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ENSEMBLE

ENabling SafE Multi-Brand pLatooning for Europe

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Revision history

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1.0	27/02/2019	Kujtesa Hajredini, ERTICO	First draft	Prepared
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1. EXECUTIVE SUMMARY

Context

Platooning technology has made significant advances in the last decade, but to achieve the next step towards deployment of truck platooning, an integral multi-brand approach is required. Aiming for Europe-wide deployment of platooning, 'multi-brand' solutions are paramount. It is the ambition of ENSEMBLE to realise pre-standards for interoperability between trucks, platoons and logistics solution providers, to speed up actual market pick-up of (sub)system development and implementation and to enable harmonisation of legal frameworks in the member states.

Project scope

The main goal of the ENSEMBLE project is to pave the way for the adoption of multi-brand truck platooning in Europe to improve fuel economy, traffic safety and throughput. This will be demonstrated by driving up to seven differently branded trucks in one (or more) platoon(s) under real world traffic conditions across national borders. During the years, the project goals are:

- Year 1: setting the specifications and developing a reference design with acceptance criteria
- Year 2: implementing this reference design on the OEM own trucks as well as perform impact assessments with several criteria
- Year 3: focus on testing the multi-brand platoons on test tracks and international public roads

The technical results will be evaluated against the initial requirements. Also, the impact on fuel consumption, traffic, infrastructure, drivers and other road users will be established. In the end, all activities within the project aim to accelerate the deployment of multi-brand truck platooning in Europe.

Abstract of this Deliverable

Within the ENSEMBLE project, WP6, Task 6.2.2 aims to disseminate a **Letter of Intent (LoI)** signed by the ENSEMBLE partners, relevant road authorities and other stakeholders part of the European truck platooning challenge network (ETPC) for the execution of the live event, related to the results of the ENSEMBLE project and its exploitation.

This deliverable describes the **purpose** of the LoI, how this LoI is **established**, the **intended distribution** and the **related timelines**.



2. INTRODUCTION

2.1. Background

ENSEMBLE Project WP6 Task 6.2 **Maintaining and growing the Stakeholder's Forum** has defined as the main objectives to involve the relevant public and private stakeholders in the ENSEMBLE project development and outcomes, specifically the relevant road authorities.

In addition, as a key objective within this Task 6.2 is the exchange of experience and learnings from different Truck Platooning activities in Europe and beyond as well establish ETPC as the reference platform for Truck Platooning in Europe and beyond.

Among other important objectives of Task 6.2 is the use the ETPC as a platform for interaction with wider industry, shippers, fleet operators, and other stakeholders and receive endorsement from the ETPC community as a whole as a reference flagship initiative. And last but not least, the objective is to contribute to the realization of the ETPC roadmap.

WP6 intends to take advantage of the existing relationships between the project members and the European Truck Platooning Challenge (ETPC) community in order to achieve a high degree of adoption of the results beyond the project. With this intention, ENSEMBLE will improve the cooperation with a large community of EU stakeholders, including the ETPC, road authorities and private stakeholders.

The work will consist of the following tasks:

- organise regular ENSEMBLE-ETPC networking meetings,
- Create community engagement using **Letter of Intent** and MoU mechanisms, specifically with road authorities involved in the final demonstrations,
- Establish a list of recommendations & actions for ETPC outside the scope of ENSEMBLE.

2.2. Aim

ERTICO and Ifsttar have issued a Letter of Intent (LoI) with the aim of asking the support and engagement of the automotive industry and road authorities' and a large amount of ETPC stakeholders, expressing their intent to bring truck platooning technological solutions to the market.

As a follow up of the Letter of Intent, the second community engagement is the MoU that is meant to be signed by these parties in order to guarantee the fast adoption of Multi-Brand Truck Platooning technologies once they are available on the market.

In addition, the ENSEMBLE Coordinator, truck manufacturers and ERTICO are continuously and actively involved in ETCP activities to convince important ETCP stakeholders to officially engage in ENSEMBLE by signing a **Letter of Intent**.

3. LOI PURPOSE

The purpose of the task 6.2 is the community engagement. As a result, an ENSEMBLE Letter of Intent has been drafted to validate the engagement of the wider community in the concept of truck platooning across Europe.

