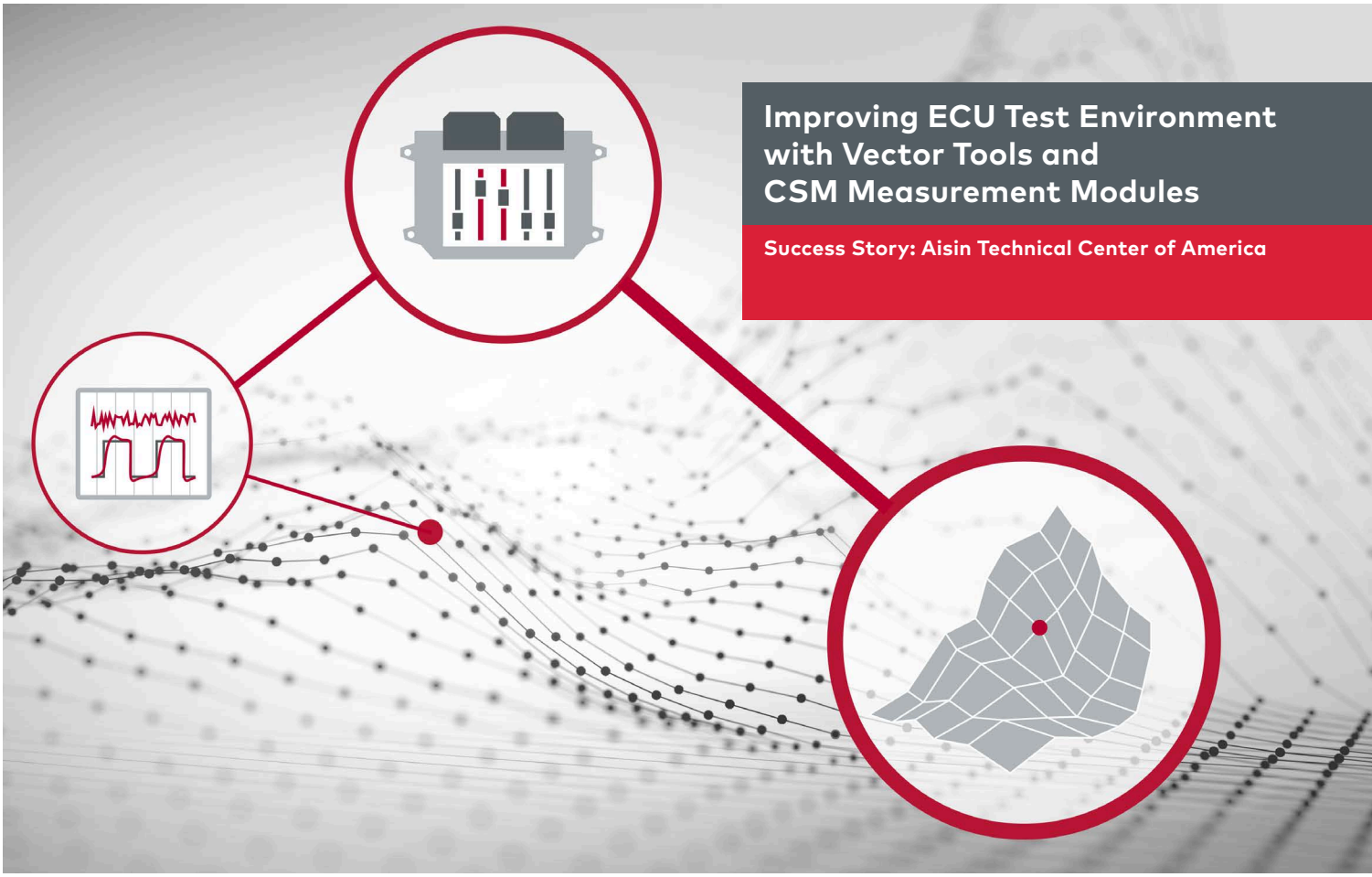
VECTOR



Improving ECU Test Environment with Vector Tools and CSM Measurement Modules

Success Story: Aisin Technical Center of America

Aisin Technical Center of America (ATCA) is a subsidiary of Aisin Seiki, a worldwide Tier 1 supplier of automotive components. As the first technical center established by Aisin Seiki outside of Japan, ATCA will lead Aisin's product development for the North, Central and South American regions, providing a greater presence in these important markets served by the Aisin Group of companies. Currently ATCA is focused on localization of ECU software targeting European and US vehicle OEMs. This article will focus on the ATCA test environment for Aisin's sunroof control ECU product.

The Challenge

Existing tools presented challenges to the development process and test efficiency in two key areas – vehicle test / calibration and requirements verification.

Vehicle Test/Calibration

For several years the ECU test environment consisted of a combination of in-house tools and commercial tools. Several tools (in-house switch box, oscilloscope) were needed because each tool supported a limited scope of capabilities. Especially challenging was the synchronization of measurement data from multiple sources, such as CAN bus data, ECU RAM variables, and analog system data. Sunroof motor pulses were measured with heavy data loggers, exported to Excel, merged offline, graphed, and analyzed through a manual process.

