind and leave: different combinations
  - ◆ Steady state platooning with speed variations
  - ◆ Emergency braking
  - ◆ Cut in
- Some of the issues encountered:
  - ◆ Alignment of time and matching platooning partner
  - ◆ Load of communication box with Signing & Verification and logging 'on'



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# Early feedback

- Feedback was actually an ongoing process during development and testing of the platooning systems
- Examples
  - ◆ KeyUpdate sequences: key management function necessary
  - ◆ When to stop sending PCM in leave sequence: after receiving 'preparing' or 'prepared'?
  - ◆ When to update certain data fields during joining / platoon merge



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# Towards the final event

- Technical evaluation
- Impact assessment
- Finalise Specifications and Requirements
- Final event:  
Antwerp, 17 March 2022



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# What's next

- Towards deployment of Platooning as a Support Function:
  - ◆ Standardisation of communication: message sets, protocol, encryption
  - ◆ Use in normal driving
  - ◆ Impact on road and traffic
- Further developments for Platooning as an Autonomous Function:
  - ◆ Platooning partner identification
  - ◆ Brake performance estimation
  - ◆ Connection to 'road side' / I2V

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# GET IN TOUCH

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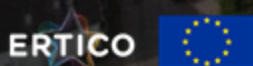
[Platooningsensemble.eu](https://platooningsensemble.eu)

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Consortium Leader

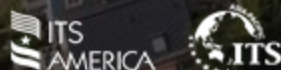
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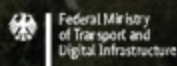
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# Public demo event



Drones - YouTube

