

A streamlined approach to thermal energy optimisation

Case study overview

The move towards electrification has seen energy efficiency take on unprecedented significance in automotive development. In cold conditions, as much as 40 per cent of the energy consumed by an electric vehicle is required to heat and maintain the cabin and the powertrain. This large swing in potential vehicle range is a barrier to EV adoption and a huge area of improvement for manufacturers.

HORIBA MIRA's Vehicle Thermal Energy Optimisation Suitew (VTEOS) is essentially a 'mini-wind tunnel' that enables automotive manufacturers to slash the time and cost associated with this type of development.

Engineering team deployed: The VTEOS facility is run by 3-4 permanent staff in the UK, with access to a 25 strong team of subject matter experts and support engineers.



Thermal systems, climate control and energy management



Passenger cars, light commercial vehicles and heavy commercial vehicles



Worldwide



VTEOS is an extremely powerful tool for linking simulation with physical testing. It's a fast and cost effective way of establishing correlation and gaining confidence in the design, enabling engineers to get the most out of the simulation and have no nasty surprises towards the end of development.

Ben Gale, Solutions Leader for Automotive Energy Efficiency,
HORIBA MIRA



Approach

HORIBA MIRA's VTEOS facility enables much earlier development of thermal systems at a fraction of the traditional cost and time. Rather than waiting for expensive prototype vehicles to be built, safe, calibrated and fault-free, HORIBA MIRA customers can simply deliver a box of thermal components for HORIBA MIRA engineers to assemble, instrument and install onto a modular trolley system. This system is then subject to appropriate hot/cold air flow and component heat rejection (i.e. battery/motor heat) in the VTEOS, to emulate different driving scenarios. This enables the rapid identification of performance issues, component compatibility barriers, development of control logic and validation of warranty conditions, all before a prototype vehicle's wheels start turning.

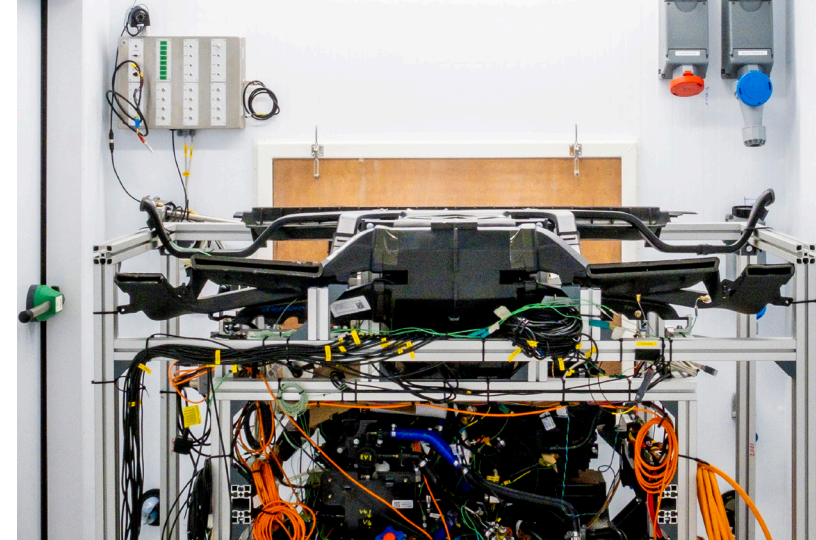
With this approach, OEMs can begin physical testing much earlier in the vehicle programme, with far lower programme risk. It eliminates the time and cost associated with preparing a mule vehicle for thermal development, while dramatically reducing operational costs compared to a traditional full-scale climatic wind tunnel.

The controlled, repeatable environment of the VTEOS and the accessibility of the trolley system provides an ideal platform for de-bugging issues, swapping components for comparison and, crucially, correlating simulation models. This, in turn, establishes confidence in virtual models at an early stage, allowing the simulation to be exploited far more effectively, with less reliance on physical testing, leading to a cheaper and more environmentally sustainable route to market.

Successes and benefits

VTEOS provides a fast and cost-effective springboard into physical testing long before a complete prototype vehicle is available. Its highlights include:

- ✓ A **70 per cent reduction** in operational costs compared to climatic wind tunnel testing, saving the customer both money and CO2 footprint
- ✓ **Significantly shorter setup times** and lower costs than building and preparing a mule vehicle
- ✓ **Easy access** to components on the trolley for rapid de-bugging and instrumentation
- ✓ **A faster route to correlation**, allowing greater reliance on simulation, which further reduces the costs associated with physical testing
- ✓ Hardware-in-the-loop (HiL) sandbox environment for **thermal control logic/strategy development**



Deliverables

- ✓ System assembly
- ✓ Instrumentation
- ✓ Charge determination
- ✓ System performance analysis
- ✓ Optimisation (e.g. TXV tuning)
- ✓ Refrigerant analysis
- ✓ Compressor oil warranty conditions