First Automotive Works (FAW) develops the mobility concepts of tomorrow in line with the AUTOSAR standard. The company uses virtual electronic control units (V-ECUs) as well as the prototyping system MicroAutoBox II, the production code generator TargetLink, and the system architecture tool SystemDesk, all from dSPACE, to implement new propulsion technologies on the basis of models and AUTOSAR.

AUTOSAR-based development for the electric and hybrid drives of the future

Excellence as a Standard

For new electric and hybrid vehicles, FAW relies on AUTOSAR-compliant controller software to advance the development of electric and hybrid mobility concepts. To this end, FAW initiated and carried out a prototyping project. In the course of this project, existing controller models were migrated to an AUTOSAR-compliant format. In addition to the tool-based migration, new functions had to be tested in the vehicle by means of rapid control prototyping, among others. The tool chain FAW originally used was not designed for AUTOSAR-compliant development, so the migration required numerous changes. For example, new tools that are optimized for AUTOSAR-compliant processes were added to the existing tool chain.

AUTOSAR Migration

The basis for the migration to AUTOSAR-compliant development was Simulink models and existing communication descriptions from an orig-

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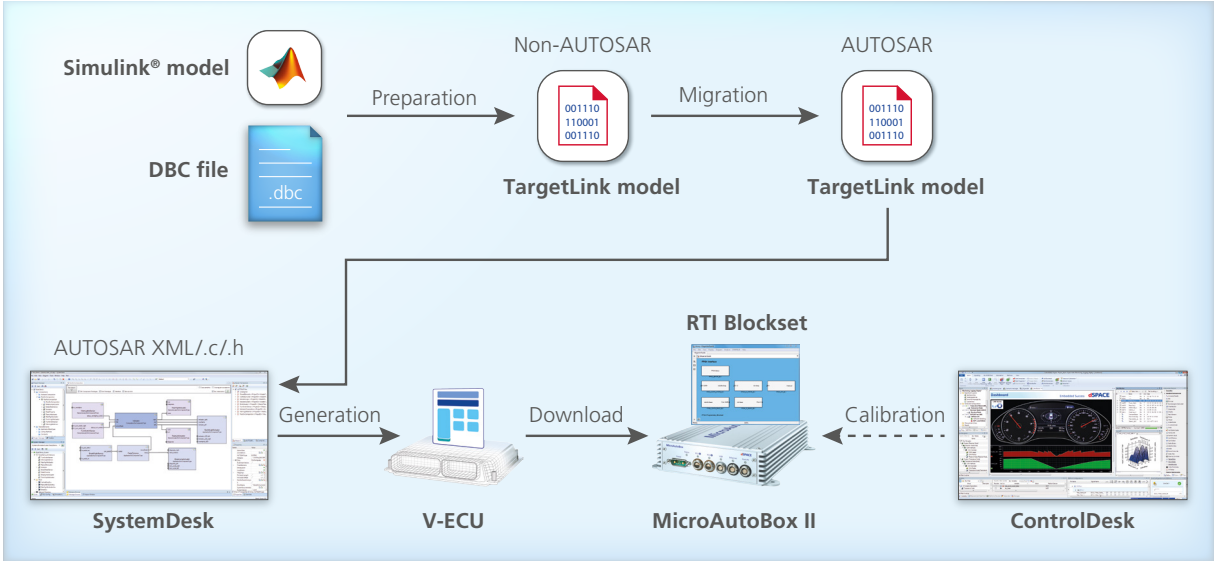


Migration process for the controller software of an AUTOSAR-compatible ECU. The controller software can be tested in the vehicle using the prototyping system.

inally non-AUTOSAR development project. To generate AUTOSAR-compatible software structures, developers at FAW used dSPACE TargetLink as well as a number of TargetLink extensions. One of these extensions is the TargetLink AUTOSAR Migration Tool, which transforms standard TargetLink models that are not AUTOSAR-compliant into AUTOSAR-compatible models at the click of a button. The developers first imported the Simulink models to TargetLink, which converted them to TargetLink models. They were then immediately able to use the models to generate AUTOSAR-compatible code as well as an AUTOSAR software component description. FAW used the flexibility provided by the configuration options of the AUTOSAR Migration Tool to meet their own software architecture requirements. This enabled them to create AUTOSAR-compatible software components (SWCs), which were then available for other development tasks.

Virtual ECU Generation

The next challenge for FAW was to use the AUTOSAR-compliant software components for in-vehicle tests. This is where virtual ECUs (V-ECUs) and their ability to run on MicroAutoBox II played a decisive role. The architecture software dSPACE SystemDesk is the perfect choice for V-ECU creation. After FAW imported the new SWC and the DBC files into SystemDesk, the tool provided an ECU configuration framework with automation functions. This made it possible to automate the AUTOSAR-compliant configuration and generation of the V-ECUs. These steps and tools enabled FAW to migrate their controller software for AUTOSAR-compliant development.