Community engagement in truck platooning will be by first tackled by disseminating a Letter of Intent signed by the ENSEMBLE partners and relevant road authorities for the execution of the ENSEMBLE project and its exploitation.

This LoI will highlight the efforts of amongst other the automotive industry and road authorities to carry the technological solutions of truck platooning into the market.

The LoI signed parties will declare their support on objectives for enabling the final ENSEMBLE live demonstration event, bringing truck platooning technological solutions to the market and contribute to related marketing and communication ENSEMBLE project topics.

Through this LoI, signed parties will support and provide the required resources for workshops organising the final ENSEMBLE event under the coordination of ENSEMBLE WP6 leader. Based on the results of these workshops, ENSEMBLE WP6 leader intends to create and execute an operational plan to ensure the physical and digital infrastructure support and availability, or technical implementation and testing support to the platooning final event.

The organizations signing this LoI intend to accept the final exemptions as defined by these workshops to guarantee that the final event is in accordance with the local applicable law.

LoI signed parties will declare their interest to take the ENSEMBLE project results and identify necessary actions to contribute in further deployment of truck platooning.

LoI signed parties intend to align those actions with other involved stakeholders in a coordinated way governed by ETPC. Nevertheless, organisations signing this LoI intend to follow to the Code of Conduct of Communication and Dissemination as defined by ENSEMBLE Work Package 6.

The LoI is part of the deployment process of multi brand platooning. In a first instance it enables the live show case of the ENSEMBLE research results in a real cross border member state environment.

In a second instance, parties engage themselves in a positive attitude to deploy a certain instance of platooning technology as soon as possible after May 2021, as laid out by the ETPC 'Vision 2022' as described in the minutes of the ETPC network November 2018 event.



The result of Ensemble WP5 (testing) and the set of signed LoI's together with the intended market communications (WP6) will determine the final event locations, involved parties and stakeholders, and the final show case for the ENSEMBLE project.

4. LOI ESTABLISHMENT

This LoI has been established by introducing the main intentions of relevant stakeholders to achieve the final ENSEMBLE live demonstration event and express their willingness to support with necessary actions.

The ENSEMBLE LoI signed parties among other will express their readiness to:

- 1) to enable the final ENSEMBLE live demonstration event.
- 2) identify necessary actions to contribute in further deployment of truck platooning.
- 3) align actions with other involved stakeholders in ETPC.
- 4) follow the ENSEMBLE Code of Conduct of Communication and Dissemination

4.1. LoI intended distribution

The LoI is addressed to a large number of stakeholders focusing primarily in ERTICO contact database of all ENSEMBLE Partners, Automotive industry (ACEA) which are OEMS as ENSEMBLE partners.

The LoI will be distributed to ETPC members (Road authorities included) and EU-EIP Network.

The contact list is in accordance with the GDPR rules.

4.2. LoI distribution timeline

LoI draft is foreseen to be finalised by end of February 2019. The validated LoI will be presented at the EPC network event at the end of March 2019 and then will be sent to all related stakeholders by mid of April 2019. Expected signatures are by end of May 2019. Results of signature will be announced at the European ITS congress Brainport, Eindhoven.

The duration of this LoI lasts at least for the entire project time of ENSEMBLE.

Afterwards this LOI can be terminated with a three months' notification to the ETPC management.

4.3. LOI versions

The LOI draft in addendum 1 is a reference draft. Derived from this draft, legal documents will be generated that contain a 'subset' of intentions relevant to the envisioned stakeholders.

5. SUMMARY AND CONCLUSION

This LoI plays a crucial role on highlighting the aims and promises of automotive industry, road authorities and other related stakeholders to bring truck platooning technological solutions to the market in a short time perspective.

LoI will support ENSEMBLE project goals for its final event to have a live demonstration of multi brand platooning of seven trucks electronically coupled and driving across several Members States.

Signature of this LoI by ENSEMBLE Partners, ETPC members and EU-EIP Network will enable contribution to final ENSEMBLE live demonstration event.

LoI will express the willingness of ENSEMBLE partners as related authority to cooperate in case if the ENSEMBLE final event is proposed to be executed in their involved road network.

The duration of this LoI lasts as long as the project of ENSEMBLE.

APPENDIX A LOI DRAFT

Note: this draft will be made official soon after a check for the legal language by a legal expert.

