

Gasoline and Alternative Fuels Engineering

Powertrain Controls, Calibration and Testing



Powertrain Controls

Model-Based Development

Advanced combustion and after-treatment hardware demand advanced controls techniques and processes. Traditional ECU maps and PID controllers are no longer capable of delivering the level of performance required for both low emissions and high fuel economy. IAV has established itself as a

leader in the industry for advanced controls and algorithms. The IAV process begins with accurate system models of the engine that allow for very rapid algorithm debugging, concept validation, and desktop calibration. Performing these steps in simulation saves significant time before the process is moved to the dynamometer for final validation.

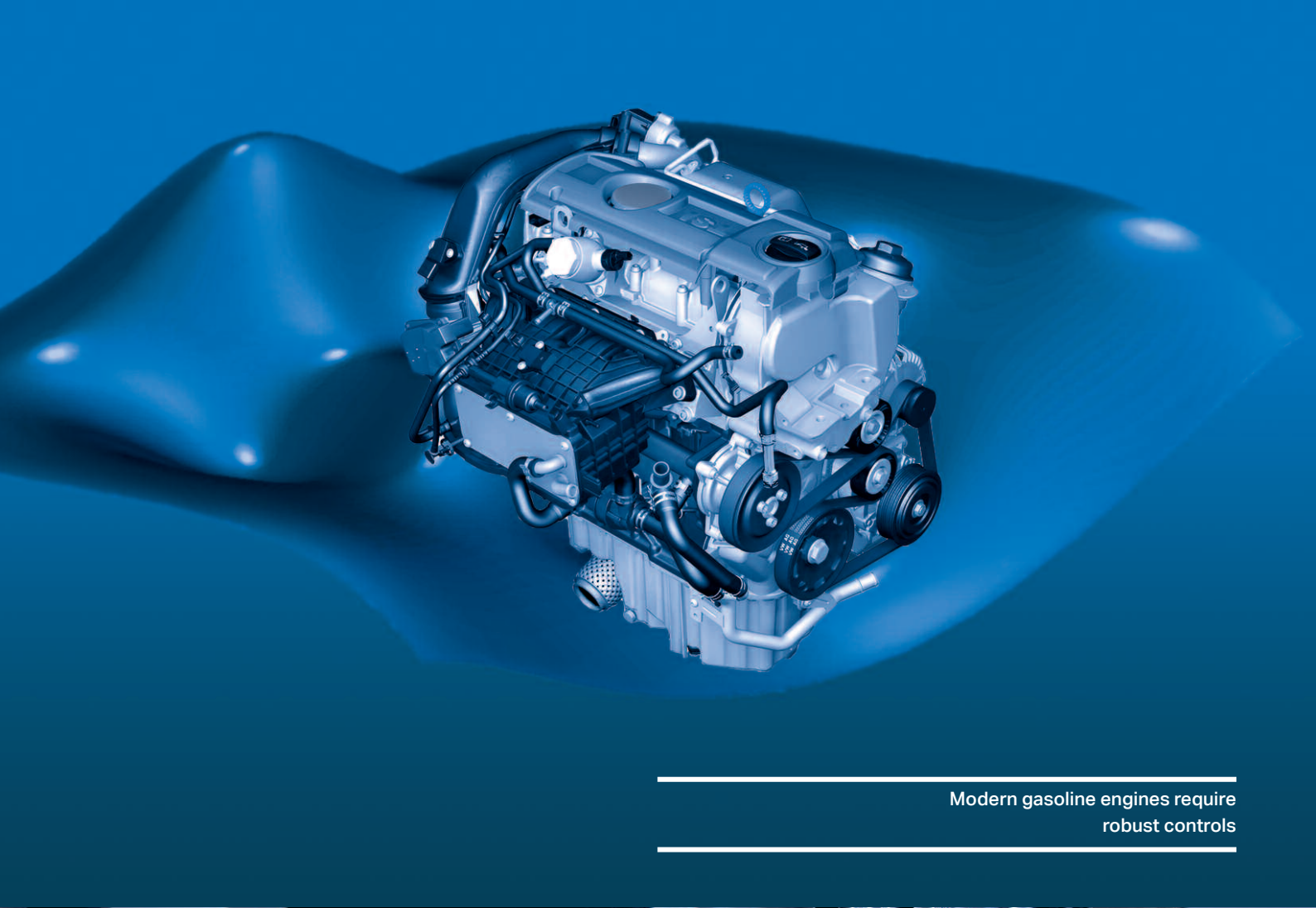
Engine Calibration

IAV has invested in state-of-the-art engine dynamometer test cells in Northville, Michigan in order to provide customers with the best technology and processes available. Years of experience with IAV's test cells in Germany have been condensed into uniform processes and practices that have been implemented at the new US technical center. This harmonization of processes allows IAV to support global development efforts with a high degree of confidence.

