Solutions for the Automotive Industry

Systems and Applications
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Editorial</td>
<td>3</td>
</tr>
<tr>
<td>dSPACE Tools for Automotive Software Development</td>
<td>4</td>
</tr>
<tr>
<td>Software Architecture</td>
<td>7</td>
</tr>
<tr>
<td>Virtual Validation</td>
<td>8</td>
</tr>
<tr>
<td>Rapid Prototyping and Vehicle Testing</td>
<td>10</td>
</tr>
<tr>
<td>Production Code Generation</td>
<td>12</td>
</tr>
<tr>
<td>Hardware-in-the-Loop Testing</td>
<td>14</td>
</tr>
<tr>
<td>Data Management</td>
<td>16</td>
</tr>
<tr>
<td>Electrical and Mechatronic Test Benches</td>
<td>18</td>
</tr>
<tr>
<td>dSPACE Engineering Services</td>
<td>19</td>
</tr>
<tr>
<td>dSPACE Process Consulting</td>
<td>20</td>
</tr>
<tr>
<td>Automotive Standards</td>
<td>21</td>
</tr>
<tr>
<td>Company Profile</td>
<td>22</td>
</tr>
<tr>
<td>dSPACE Worldwide</td>
<td>23</td>
</tr>
</tbody>
</table>

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dSPACE tools for developing and validating software in vehicles are ideal solutions for the automotive industry. They have been used around the world for over 30 years and are an indispensable part of the engineering toolkit for developing electronic controls and networking systems and bringing them to production maturity. Our tools play a key role in managing complexity and ensure highest software quality in all areas of vehicle electronics development, from engine and transmission control to vehicle dynamics and body control as well as advanced driver assistance systems and electric drives.

Presently, we are driven by the industry’s race towards implementing highly automated and autonomous driving and electromobility technologies. The challenges in these areas are reaching unprecedented dimensions. This can be witnessed by the number of engineers and information scientists employed in these areas as well as the introduction of agile development and continuous integration, the use of new algorithms and processes, such as deep learning, and last but not least, the passionate debates about the best methods for validation. Development departments are facing additional tasks due to the increasing interconnection of systems based on automotive Ethernet and new electronic architectures.

dSPACE provides the answers to these and many other challenges. Our close cooperation with customers and development partners creates new stimuli for the continuous expansion of our product range. We translate these stimuli into products, basing them on well-thought-out concepts. Selected cooperation partners from the dSPACE Partner Program complete the portfolio with their own state-of-the-art products. This results in a comprehensive and reliable one-stop solution with the added benefit of dedicated service and support teams. As a result, we substantially contribute to our customers’ success in this dynamic environment.

As part of a new consulting service, our experienced dSPACE specialists will support you in optimizing your development and validation processes with a view to functional safety and the aim of selecting and efficiently using the most suitable methods and tools.

This brochure will give you a first overview of the dSPACE solutions for the automotive industry. Please do not hesitate to get in touch with your dSPACE contact person if you require more information.

Dr. Rainer Otterbach, Director of Product Management
dSPACE Tools for Automotive Software Development

Software Architecture
SystemDesk is a software architecture tool that helps develop complex software architecture, from modeling the individual software components to specifying overall characteristics of a system. SystemDesk supports the AUTOSAR standard and therefore easily allows for the integration of software components from various sources.

Virtual Validation (MIL/SIL Simulation and Testing)
Virtual validation makes it possible to frontload validation, verification, and integration steps to an early phase of the development process. Virtual electronic control units (V-ECUs) that were generated using SystemDesk and
the PC-based simulation platform VEOS let you perform MIL and SIL tests in open- and closed-loop operation without the need for real ECU prototypes. Therefore, system testing can begin early on in the function development stage. For large testing efforts, VEOS can be deployed in scalable PC clusters. Additionally, VEOS allows test developers to create test scenarios for HIL testing.