To whom it may concern:

Stakeholders: All ENSEMBLE Partners,
ETPC members (Road authorities included)
EU-EIP Network

The main goal of the ENSEMBLE project is to pave the way for the adoption of multi-brand truck platooning in Europe to improve fuel economy, traffic safety and throughput.

ENSEMBLE project aims that in its final event being a live demonstration of multi brand platooning of seven trucks electronically coupled and driving across several Members States.

This LoI formulates the intention and commitment of automotive industry, road authorities and other related stakeholders to bring truck platooning technological solutions to the market in a short time horizon.

The signatories agree to the following four intentions stated, aiming to enable the final ENSEMBLE live demonstration event:

1 Enabling the live demonstration: In the case the ENSEMBLE final event is proposed to be executed in our involved road network and we are an involved related authority, or if it relates to our activity, our organisation intends to positively contribute and to cooperate with ENSEMBLE project partners to enable the final ENSEMBLE live demonstration event.

2 Providing the necessary resources: This contribution and cooperation includes but is not limited to providing the necessary resources in the preparation of the workshops for organising this final event under coordination of the WP6 ENSEMBLE leader.

3 Support the final event: Based on the results of these workshops, our organisation intends to create and execute an operational plan to ensure the physical and digital infrastructure support and availability, or technical implementation and testing support to the platooning final event.

4 Contribute to the acceptance of the exemption: Our organisation intends to accept the final exemptions as defined by these workshops to guarantee that the final event is in accordance with the local applicable law.

The signatories agree to the following aiming at bringing truck platooning technological solutions to the market in a short time horizon.



5 Identify necessary actions for further deployment: Our organisation intends to take the ENSEMBLE project results and identify our necessary actions to contribute in further deployment of truck platooning.

6 Coordinate actions under the ETPC: Our organisation intends to align those actions with other involved stakeholders in a coordinated way governed by ETPC.

The signatories agree to marketing and communication of ENSEMBLE project related topics:

7 Disseminate Ensemble results: Our organisation intends to adhere to the Code of Conduct of Communication and Dissemination as defined by ENSEMBLE Work Package 6

The duration of this LOI lasts at least project time of ENSEMBLE.

Afterwards this LOI can be terminated with a three months' notification to the ETPC management.

Signatures

APPENDIX B. GLOSSARY

Definitions

Term	Definition
Convoy	A truck platoon may be defined as trucks that travel together in convoy formation at a fixed gap distance typically less than 1 second apart up to 0.3 seconds. The vehicles closely follow each other using wireless vehicle-to-vehicle (V2V) communication and advanced driver assistance systems
Cut-in	A lane change manoeuvre performed by vehicles from the adjacent lane to the ego vehicle's lane, at a distance close enough (i.e., shorter than desired inter vehicle distance) relative to the ego vehicle.
Cut-out	A lane change manoeuvre performed by vehicles from the ego lane to the adjacent lane.
Cut-through	A lane change manoeuvre performed by vehicles from the adjacent lane (e.g. left lane) to ego vehicle's lane, followed by a lane change manoeuvre to the other adjacent lane (e.g. right lane).
Ego Vehicle	The vehicle from which the perspective is considered.
Emergency brake	Brake action with an acceleration of $<-4 \text{ m/s}^2$
Event	An event marks the time instant at which a transition of a state occurs, such that before and after an event, the system is in a different mode.
Following truck	Each truck that is following behind a member of the platoon, being every truck except the leading and the trailing truck, when the system is in platoon mode.
Leading truck	The first truck of a truck platoon
Legal Safe Gap	Minimum allowed elapsed time/distance to be maintained by a standalone truck while driving according to Member States regulation (it could be 2 seconds, 50 meters or not present)
Manoeuvre ("activity")	A particular (dynamic) behaviour which a system can perform (from a driver or other road user perspective) and that is different from standing still, is being considered a manoeuvre.
ODD (operational)	The ODD should describe the specific conditions under which a given automation function is intended to function. The ODD is the definition of where (such as what roadway types and speeds) and when (under what conditions,

