DoE-based Technology

AUTHORS

Jessica Tian
is Measurement and Calibration Solutions Manager at **ETAS** in Ann Arbor, MI, U.S.

Guo Wei
is Senior Specialist for measurement, calibration, and diagnostic tools and works in the technical sales and support team at **ETAS** in Shanghai, China.

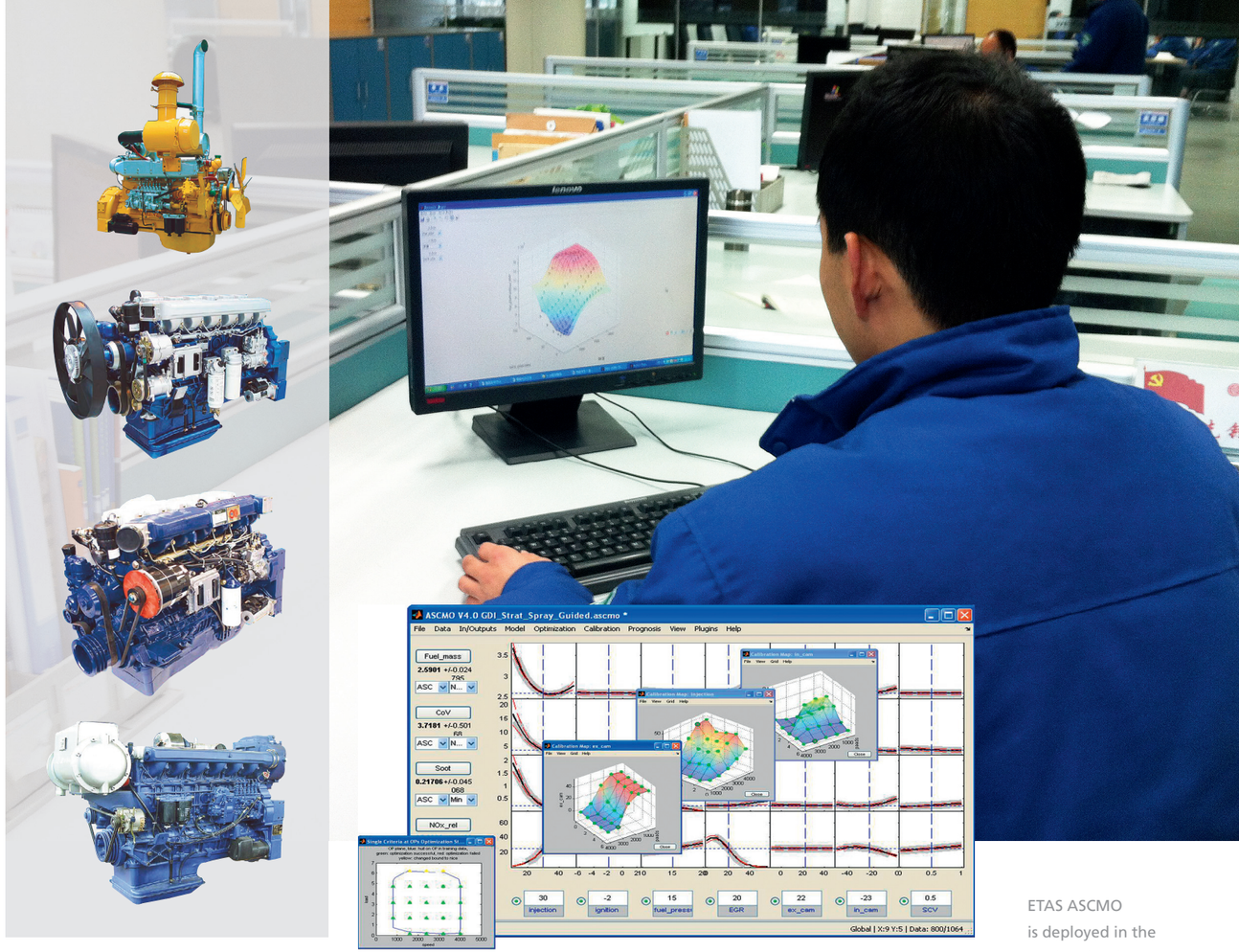
Efficiency boost at Weichai engine project

ETAS ASCMO is a widely used tool suite for mathematical modeling, simulation, and optimization. Based on the Design of Experiments (DoE) methodology, ETAS ASCMO uses a new, measurement-based statistical modeling algorithm. It accurately simulates the behavior of complex systems such as engines, transmissions, and vehicles. In addition to modeling, ETAS ASCMO offers a variety of effective model output optimization methods to suit different calibration tasks. ETAS ASCMO, which is worldwide deployed in powertrain calibration, has received a very positive response from OEMs and Tier 1s.