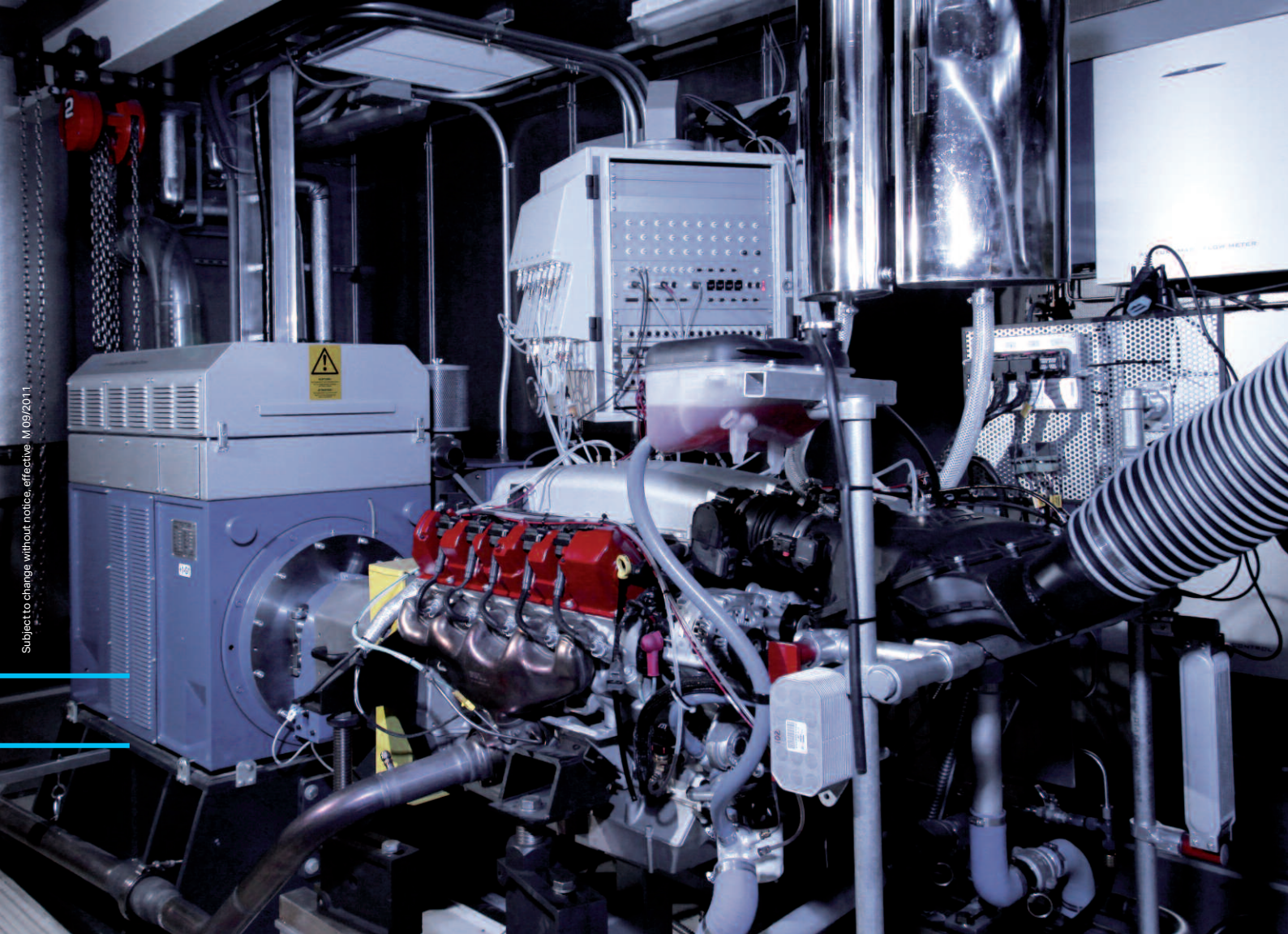
Four test cells have been constructed at the new technical center. One test cell is sized for heavy-duty applications with a maximum power rating of 660 kW, while the remaining three are designed for a power rating of 330 kW. However, one of the light-duty test cells has been sized for high-torque applications such as medium duty diesel engines or hybrid-electric power packs. All cells are fully transient capable with a wide range of instrumentation available for emissions, blow-by, and combustion analysis.