Term	Definition
design domain)	such as day/night, weather limits, etc.) an automation function is designed to operate.
Operational layer	The operational layer involves the vehicle actuator control (e.g. accelerating/braking, steering), the execution of the aforementioned manoeuvres, and the control of the individual vehicles in the platoon to automatically perform the platooning task. Here, the main control task is to regulate the inter-vehicle distance or velocity and, depending on the Platooning Level, the lateral position relative to the lane or to the preceding vehicle. Key performance requirements for this layer are vehicle following behaviour and (longitudinal and lateral) string stability of the platoon, where the latter is a necessary requirement to achieve a stable traffic flow and to achieve scalability with respect to platoon length, and the short-range wireless inter-vehicle communication is the key enabling technology.
Platoon	A group of two or more automated cooperative vehicles in line, maintaining a close distance, typically such a distance to reduce fuel consumption by air drag, to increase traffic safety by use of additional ADAS-technology, and to improve traffic throughput because vehicles are driving closer together and take up less space on the road.
Platoon Automation Levels	In analogy with the SAE automation levels subsequent platoon automation levels will incorporate an increasing set of automation functionalities, up to and including full vehicle automation in a multi-brand platoon in real traffic for the highest Platooning Automation Level. The definition of “platooning levels of automation” will comprise elements like e.g. the minimum time gap between the vehicles, whether there is lateral automation available, driving speed range, operational areas like motorways, etc. Three different levels are anticipated; called A, B and C.
Platoon candidate	A truck who intends to engage the platoon either from the front or the back of the platoon.
Platoon cohesion	Platoon cohesion refers to how well the members of the platoon remain within steady state conditions in various scenario conditions (e.g. slopes, speed changes).
Platoon disengaging	The ego-vehicle decides to disengage from the platoon itself or is requested by another member of the platoon to do so. When conditions are met the ego-vehicle starts to increase the gap between the trucks to a safe non-platooning gap. The disengaging is completed when the gap is large enough (e.g. time gap of 1.5 seconds, which is depends on the operational safety based on vehicle dynamics and human reaction times is given). A.k.a. leave platoon

Term	Definition
Platoon dissolve	All trucks are disengaging the platoon at the same time. A.k.a. decoupling, a.k.a. disassemble.
Platoon engaging	Using wireless communication (V2V), the Platoon Candidate sends an engaging request. When conditions are met the system starts to decrease the time gap between the trucks to the platooning time gap. A.k.a. join platoon
Platoon formation	Platoon formation is the process before platoon engaging in which it is determined if and in what format (e.g. composition) trucks can/should become part of a new / existing platoon. Platoon formation can be done on the fly, scheduled or a mixture of both. Platoon candidates may receive instructions during platoon formation (e.g. to adapt their velocity, to park at a certain location) to allow the start of the engaging procedure of the platoon.
Platoon split	The platoon is split in 2 new platoons who themselves continue as standalone entities.
Requirements	Description of system properties. Details of how the requirements shall be implemented at system level
Scenario	A scenario is a quantitative description of the ego vehicle, its activities and/or goals, its static environment, and its dynamic environment. From the perspective of the ego vehicle, a scenario contains all relevant events. Scenario is a combination of a manoeuvre (“activity”), ODD and events
Service layer	The service layer represents the platform on which logistical operations and new initiatives can operate.
Specifications	A group of two or more vehicles driving together in the same direction, not necessarily at short inter-vehicle distances and not necessarily using advanced driver assistance systems
Steady state	In systems theory, a system or a process is in a steady state if the variables (called state variables) which define the behaviour of the system or the process are unchanging in time. In the context of platooning this means that the relative velocity and gap between trucks is unchanging within tolerances from the system parameters.
Strategic layer	The strategic layer is responsible for the high-level decision-making regarding the scheduling of platoons based on vehicle compatibility and Platooning Level, optimisation with respect to fuel consumption, travel times, destination, and impact on highway traffic flow and infrastructure, employing cooperative ITS cloud-based solutions. In addition, the routing of vehicles to allow for platoon forming is included in this layer. The strategic layer is implemented in a