Rapid Prototyping and Vehicle Testing

dSPACE offers a comprehensive portfolio of modular systems, such as SCALEXIO, as well as compact and robust systems, such as MicroAutoBox platform. These systems are often deployed as development ECUs (rapid prototyping) and data acquisition during vehicle testing. These systems are used as ECU substitutes (fullpassing) or to expand the capabilities of existing ECUs (bypassing) during model-based controller development for various applications, such as drivetrains, vehicle dynamics, and electromobility. They offer high real-time computing power, accurate time synchronicity, and comprehensive interface options for sensors, actuators, and communication buses and networks, thus providing a powerful platform for developing multisensor applications for advanced driver assistance systems and highly automated driving. Depending on the variant, systems can be used in the laboratory, on the test bench, or directly in the vehicle. The extensive software support allows for a fast implementation and lets you operate the systems at run time.

Production Code Generation

Automatic production code generation of the ECU software is a key development phase. The dSPACE production code generator TargetLink generates highly efficient C code directly from MathWorks® Simulink®/Stateflow® and allows for early verification via integrated simulation and testing options. Furthermore, TargetLink offers powerful AUTOSAR support and is certified for developing safety-critical functions in accordance with the functional safety standard ISO 26262. The production code generator and numerous third-party tools make up the TargetLink Ecosystem for model-based software development.
HIL Testing
The real-time simulation platform SCALEXIO lets you quickly and automatically test ECUs to verify whether they work correctly. The system simulates the real operating environment of the system allowing engineers to systematically and reproducibly test every operating scenario imaginable. dSPACE products for HIL testing can be used from early function development tests to integration testing of a large number of networked ECUs. Automotive Simulation Models (ASMs) are dSPACE real-time models that are part of the dSPACE software portfolio, which also includes AutomationDesk for convenient test automation, ControlDesk for test control, and MotionDesk for 3-D visualization.

Data Management
During ECU development and validation, large volumes of data are generated by means of requirements, models, parameters, and tests. Managing this data is a tremendous challenge. The dSPACE data management software SYNECT keeps your data consistent and traceable. Moreover, the data resulting from projects (e.g., for new vehicle and ECU variants) and different teams can be reused safely and efficiently.

Electrical and Mechatronic Test Benches
dSPACE offers highly dynamic, turn-key test benches for the comprehensive testing of software including the mechatronic components and systems as well as power hardware-in-the-loop systems for testing power electronic components in high-voltage applications. We deliver a complete system that lets you perform all the necessary tasks, such as design, planning, implementation, installation, and support. Around the world, dSPACE provides systems that are perfectly tailored to your requirements.

dSPACE Engineering Services
If projects become more complex or require tailor-made solutions, dSPACE offers fast and competent help with its dSPACE Engineering Services. Our experienced engineers support you in projects of all sizes. If required, dSPACE engineers can also be on-site with you for an extended period of time.

dSPACE Process Consulting
It is a challenge for both automotive OEMs and suppliers to set up the ideal ECU development process that helps deliver high-quality, safe, and reliable systems with highly complex software architectures that are also in compliance with various standards and regulations, such as ISO 26262. dSPACE Process Consulting supports you to efficiently create and optimize your processes.
Software Architecture – Efficiently Achieving Goals with SystemDesk

A complete ECU software system consists of numerous software components that can work with one another across individual ECUs. To keep an overview when developing complex architectures, dSPACE offers the SystemDesk software architecture tool. It allows for a structured process with a user-friendly interface and comprehensive AUTOSAR support.

Comprehensive AUTOSAR Support
Since ECU software is usually not developed by one team alone, but by several groups in a company or even in different companies, it is important that software components can be integrated from different sources. SystemDesk support of the AUTOSAR standard simplifies integration and reuse of existing and tested software components.

Generating Virtual ECUs
With SystemDesk, fully developed ECU software components can be integrated to generate virtual ECUs (V-ECUs), which are used for tests until the actual ECU becomes available. As part of the virtual validation, these V-ECUs are tested for different scenarios on a PC with VEOS.

