

Novel XiL approach to fast-track new Tevva EV powertrain implementation

Case study overview

HORIBA MIRA was brought in to support the integration of a new powertrain on Tevva's 7.5-tonne battery electric trucks.

Having previously carried out cell characterisation to assist with Tevva's choice of battery pack for the new powertrain, a team of consultants from HORIBA MIRA developed an x-in-the-loop (XiL) simulation environment (both physical and virtual) that was used to fast-track and de-risk the integration of the new systems.

A key focus was the use of hardware, software, and model-in-the-loop development – hence the 'X' in XiL – to de-risk the integration of validated HORIBA MIRA BMS algorithms with the legacy BMS and Vehicle Control Unit (VCU).

Engineering team deployed: Five UK-based subject matter experts formed the core of a team that numbered up to ten at times.



Battery management, virtual validation, de-risk vehicle trials



LCV / HCV



UK



HORIBA MIRA has a vast array of engineering competencies in one place, which we can combine to make projects like this as low-risk as possible. There's nowhere else in the world that gives access to the same spectrum of expertise in one place.

Ben Gale, Solution Leader for Automotive Energy Efficiency
HORIBA MIRA



Approach

The traditional approach to integrating a new powertrain would be to build a proof-of-concept vehicle. Waiting for such a prototype vehicle to be designed, built, made safe, and finally become available, is a time consuming and expensive exercise. De-bugging such a prototype on a proving ground or on a dyno then adds to this burden. HORIBA MIRA therefore proposed using an XiL approach in combination with a range of physical tests.

A complete Tevva powertrain was assembled on the test bench at HORIBA MIRA's Propulsion Test and Development Centre (PTDC) in Nuneaton, including a physical battery pack, thermal emulation, and EDU linked to a 1e Dyno in closed loop with HORIBA MIRA's own real-time simulation vehicle model of the Tevva truck.

This combination of hardware- and software-in-the-loop provided a complete digital sandbox that could be used for shake-down testing, fault-finding, and initial calibration.

Successes and benefits

By leveraging a highly efficient simulation-led engineering approach, HORIBA MIRA was able to slash the time and risk involved in Tevva's new powertrain integration. Further benefits Tevva gained from this approach included:

- ✓ Implementing a **whole-vehicle simulation model** with a complete powertrain, including both hardware, software, and modelling elements, in the loop, removing the need for a costly prototype vehicle
- ✓ Providing a **totally controlled environment** for repeatable testing and debugging, minimising risks to in-field testing
- ✓ **Flexibility** to bring in subject matter experts and test services as required, and then step back to provide a more **cost-effective long-term solution**
- ✓ **Fast-track approach**, enabling the vehicle to be delivered in a heavily compressed time scale compared to traditional methods, **reducing** the traditional in-field calibration time by **about 4 months**



Deliverables

- ✓ Vehicle modelling
- ✓ Drive cycle analysis
- ✓ Powertrain and HV battery performance validation
- ✓ HV/LV wiring updates
- ✓ EDU and HV battery thermal performance validation