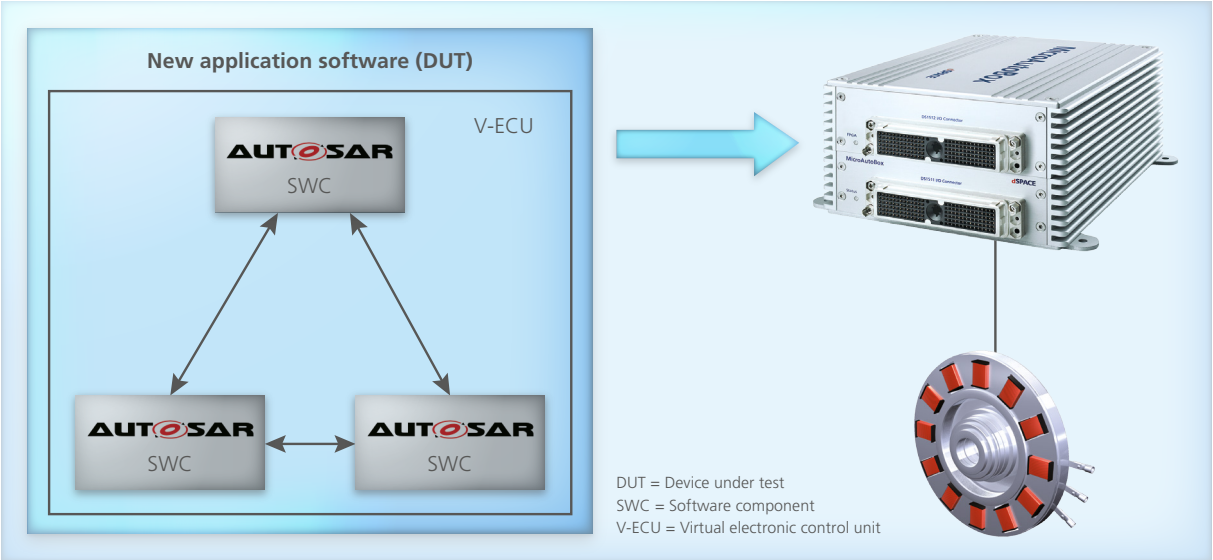
Preparing the Prototyping System

FAW used classic prototyping to test the new controller software in the vehicle to make sure it behaved exactly like the non-AUTOSAR software version. The developers used Real-Time Interface (RTI) blocksets to exchange information between the V-ECU and the MicroAutoBox II. They were also able to use the blocksets to conveniently connect the I/O and signals of the V-ECU with the I/O and communication interfaces of the MicroAutoBox II. Therefore, the MicroAutoBox II took on the role of the ECU in the vehicle during prototyping.

Outcomes and Outlook

FAW successfully completed a core prototyping project on the topic of AUTOSAR-compatible controller software for electric drives. Thanks to the tool-supported AUTOSAR migra-

> "The seamless dSPACE tool chain is easy to use and provides the functionality needed so that even less experienced developers are able to migrate controller software to AUTOSAR."
>
> *Guohuang Ji, FAW*



The controller software was migrated to an AUTOSAR-compatible structure, which let FAW use it in the vehicle.

tion, the developers were able to focus on the models and new functions. The results of the project are used as the basis for further improvements and will be used in the series production of the controllers. Since FAW was able to achieve the results with great efficiency, the teams will continue to develop ECUs with the new approach. They will also continue to use the tool chain consisting of the dSPACE products SystemDesk, TargetLink, and MicroAutoBox II. ■

Guohuang Ji, Dali Jiang, FAW

> "The production code generator TargetLink played a central role in the implementation of the ECU software and will continue to support us in the new, AUTOSAR-compliant development process."
>
> *Dali Jiang, FAW*

At a Glance

The Task
Developing the controller software of future electric and hybrid drives at FAW according to AUTOSAR.

The Challenge
Setting up a tool chain for the AUTOSAR-compliant development and migration of non-AUTOSAR software. Quickly migrating non-AUTOSAR software to AUTOSAR and performing in-vehicle tests.

The Solution
Using a seamless dSPACE tool chain has made it possible to migrate controller software to an AUTOSAR-compliant structure with only little effort and experience. MicroAutoBox II in combination with V-ECUs were used to test the AUTOSAR-compliant software in the vehicle.

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