Features at a Glance
- Development of ECU software architectures and systems, in accordance with AUTOSAR R3 and R4
- Efficient modeling, including plausibility checks and suggestions for corrections
- Flexible generation of virtual ECUs (e.g., with customer-proprietary basic software) for early validation with VEOS
- Full API automation, including documentation

More Information
www.dspace.com/go/systemdesk

Customer Application PSA Peugeot Citroën: AUTOSAR Implemented
To optimize cooperation with electronic control unit suppliers, PSA makes their development process for drive-train ECUs AUTOSAR-compliant.
dSPACE Magazine: 2/2014
Virtual Validation —
Model- and Software-in-the-Loop Simulation on a PC

Virtual validation aims at frontloading individual tasks during ECU development. This results in time and money savings across the entire development process, because you can find and correct errors sooner, and continue your work with improved software quality.

**Virtual Validation in the Development Process**

The most important elements of virtual validation are:
- VEOS, the PC-based simulation platform
- Virtual ECUs (V-ECUs)

V-ECUs contain available software components and basic software. This enables you to test the overall ECU software without the actual ECU hardware.

VEOS platform is used for the model-in-the-loop and software-in-the-loop simulations with realistic plant models directly on a PC. You can test individual functions or even complete virtual ECUs of various versions in a virtual environment. Moreover, you can prepare and execute hardware-in-the-loop (HIL) tests.

VEOS enables function tests in the early development phases directly on the PC.
Cluster Simulation for Driver Assistance Functions

Improved confidence in the development of advanced driver assistance systems and highly automated driving requires driving millions of test kilometers, which can be achieved only by means of simulation. To fulfill this requirement, multiple instances of VEOS can be executed on a PC cluster, which lets you easily adjust the computing power to your individual needs. SYNECT, the data management software, can be used to manage test cases and resulting data.

Combining PCs and virtual machines lets you easily adapt the VEOS clusters to different requirements.

Features at a Glance

- Developing new functions and validating the ECU software early in the development process by using virtual ECUs (V-ECUs)
- Identical tools throughout the entire development process

Support of automotive standards such as XIL API, AUTOSAR, ASAM, and Functional Mock-up Interface (FMI)

Support of communication bus simulation for CAN, CAN FD, and LIN

More Information

www.dspace.com/go/viva

Customer Application Jaguar Land Rover: Virtual Revolution

To be able to test new functions as efficiently as possible, Jaguar Land Rover has implemented virtual validation in their development process.

dSPACE Magazine: 1/2017
Rapid Prototyping and Vehicle Testing – dSPACE Systems Make Your Ideas Soar

Whether you want to use MATLAB®/Simulink®/Stateflow® for developing new controllers or for developing controllers further, process sensor and bus data, develop multisensor applications, or record data during the vehicle test, our flexible dSPACE systems let you optimize the models and algorithms until they meet your requirements. This means maximum freedom for developing many different applications from autonomous driving to electromobility.

Robust dSPACE Prototyping and Data Capturing Systems (Excerpt)

In addition to laboratory systems, dSPACE offers robust systems, either compact or modular, for use in vehicles and on test benches. The systems provide a seamless interface to MATLAB®/Simulink®/Stateflow®, so that controller designs can be implemented and optimized fast and with little effort. The systems also support RTMaps for multisensor applications and time-synchronous data capturing.
Application Areas

dSPACE systems are used for development systems in numerous projects:
- Open and closed loop control strategies for combustion engines, electric motors, hybrid drives, fuel cells, etc.
- Chassis control, optimizing vehicle dynamics
- Highly automated and autonomous driving
- V2X applications
- Data acquisition in the vehicle with support for all types of sensors including cameras, lidars, etc., as well as bus and network communication
- AUTOSAR and non-AUTOSAR applications
- Applications for functional safety
- Experimental vehicle concepts and robotics
- Supervisory control in the vehicle network

Features at a Glance

- Fast design iterations due to intuitive handling and comprehensive software support, including seamless integration in MATLAB®/Simulink®/Stateflow®
- Real-time capability, high reliability, and long-term support
- Comprehensive and configurable I/O as well as bus and network interfaces (e.g., CAN FD, LIN, Ethernet, FlexRay)
- Robust, scalable, and flexible solutions for in-vehicle use and use in the laboratory and on the test bench
- Dedicated solutions for multisensor applications and time-synchronous capturing of large data volumes