Requirements Verification

Automated ECU tests were executed using the CAPL scripting language in the Vector CANoe tool. While an effective testing mechanism, any change to the tests required expert knowledge of the CAPL code. As projects increased, efficient sharing and management of test cases became a challenge.

The Solution

Due to the opportunity to improve the test environment for a new development project, ATCA adopted the following standards:

1. De facto standard tool
   Meet OEM requirements, support open-standard file formats, and provide a seamless path to future technologies such as CAN FD.

2. Rich tool chain
   ATCA believes that true efficiency is not an improvement of a single tool, but how tools are combined to build a tool chain that is flexible with respect to both technology trends and user extensibility.
3. Vendor that can provide global support
   The AISIN Group is a global company that supports customers all over the world. A tool vendor that can provide local support for all AISIN locations worldwide is a requirement for broad deployment of testing solutions.

Considering these three key attributes, ATCA selected the following tools:

> Vector measurement and calibration tool CANape with ECU interface VX1000 and CSM ADMM and CNTMM measurement modules as the vehicle test/calibration environment
> Vector vTESTstudio as the requirements verification front end for the existing Vector CANoe test environment

Benefits and Advantages Gained

Measurement with CANape, VX1000, and ADMM/CNTMM modules

The Vector VX1000 ECU interface allows for all relevant data to be measured at the same time directly from the ECU RAM and external input signals.

C. Castelino of the ECU team mentioned that the ability to collect all relevant data in a single measurement is very convenient. This provides the capability to quickly extract and evaluate select signals with ease after measurement to create the measured waveform for analysis. The need to manually extract and copy measurement data for analysis in Excel has been eliminated. Analysis is performed directly on the measurement data using calculations implemented with the CASL scripting language in CANape. Gone are Excel spreadsheets that are difficult to align and track with specific test runs. Gone are the errors often experienced with complex Excel calculation macros.

In addition to ECU RAM data and CAN bus data, it was necessary to synchronize with external input signals like current and frequency.

