

CASE STUDY

October 2014



ATI VISION Software Suite Helps JCB Meet Emissions Challenge

Legislation to reduce vehicle emissions affects manufacturers in every sector. In the off-highway market a demanding 5-stage process, which began in 1996, currently stands at Stage 4 in Europe (Tier 4 Final in the US), challenging manufacturers such as JCB, the world-renowned off-highway equipment producer, to develop increasingly innovative emissions control technologies. ATI's VISION software has helped JCB in these developments, by providing a powerful, flexible and cost-effective rapid prototyping environment in which new strategies can be optimized and validated.



JCB's award winning EcoMAX engine family has remained ahead of the latest emissions standards, delivering robust performance under arduous conditions, and satisfying the demands of the most critical customers. To remain competitive means meeting aggressive timescales for new product introduction and quickly perfecting the application of new technologies, such as developments in exhaust after-treatment systems to reduce tailpipe emissions.

ATI's VISION software provided a single, comprehensive, calibration, data-acquisition and rapid-prototyping solution that not only accommodated JCB's engine ECU (electronic control unit) but also expanded support for its after-treatment ECU, allowing significant time saving during system development. Thanks to its inherent flexibility, it was able to satisfy JCB's tough combination of

requirements: multiple ECU support; real-time calibration and modification of closed loop control systems; time alignment and analysis of all data acquisition; calibration data change management and ECU reprogramming, all within one application.

According to JCB's controls and calibration engineers, the functionality of VISION software provides a convenient and effective means to handle both engine and after-treatment data in a single file, and allows communication between engine and after-treatment ECUs from different suppliers via the same CAN bus.

Operating within the VISION software suite, JCB has utilized the Rapid Prototyping environment to develop control algorithms. ATI's No-Hooks™ allows JCB to carry out rapid prototyping directly on both production ECUs without the need to access ECU source code, using only the readily available description and memory image files for both ECU types. Though engine and after-treatment ECUs use different protocols, JCB was able to reprogram both controllers through the same, versatile ATI software.

JCB's controls and calibration engineers believe they are saving weeks on each software iteration by using No-Hooks, because they can ensure the new strategies work fully before involving the ECU suppliers, increasing their confidence in the proposed algorithm changes. Previously when requesting changes, there was always a risk that something would be missed and not all the necessary software hooks would be requested. Though not part of the final production product, the engineers feel that ATI No-Hooks provides JCB with a much faster, more efficient way of getting there.

The traditional prototyping alternative would be to formally request hooks in the code from the ECU suppliers, which not only requires the accurate definition in advance of every hook needed, but is often cost prohibitive. Using ATI tools, JCB can experiment and test the No-Hooks rapid-prototype control strategies autonomously and without restriction, on the actual production-intent ECUs. This minimizes mistakes and provides the confidence to request production changes in parallel while continuing to calibrate the No-Hooks rapid-prototype strategies, compressing development timescales.

No-Hooks allows the user to bypass an existing control strategy variable and substitute an alternative, user-defined variable. The addition of ATI OnTarget allows an existing control strategy variable to be bypassed using the result of a user-defined control algorithm model. OnTarget works seamlessly with

MathWorks® Simulink® software. Together, No-Hooks and OnTarget provide a complete software-centric rapid prototyping toolset.

JCB's Director of Engine Programmes, Alan Tolley, describes other applications for ATI software within the company, beyond the JCB Power Systems engine division. "A typical JCB product incorporates ECUs throughout the vehicle, e.g. transmission, telematics, hydraulics and exhaust after-treatment systems that also benefit from the time saving and increased flexibility provided by ATI during development," he said. "The ability to record data from many ECUs, across different on- and off-highway communication protocols, whilst logging time-aligned analogue instrumentation data, greatly improves the speed at which we can test, develop and validate the robustness of our products."

The broad compatibility of ATI's software tools allows JCB to work productively with combinations of ECUs from different suppliers, to develop market leading systems and products while saving time and cutting costs. As JCB's experience has shown, issues such as incompatibility, multiple tool maintenance and time wasted during development, can be avoided or greatly reduced through the use of an autonomous and flexible development environment.