More Information
www.dspace.com/go/rcp

Customer Application Mitsubishi Electric:
Driving Your Car from Space
Developing satellite-based autonomous vehicle control system using dSPACE MicroAutoBox II.
dSPACE Magazine: 2/2016
Production Code Generation —
Meeting Highest Demands with TargetLink

Today, model-based design and automatic code generation are internationally established industry standards for developing software for automotive ECUs. dSPACE TargetLink generates highly efficient production code directly from the graphical MathWorks® Simulink®/Stateflow® development environment. TargetLink is used by a large number of renowned companies in the automotive industry. TargetLink applications cover all automotive systems, including the powertrain (combustion engines, electric motors, and hybrid drives), highly automated driving, chassis, driver assistance, and comfort, as well as active and passive safety and assistance systems.

The Ideal Path to Complete ECU Code

The production code generator TargetLink provides comprehensive AUTOSAR support. TargetLink is certified for use to develop safety-critical functions according to ISO26262, IEC25119, and IEC61508. The integrated features for software design and verification as well as a comprehensive range of available high-performance partner tools form a TargetLink Ecosystem that delivers high efficiency throughout the entire development process.

In addition to code generation, TargetLink offers numerous options for software testing and verification.
Developing AUTOSAR-Compliant Software

TargetLink provides a wide range of functions for designing, autocoding, and testing AUTOSAR-compliant software components. AUTOSAR-based round trip development that involves various tools makes the development process particularly efficient, thanks to the TargetLink Data Dictionary with its wide range of editing, diff & merge, and import/export functions. Moreover, combining TargetLink with SystemDesk makes the AUTOSAR-compliant development process even simpler, more transparent, and more efficient, because component containers can be easily exchanged.

Features at a Glance

- TargetLink code has been used in numerous production projects and millions of vehicles since 1999
- First-class code that is highly efficient, flexibly configurable, MISRA-compliant, and has traceable model/code dependencies
- Powerful functions for software design, for example, the TargetLink Data Dictionary
- Easy software validation with model-in-the-loop (MIL), software-in-the-loop (SIL), and processor-in-the-loop (PIL) simulation at the click of a button to avoid expensive errors in the ECU software by validating concepts and code early in the process
- Ideal for AUTOSAR and non-AUTOSAR projects
- Strong partner tools (TargetLink Ecosystem) for model design, verification, and validation
- TargetLink is certified for use when developing safety critical functions according to ISO 26262, ISO 25119, and IEC 61508 as well as derived standards
- Tool integration with the VEOS simulation software, and the SystemDesk system architecture software
- Perfect for on-target bypassing when combined with the dSPACE ECU Interface Software, closing the gap between function and production development

More Information

www.dspace.com/go/targetlink

Customer Application Toyota:
A Forward Leap for E-Volution

New software development process with TargetLink and BTC tools for the new Toyota Prius.
dSPACE Magazine: 1/2017

Production Code Generation | 13
Hardware-in-the-Loop Testing –
Testing ECUs from the Component to the Network

Hardware-in-the-loop testing lets you test ECU functions in the laboratory. For this, you can simulate the operating environment of the ECU, for example, additional ECUs, individual components such as the engine, or even the entire vehicle and surrounding traffic. The great benefit of HIL simulation is that critical driving situations can be safely tested and that tests can be automated to be executed 24/7 at night and/or on weekends.

Setting up a HIL Test System

A HIL test system includes hardware interfaces that are used to connect the ECU and fault simulation systems, among other components. Another critical component is the processor core, required computing simulation models that are executed in real-time. The host PC that runs the software for test control or data management is connected to the real-time system. dSPACE HIL simulators can be set up in various system sizes to cover all test variants – from a simple function test to networked ECUs for testing fully virtual vehicles.

dSPACE offers all hardware and software components for setting up a HIL test system based on SCALExIO technology as a one-stop solution.
Sensor Simulation for Highly Automated Driving

Data from camera, radar, and lidar sensors is required to test modern advanced driver assistance systems and functions for highly automated driving. For HIL simulation, dSPACE offers sensor models with varying degrees of detail. The portfolio covers numerous models from a technology-independent sensor that immediately creates object lists on the basis of the available information and a physical camera model for direct image data input to over-the-air stimulation of radar sensors.