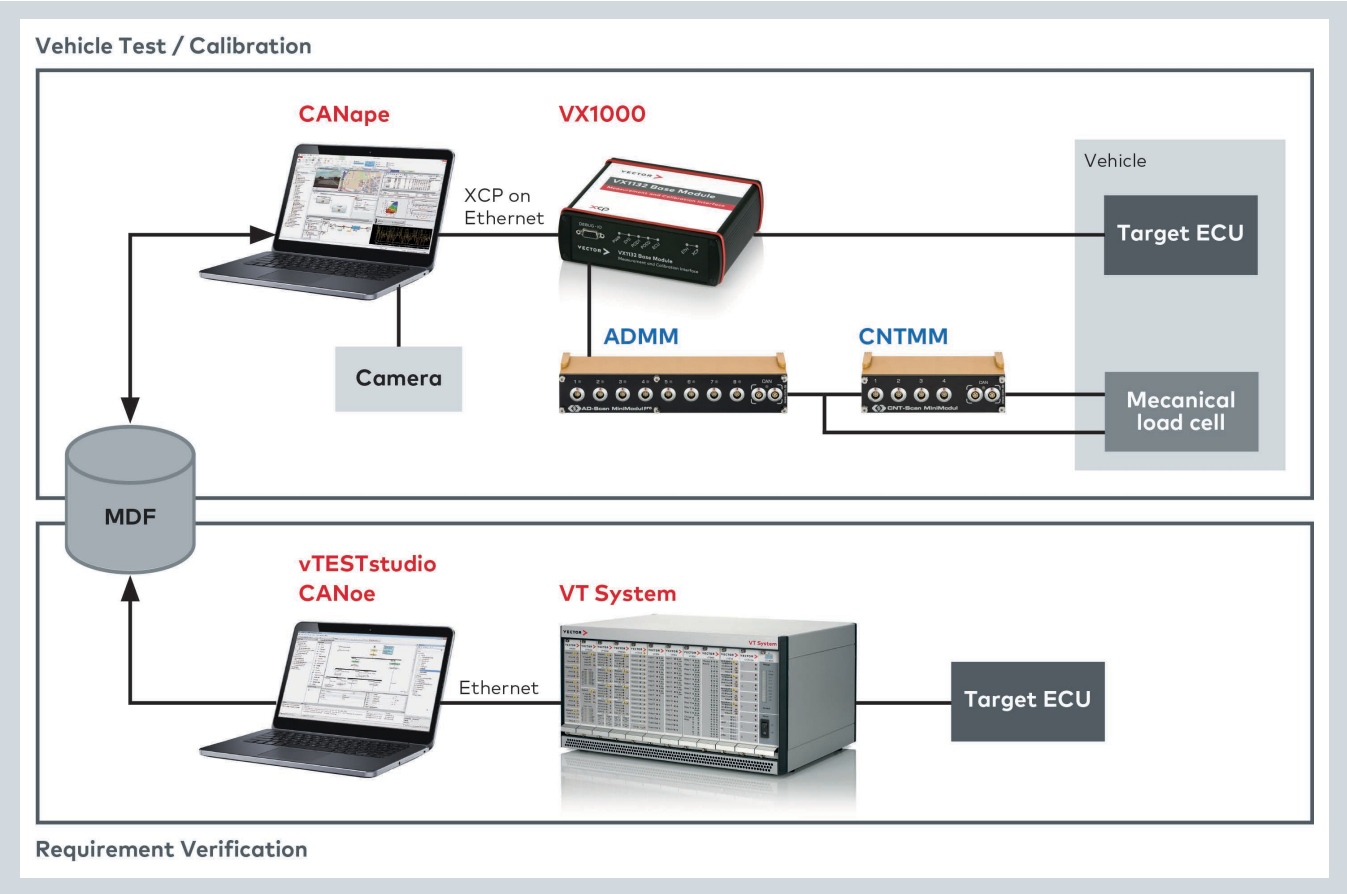


Figure 1: Test environment overview

The CSM ADMM and CNTMM measurement modules solve this problem. These measurement modules have excellent compatibility and integration with CANape. All settings of the CSM measurement modules can be managed and applied directly from within CANape. The CSM modules transfer sensor data to CANape via CAN, effectively eliminating signal noise concerns between the measurement hardware and the measurement software. The combination of CSM hardware and Vector software makes efficient use of the limited space available inside the vehicle.

G. Pulikonda of the ECU team says that by observing the mechanical movement in parallel using both a reference camera connected to CANape and synchronizing the video with the measurement data, it is possible to compare mechanical movement and software signal change with a single measurement. This combined measurement concept is very valuable when investigating unintended sunroof system behavior. Reactor events can be shared quickly and the cause of the problem can be easily identified.

Calibration with CANape and VX1000

The ECU calibration interface is configured with a A2L file conforming to the ASAM standard which gives compatibility to all tools of the development process chain and consistency in data exchange. This compatibility and data exchange is a key enabler for working effectively with ATCA's vehicle OEM customers.

C. Chueh of the system team says it is an advantage to be able to make live calibration changes with CANape and VX1000 and not have to change, rebuild, and reflash ECU software as had been the case in the past. Now ATCA has real-time calibration and the ability to monitor the ECU response immediately. It is also an efficiency improvement that measured data and calculated results can be confirmed at the same time using CASL.

Figure 2: Sunroof

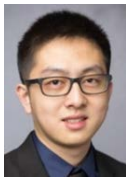
With the adoption of CANape, synchronous measurement, calibration, result analysis, and flashing can be done with one tool. By the unified measurement and calibration environment, an efficiency improvement of about 25 percent (in-house ratio) has been achieved.

Requirements verification with vTESTstudio and CANoe

H. Wu of the ECU team says that even without programming skills, it is possible to create test cases and easily share them with others. The ability to use the new test cases created with vTESTstudio in conjunction with the existing CAPL functions enables a smooth transition to the new environment. In an actual vehicle test environment, comprehensive tests including cases that are difficult to reproduce became possible, and management of those test cases became easier. Also, since all measured data is managed in MDF format, it is possible to analyze the waveform which indicated anomalous behavior detected by the automatic ECU test result using VT System/CANoe/vTESTstudio along with CANape.

Yoshihiko Nakajima
Yoshihiko Nakajima joined ATCA in 2015, where he is a Software planning manager in ECU Dept. Prior to joining ATCA, he was primarily in charge of software audit based on CMMI and Automotive-SPICE at Aisin Seiki in Japan. He was assigned by Aisin Seiki to realize localization of software design in ATCA, North America. He received his degree in Electrical Engineering from the Kansai University in Japan. All test environments construction described in the article were planned by him.

Gowtham Pulikonda
Gowtham Pulikonda joined ATCA in 2016, where he is a Project Engineer for Sunroof systems in ECU Dept. He primarily works on in-vehicle ECU test planning, testing and validation. He received his master's degree in Electrical Engineering from Louisiana State University, Baton Rouge. All hardware schematic design and construction described in the article were implemented by him.



Hanjun Wu
Hanjun Wu joined ATCA in 2016, where he is a Project Engineer for sunroof systems in ECU Dept. He primarily works on HILS construction for system test and ECU software development. He received his master's degree in Electrical and Computer Engineering from University of Michigan, Ann Arbor. All software construction described in the article was implemented by him.

Mark Jensen
Mark Jensen joined Vector in 2001, where he is the North American Product Line Director for Measurement and Calibration Tools. Mark has spent his entire career in the ground vehicle industry and worked at all three Detroit OEMs before joining Vector. He received his degree in Computer Science from the University of Michigan, in Ann Arbor.