To achieve high efficiency and productivity, the dynamometers are capable of fully automated operation around the clock. When combined with IAV's proprietary design-of-experiments tools, development time is reduced for base engine calibration, thus delivering high value to customers. Models based on this data are available for desktop optimization to aid engineers in producing the best possible calibration, balancing performance, emissions, and NVH.

[One of four development cells at IAV in Northville](#)



Modern gasoline engines require
robust controls



Subject to change without notice, effective M 09/2011

Vehicle Calibration and Testing

Driveability, Emissions, and OBD

Engine calibration on the dynamometer is only half of the story in a vehicle development program. Once the engine calibration has been optimized, it is transferred to a pre-production vehicle for further refinement. Vehicle calibration is where the soul of the vehicle is born. The final performance, engine behavior, and driver experience take shape through careful calibration of the engine's and transmission's dynamic controls. Shifting behavior, launch feeling, pedal response, and torque compensation are all modified to meet subjective manufacturer targets.

Emissions performance cannot be ignored during this process, and IAV's engineers are well-versed in the variables that balance performance, economy and low emissions. Changes made to the calibration can also be checked on the desktop with IAV's Model-Analyzer software to determine the impact on emissions without constant and costly iterations on an emissions-capable chassis dynamometer.

IAV has been providing full gasoline vehicle calibrations to customers for the past 25 years, ever since the first electronically controlled gasoline passenger car hit the market. These calibrations can be found on the streets of America, Europe, and Asia behind the badges of nearly every major automobile manufacturer for every emissions level and OBD requirement. To meet the demands of each market, IAV's engineers have traveled to the coldest, highest, and hottest spots available to ensure good performance under all conditions. Available support includes remote analysis of vehicles undergoing durability testing and post-launch field support for mechanical troubleshooting.

Calibration is the soul
of the vehicle



Durability and Benchmarking

Durability: Fleet Testing and Management

Durability testing can be the most critical step to ensure hardware and software robustness. From full-life emissions and OBD fleets to mid-life warranty fleets, durability testing can provide real-world data that cannot be simulated or modeled. With shrinking development times and decreased budgets, it is more important than ever to not only reduce the fleet size, but to also reduce down time that sometimes occurs with software and hardware updates.