Electric Drives

Electric drives have a significantly higher torque and higher dynamics compared to conventional combustion engines. Therefore, shorter calculation times are required for simulation. Furthermore, additional elements, such as the battery, battery management, and energy recovery, must be simulated and tested. dSPACE provides solutions for its HIL simulators so that you can test all functions of an electric vehicle.

Features at a Glance

- Leading supplier of HIL simulators worldwide
- HIL test systems from small to large – from function tests of individual components to integrated systems simulating entire vehicles
- International projects, delivery, and setup of turn-key systems
- Covers all domains of the automotive industry
- Comprehensive and configurable I/O, bus, and network interfaces (e.g., CAN FD, LIN, Ethernet, FlexRay)
- Long-term experience with customer projects

More information: www.dspace.com/go/hil

Customer Application Porsche: Dynamic Models

For the perfect driving experience, Porsche uses dSPACE simulation models for the virtual vehicle dynamic development.

dSPACE Magazine: 2/2015
Data Management – Connecting Users, Data, and Tools using SYNECT

SYNECT, the dSPACE data management and collaboration software, helps engineers centrally manage models, signals, parameters, tests, and test results as well as the dependencies, versions, and variants, with full traceability to the system requirements. By means of central data storage and access to distributed teams, SYNECT helps connect teams for an efficient development process. A key benefit of SYNECT is the direct connection to engineering tools, such as MATLAB®, Simulink®, TargetLink, and AutomationDesk, as well as systems for the application life cycle management (ALM) systems. SYNECT supports relevant standards, such as ReqIF™, OSLC, and FMI, for easy integration of existing processes and tool chains. Thus, SYNECT can be used for the entire development process and various applications to validate safety-critical systems, to manage data centrally, and to automatically provide and process data.

Using HIL Systems More Efficiently

HIL systems have been established for simulation-based testing of individual ECU or a complete ECU network for many years and standards, such as ISO 26262, recommend them for validation. To manage the steadily increasing test scope and to efficiently use HIL test systems, the entire test process must be efficiently organized and automated from requirements management, provision of test cases to match the HIL configuration, test execution, and test evaluation. SYNECT provides the ideal support for performing these tasks.

Central data and test management to prepare and perform tests.
**Agile Software Development**

Agile development and test methods make it possible to arrive at deployable software more quickly and to improve it continuously. Tools for model-based development and production code generation, such as TargetLink, and a highly integrated test environment, such as BTC Embedded Platform, offer a powerful environment for agile software development and continuous integration/delivery strategies if combined with SYNECT. With SYNECT, you can fully automate recurring tasks. In addition, central data management throughout the development process allows for a tight-knit network of all tools, users, and development artifacts.

### Features at a Glance

- Central management, direct networking, and comprehensive use of all development data
- Full traceability across all stages of the validation from requirements to test results
- Integral evaluation and monitoring of the development and test progress
- High level of automation at all steps of the process
- Variant and workflow management to create and systematically validate systems with many variants
- Direct integration in existing IT infrastructures, tool chains, and processes

### More Information

[www.dspace.com/go/synect](http://www.dspace.com/go/synect)

**Customer Application Weichai: Modeling the Future**

Customer-specific simulation models for highly efficient truck engine technology.

*dsPACE Magazine: 2/2017*
Electrical and Mechatronic Test Benches — Closed-Loop Tests at Various Physical Levels

For testing complex mechatronic systems, dSPACE offers turn-key system solutions that are tailored to customer requirements and thus enable closed-loop tests at various physical levels including electrical and mechanical. The dSPACE test benches let you evaluate the complex systems in real-time, 24 hours a day. dSPACE hardware offers the required scalability, real-time capability, I/O interfaces, and a powerful tool chain to control the entire test from Simulink®.

**Electrical Test Benches**
Control systems for electric motors have to be tested from signal level to power level. The power hardware-in-the-loop (PHIL) systems from dSPACE allow for simulating traction motors up to several hundreds of kilowatts. Because no mechanic components are involved in the tests and because safety mechanisms are integrated into the test system, you can test traction systems under realistic conditions as well as at critical operation points without any risks.

