

**HORIZON EUROPE PROGRAMME**  
TOPIC HORIZON-CL5-2023-D2-05-01

GA No. 101137975

**Situationally Aware Innovative Battery Management  
System for Next Generation Vehicles**



**InnoBMS - Deliverable report**

**D5.1 - Test suite and hardware specifications for real-time HIL testing**



Funded by the  
European Union

<b>Deliverable No.</b>	D5.1	
<b>Related WP</b>	WP5	
<b>Deliverable Title</b>	Test suite and hardware specifications for real-time HIL testing	
<b>Deliverable Date</b>	2025-03-07	
<b>Deliverable Type</b>	REPORT	
<b>Dissemination level</b>	Sensitive – member only (SEN)	
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#### Document History

Version	Date	Editing done by	Remarks
V1.0	2025/02/28	Fagarasi, Lorand (BOSCH)	First draft for internal Review
V1.1	2025/03/07	Dumitrascu, Gabriel (BOSCH)	Review from Bosch
V1.2	2025/03/11	Chakraborty, Sajib (VUB)	Review from VUB

#### Project summary

The core objective of InnoBMS is to develop and demonstrate (TRL6) a future-ready best-in-class BMS hardware and software solution that maximizes battery utilization and performance for the user without negatively affecting battery life, even in extreme conditions, whilst continuously maintaining safety. Concretely, the InnoBMS proposal will deliver a 12% higher effective battery pack volumetric density, a 33% longer battery lifetime and a demonstrated lifetime of 15 years. The results will be demonstrated using novel testing methods that give a 36% reduction in the testing time of a BMS. The results will be demonstrated in two use cases, one light commercial vehicle (Fiat Doblo Electric) and one medium-duty van (IVECO eDaily). The key outcomes will enable a cost reduction of 12% and 9.7% for passenger cars and light-duty vehicles, respectively. The core objective will be achieved through five technical objectives:

1. advanced hybrid physical and data-driven models and algorithms to enable a flexible and modular BMS suitable for a wide range of batteries.
2. Software for a fully connected and fully wireless BMS that acts as a communication server inside the vehicle E/E-architecture, the center of connection, on-board diagnostics and decision-taking for all battery-related information.
3. A scalable, fully wireless and self-tested BMS hardware that enables using different battery sizes at different operating voltage levels, and smart sensor integration.
4. Better battery utilization and exploitation using cloud-informed strategies and procedure.
5. A heterogeneous simulation toolchain and automated test methods.

## Publishable summary

The core objective of InnoBMS project is to develop and demonstrate (TRL6) a future-ready, best-in-class BMS hardware and software solution that maximizes battery utilization and performance for the user without negatively affecting battery life, even in extreme conditions, while continuously maintaining safety.

InnoBMS leverages on seven work packages, with WP5 identifying and selecting the relevant test scenarios and validating the system behaviour. The objective of WP5 focuses on the virtual and physical testing of the complete InnoBMS solution, for both cloud and BMS control, developed in WPs 2 through 4 in both controller hardware-in-the-loop and vehicle testbench demonstration considering the application use cases and real BMS hardware. Beside this the WP will achieve the following sub-objectives:

1. Hybrid infrastructure available for real-time testing of EV models in the project;
2. Validated the improved and optimized BMS functionalities and key performances towards achieving targeted technological objectives of the InnoBMS concept through both virtual tests and real-life demos
3. Proven modularity of the BMS towards a broad range of vehicle classes with different operating voltage (i.e., 400 V and 1000 V)
4. Standardization and future recommendation for next-generation battery management systems

The WP5 is split between five tasks containing test scenarios, virtual vehicle testing, virtual validation of the cloud BMS and last testing and validating in real vehicles to gather data for a lifetime demonstration.

The delivery report D5.1, is the direct output of the first task for the above list, and focuses on developing test suites and hardware specifications for virtual validation tests, specifically for the wireless Battery Management System (BMS) architecture. This is based on the requirement specifications and operation scenarios from earlier tasks (T1.1 and T1.2). The test suites will be designed for Hardware-in-the-Loop (HIL) tests, adhering to ISO 26262 functional safety guidelines. The output will include test automation and hardware specifications for virtual validation tests.

# 1 Acknowledgement

## 1.1 The consortium

The author(s) would like to thank the partners in the project for their valuable comments on previous drafts and for performing the review.

*Table 1. Project partners*

#	Partner short name	Partner Full Name
1	VUB	Vrije Universiteit Brussel
2	TOFAS	TOFAS Turk Otomobil Fabrikasi Anonim Sirketi
3	BOSCH	Robert Bosch SRL
4	AVL	AVL List GmbH
5	AVL-SFR	AVL Software and Functions GmbH
6	IDIADA	Idiada Automotive Technology SA
7	CID	Fundacion Cidetec
8	UL	Univerza v Ljubljani
9	THIL	Tajfun Hil Društvo sa Ograničenom Odgovornošću za Istraživanje, Proizvodnju, Rgovinu i Usluge Novi Sad
10	UNR	Uniresearch BV
11	FMF	FPT Motorenforschung AG
12	PTE	Potenza Technology Limited

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This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101137975. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.