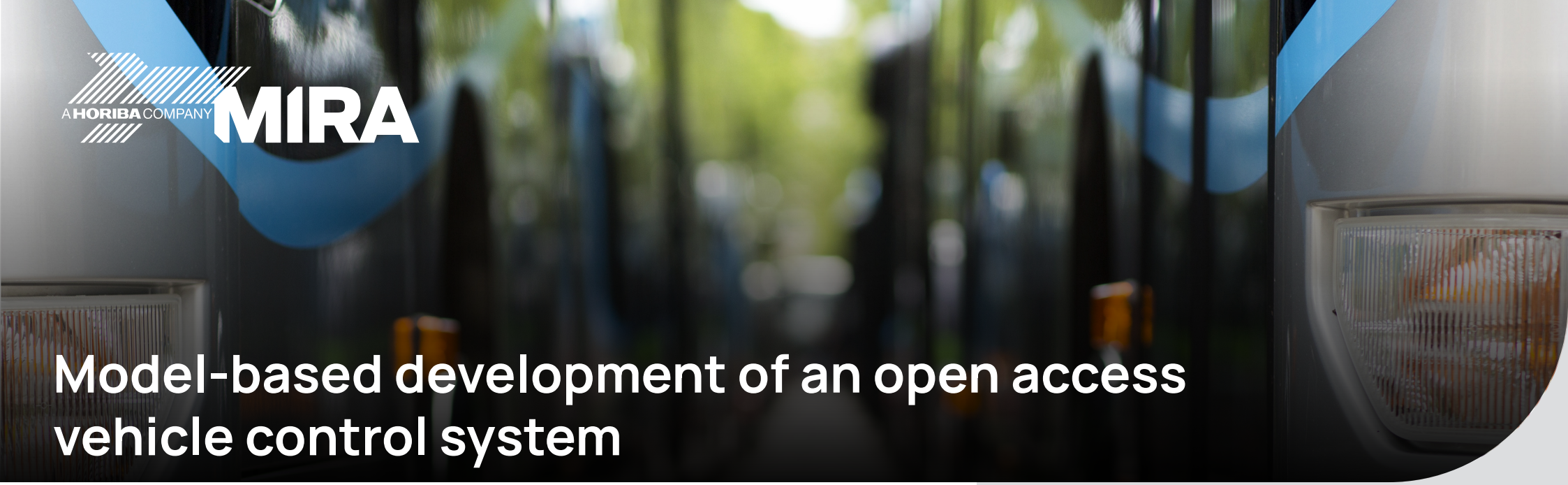

Model-based development of an open access vehicle control system

Case study overview

A globally renowned OEM approached HORIBA MIRA to develop the Vehicle Control Unit (VCU) application software for its first electric bus. The OEM was looking for a technical partner with proven experience in electric vehicle control that could develop the appropriate logic, integrate the chosen ECU vendor, and ultimately provide the software in an 'open access' format. This ensures the OEM can make future developments in-house, providing the potential to save tens of millions of pounds over the coming years and giving freedom to develop future commercial vehicle platforms.

Following the delivery of the EV bus project, the OEM has been using the open access software as a baseline from which to develop a variety of new platforms. It has consequently worked again with HORIBA MIRA to conduct key updates, such as transferring the software from the original legacy ECU to new forward-facing ECU hardware. For this specific territory and application, the rigor of ISO26262 and AUTOSAR compliance was not explicitly required. As such, HORIBA MIRA consultants advised and trained the OEM team on the functional safety standard and how the development process should be maintained to work towards compliance with the standard in future years.

Engineering team deployed: A core team of 10 consultants in the UK.

Electric vehicle / vehicle software / energy management / model-based design

Commercial transport, heavy duty commercial vehicles, light commercial vehicles

Asia

> This customer came to us because we were able to give them an open access control system without the huge cost constraints of a 'typical' software vendor. This has opened up endless possibilities for the company and its roll-out of a variety of battery electric vehicles, all based on HORIBA MIRA's core expertise.
>
> **Ben Gale, Solution Leader for Automotive Energy Efficiency**
> HORIBA MIRA

Approach

Once the vehicle requirements were clarified, the application software logic was developed in-house by HORIBA MIRA using a model-based approach. A model of the vehicle was developed with modules for each key feature (energy management, braking system, diagnostics etc). the logic required was then layered between the modules, integrated to the ECU hardware/base software layer and verified through model or software in-the-loop testing (MIL/SIL).

Hardware in the loop (HIL) was also employed, both at HORIBA MIRA's headquarters in the UK and at the OEM's facilities. This gave the customer a well-proven platform prior to the start of in-vehicle testing, cutting out much of the time and cost involved.

Critically, there were a number of deployment gateways to ensure the project was on track, such as prototype vehicle 'key-on'. HORIBA MIRA was able to provide the appropriate 'functional-only' software and on-site support prior to these milestones to ensure these gateways were passed smoothly.

Successes and benefits

A number of electric commercial vehicles, including well over 100 e-buses, are now operating with the core software logic developed by HORIBA MIRA. The OEM is poised to launch further commercial vehicle variants in coming years. Notable project successes include:

- ✓ **Fast, reliable and robust** development of an electric vehicle VCU, based on HORIBA MIRA's extensive knowledge of model-based control systems
- ✓ **Virtual verification**, plus hardware in the loop and software in the loop testing to ensure reliability
- ✓ **Complete ownership** for the client, including **open access to the software** without update fees or licensing costs
- ✓ **Training and support**, enabling the client to become self-sufficient in VCU development and calibration

Deliverables

- ✓ Guideline report on autonomous pod commercial deployment
- ✓ Abridged guideline report