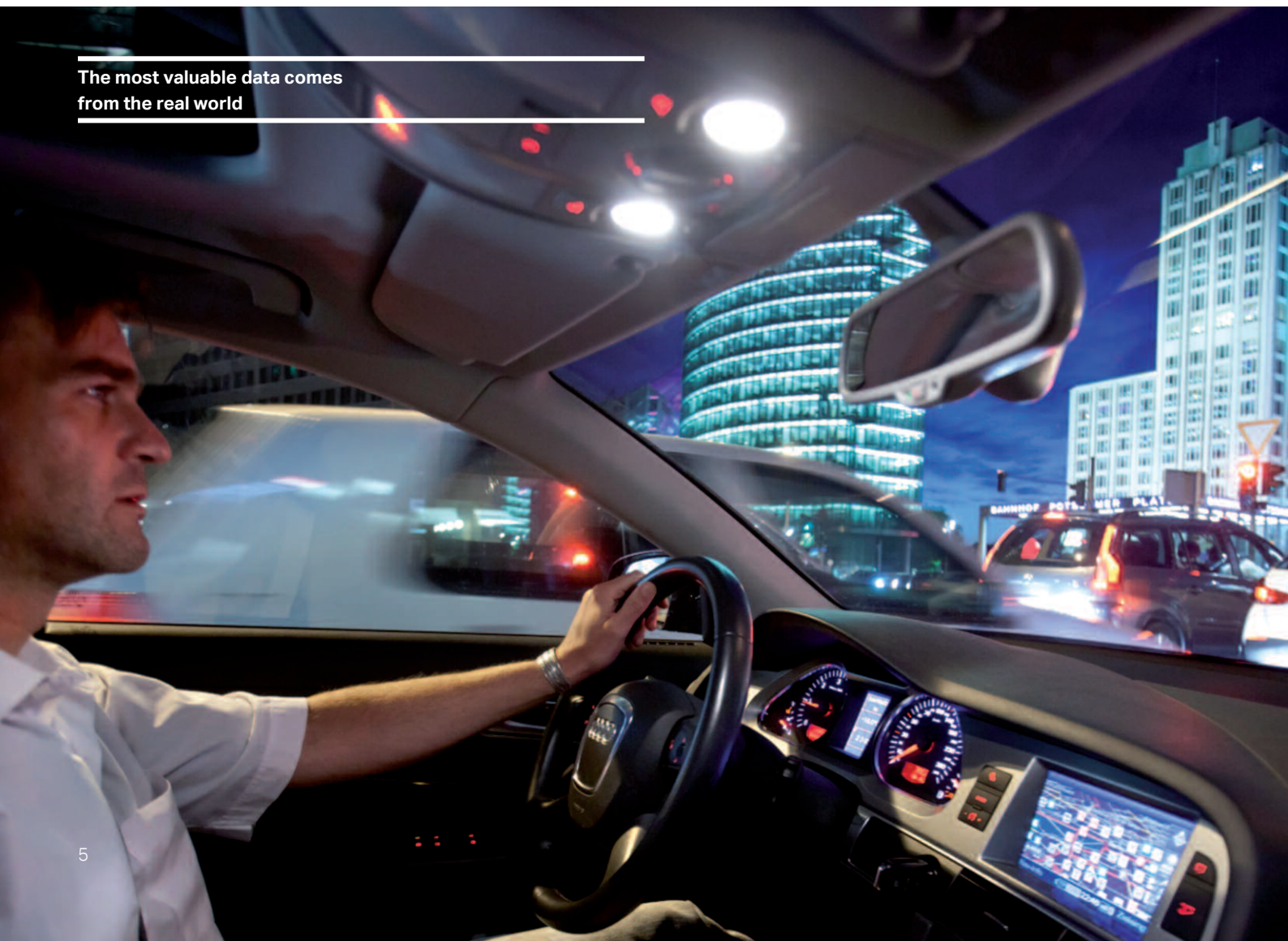
IAV's experience in full-fleet management provides a one-stop solution for fleets ranging in size from 1 to 1,000 vehicles. From data logging and emissions testing to issue tracking and logistics, IAV utilizes a network across the world to provide real-world data from nearly any environment.

Benchmarking: Whole Vehicle and Subsystem

Staying ahead of the competition is becoming increasingly difficult as advancements in technology are commonly found buried in controls and calibration, rather than bolted onto the engine. Benchmarking competitive vehicle systems and hardware can provide valuable information for both current and future product development.

By utilizing a vast array of tools and testing methods, IAV has developed an approach to reverse engineer even the most complex in-vehicle systems. Instrumentation of the existing vehicle sensors and controllers can prove to be the most cost effective method for getting a snapshot of how a vehicle reacts under various conditions. IAV's toolbox is filled with sophisticated methods of obtaining high-resolution data to help fill in the gaps.

The most valuable data comes from the real world



About IAV

Global Presence

IAV Group is a leading global automotive engineering partner, employing more than 4,000 personnel throughout Europe, Asia, and the Americas. Founded in 1998 as the North American subsidiary of IAV GmbH in Germany, IAV Automotive Engineering Inc. develops breakthrough concepts and technologies – from powertrain design and development to controls and electronics – for future vehicle generations. Clients include leading automotive manufacturers and component suppliers, all of whom rely

on the knowledge of IAV's engineers to help them design and develop some of the industry's most advanced engines and powertrains. The IAV Technical Center North America is now open in Northville, Michigan. The technical center includes four state-of-the-art development/test cells. With this exciting new facility, engineering capabilities have expanded to include full service projects, further cultivating the inventive spirit, enthusiasm, and commitment to success for which the IAV Group is known.



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