Term	Definition
	centralised fashion in so-called traffic control centres. Long-range wireless communication by existing cellular technology is used between a traffic control centre and vehicles/platoons and their drivers.
Tactical layer	The tactical layer coordinates the actual platoon forming (both from the tail of the platoon and through merging in the platoon) and platoon dissolution. In addition, this layer ensures platoon cohesion on hilly roads, and sets the desired platoon velocity, inter-vehicle distances (e.g. to prevent damaging bridges) and lateral offsets to mitigate road wear. This is implemented through the execution of an interaction protocol using the short-range wireless inter-vehicle communication (i.e. V2X). In fact, the interaction protocol is implemented by message sequences, initiating the manoeuvres that are necessary to form a platoon, to merge into it, or to dissolve it, also taking into account scheduling requirements due to vehicle compatibility.
Target Time Gap	Elapsed time to cover the inter vehicle distance by a truck indicated in seconds, agreed by all the Platoon members; it represents the minimum distance in seconds allowed inside the Platoon.
Time gap	Elapsed time to cover the inter vehicle distance by a truck indicated in seconds.
Trailing truck	The last truck of a truck platoon
Truck Platoon	Description of system properties. Details of how the requirements shall be implemented at system level
Use case	<p>Use-cases describe how a system shall respond under various conditions to interactions from the user of the system or surroundings, e.g. other traffic participants or road conditions. The user is called actor on the system, and is often but not always a human being. In addition, the use-case describes the response of the system towards other traffic participants or environmental conditions. The use-cases are described as a sequence of actions, and the system shall behave according to the specified use-cases. The use-case often represents a desired behaviour or outcome.</p> <p>In the ensemble context a use case is an extension of scenario which add more information regarding specific internal system interactions, specific interactions with the actors (e.g. driver, I2V) and will add different flows (normal & alternative e.g. successful and failed in relation to activation of the system / system elements).</p>

Acronyms and abbreviations

Acronym / Abbreviation	Meaning
ACC	Adaptive Cruise Control
ADAS	Advanced driver assistance system
AEB	Autonomous Emergency Braking (System, AEBS)
ASIL	Automotive Safety Integrity Level
ASN.1	Abstract Syntax Notation One
BTP	Basic Transport Protocol
C-ACC	Cooperative Adaptive Cruise Control
C-ITS	Cooperative ITS
CA	Cooperative Awareness
CAD	Connected Automated Driving
CAM	Cooperative Awareness Message
CCH	Control Channel
DEN	Decentralized Environmental Notification
DENM	Decentralized Environmental Notification Message
DITL	Driver-In-the-Loop
DOOTL	Driver-Out-Of-the Loop
DSRC	Dedicated Short-Range Communications
ETSI	European Telecommunications Standards Institute
EU	European Union
FCW	Forward Collision Warning
FLC	Forward Looking Camera
FSC	Functional Safety Concept
GN	GeoNetworking
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GUI	Graphical User Interface

Acronym / Abbreviation	Meaning
HARA	Hazard Analysis and Risk Assessment
HIL	Hardware-in-the-Loop
HMI	Human Machine Interface
HW	Hardware
I/O	Input/output
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
ITL	In-The Loop
ITS	Intelligent Transport System
IVI	Infrastructure to Vehicle Information message
LDWS	Lane Departure Warning System
LKA	Lane Keeping Assist
LCA	Lane Centring Assist
LoI	Letter of Intent
LRR	Long Range Radar
LSG	Legal Safe Gap
MAP	MapData message
MIO	Most Important Object
MRR	Mid-Range Radar
OS	Operating system
ODD	Operational Design Domain
OEM	Original Equipment Manufacturer
OOTL	Out-Of The-Loop
PAEB	Platooning Autonomous Emergency Braking
PMC	Platooning Mode Control
QM	Quality Management
RSU	Road Side Unit

Acronym / Abbreviation	Meaning
SA	Situation Awareness
SAE	SAE International, formerly the Society of Automotive Engineers
SCH	Service Channel
SDO	Standard Developing Organisations
SIL	Software-in-the-Loop
SPAT	Signal Phase and Timing message
SRR	Short Range Radar
SW	Software
TC	Technical Committee
TOR	Take-Over Request
TOT	Take-Over Time
TTG	Target Time Gap
V2I	Vehicle to Infrastructure
V2V	Vehicle to Vehicle
V2X	Vehicle to any (where x equals either vehicle or infrastructure)
VDA	Verband der Automobilindustrie (German Association of the Automotive Industry)
WIFI	Wireless Fidelity
WLAN	Wireless Local Area Network
WP	Work Package