Weichai Power Co., Ltd. (Weichai Power) is currently one of China's most important automotive and equipment manufacturers. Founded in 2002, the company is headquartered in the beautiful coastal city of Weifang in China's Shandong province. With its additional locations in Shanghai, Chongqing, Hangzhou, Yangzhou, and Xi'an, Weichai Power is present throughout China. It also operates R&D centers in the United States and Europe. Weichai Power employs nearly 50,000 people worldwide and covers three major business segments: powertrain, commercial vehicles, and auto parts. The company's business affiliation with ETAS predated the founding of ETAS China in 2005 and has been developed considerably since then. Today's collaboration ranges from ETAS measurement, calibration, testing, and validation systems to the complete V cycle tool chain and solutions in the field of software development.

In June 2011, as part of the global promotion of ETAS ASCMO, the tool suite was introduced to Weichai's Power Technology Center by ETAS China through product trial and on-site support. The interest generated among Weichai engineers was immense. Subsequently, the Weichai Power Technology Center deployed ETAS ASCMO on evaluation projects for a period of more than a year. The result was a significant improvement in the efficiency and quality in engine development and calibration. The Performance Development Department of the Weichai Power Technology Center applied ETAS ASCMO to the calibration of noise, vibration, and harshness (NVH) of WP7 and WP10 series engines. It managed to reduce noise levels by more than 2 dB while ensuring fuel economy and gained high marks and recognition from calibration engineers.
Weichai's Technology Department also deployed ETAS ASCMO for new product development taking advantage of ETAS ASCMO's accurate system modeling capabilities. While performing the pre-research engine development work on the variable geometry turbocharger (VGT) and EGR technology, the tool suite provided an extremely valuable experimental basis for the final design of finished engines.

During this period, ETAS China's technical support team and ETAS ASCMO product managers paid several visits to Weichai's Power Technology Center, discussing ETAS ASCMO's operational application and theoretical basis with Weichai engineers. Users were invited to attend training and promotional activities arranged by ETAS China for the "ETAS ASCMO Day 2012" in Beijing. Participants quickly became skilled in using the ETAS ASCMO tool suite which facilitated ETAS ASCMO's deployment on Weichai's current projects and extended the option for its application with the company's future projects.



ETAS ASCMO is deployed in the engine development and calibration at Weichai Power.

Based on this successful collaboration, in late 2012 Weichai Power finalized the procurement of several ETAS ASCMO tool suites for a broad deployment in product development and calibration.
The DoE methodology greatly shortens the engine development cycle, renders a visual representation of the interaction between conflicting parameters, and aids the optimization process. Therefore, it has been used in the optimization of engine emissions and fuel economy for over a decade in the automotive industry, especially in Germany and the United States. With the rapid development of China's automotive industry and the continuous improvement of independent R&D capabilities, ETAS ASCMO is bound to win acceptance and recognition from more and more Chinese auto companies.

Thanks to more than 30 years of technology transfers and corporate joint ventures, China has made remarkable achievements in its automotive development. The country's automotive industry now benefits from increasing capacities in terms of independent R&D capabilities for powertrains – in particular engine control systems – and aims at deepening its mastery of advanced tools and technologies. Today, improving independent R&D capabilities has become a general consensus of China's automotive industry – a cost- and time-intensive undertaking requiring a large number of experiments in the lab and in the vehicle. The industry therefore needs to reduce the R&D-specific economic burden imposed on China's growing automakers. It has therefore become an inevitable trend in the development of the automotive industry in China to introduce state-of-the-art tools and solutions. This also includes the application of offline simulation and model-based calibration, the dedicated design of experimental programs, and achieving intended development goals by means of fewer experiments.