**Features at a Glance**
- Highly dynamic emulation of electric drives with real energy flow
- Emulation of all operating points of an electric motor, in both motor and generator mode
- Parallel operation of two or more emulator cabinets with several high-voltage electronic load modules
- Emulation of harmonic frequencies, allowing for a highly accurate simulation of motor currents

**Mechatronic Test Benches**
Highly dynamic electromechanical systems with integrated sensing technologies require physical interfaces. They apply appropriate mechanical motion for sensor stimulation in addition to electrical interfaces and environment simulation from a HIL system. Complex mechatronic subsystems of vehicle dynamics, such as the steering or brake system are typical examples. HIL simulations at the mechanical level include test benches with real components, such as electric motors and mechanical loads that provide appropriate responses to test realistic behavior.

**Features at a Glance**
- Turn-key test bench concepts for various applications, such as electromechanical power steering, brake systems, and systems for electronic stability control
- Customer-specific enhancements, such as environmental simulation by means of an integrated climate chamber

**More Information**
www.dspace.com/go/testbench

**Customer Application Porsche:**
A Test of Character for Steering Systems
Porsche performs realistic tests of the steering behavior in the laboratory using a mechatronic test bench. *dSPACE Magazine: 2/2016*
dSPACE Engineering Services —
Individually Supporting Every Development Stage

For increasingly complex projects, if you require customized solutions, or if you are under great time pressure, you can trust dSPACE’s fast and competent engineering services. Our experienced engineers will support you in small-scale projects, as well as with complete turn-key solutions. If needed, we will support you with resident dSPACE engineers on-site. By availing of our dSPACE Engineering Services, you will be able to use our tools independently faster and you will acquire the relevant product know-how directly from our dSPACE specialists.

Wherever You Are
For global projects, dSPACE’s internationally networked team of specialists and our central project coordination will guarantee smooth and rapid project progress to help you successfully complete your project. dSPACE in Paderborn, Germany, the project centers in Germany, and the regional dSPACE companies in Japan, France, the U.K., the USA, and China provide engineering services worldwide. dSPACE Engineering Services are available for every development phase. dSPACE specialists offer standard training courses as well as customer-specific training courses.

Features at a Glance
- Worldwide engineering and consultancy services
- Customer-specific hardware and software adaptations
- Fast response
- Experienced team of engineers

More Information
www.dspace.com/go/engineering

<table>
<thead>
<tr>
<th>Typical Service (Examples)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction of development tools</td>
<td>dSPACE Engineering Services provide everything necessary to build a system that you can use long-term, for example, feasibility studies, the development of use cases, benchmarking, pilot projects, and individual trainings and consultancy.</td>
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<tr>
<td>Turn-key solutions</td>
<td>dSPACE Engineering Services provide ready-to-use solutions even for complex application scenarios. If required, the solutions can be applied across the entire tool chain, including the requirements analysis, implementation specifications, system delivery, and commissioning on site.</td>
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<tr>
<td>Customer-specific solutions</td>
<td>dSPACE Engineering Services support you with solutions tailored to your requirements. These solutions add to the dSPACE portfolio, from the I/O interface to the plant model.</td>
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<td>Resident engineers</td>
<td>If you require long-term support on-site, our resident engineers will be working by your side.</td>
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<td>Maintenance services and life cycle support</td>
<td>We provide services beyond delivery to ensure that a dSPACE system works optimally, even if the requirements change. Services include: software adaptation, interface extension, hardware modification and expansion, model adaptation, and more.</td>
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dSPACE Process Consulting –
Ideal Processes Across All Software Development Phases

To develop and test system and software architectures efficiently and in accordance with standards, manufacturers and suppliers must optimize their processes. To achieve this, it is nowadays even more important than ever to coordinate the various development phases with each other, from system design to validation, and to implement them in a process-reliable manner. dSPACE Process Consulting offers consultancy services that support you in creating processes and optimizing them across all phases of ECU development, independent of whether dSPACE tools are used. dSPACE experts will evaluate and audit your tool chain and work processes to enhance team productivity and efficiency.

Why dSPACE Process Consulting
Decades of experience, particularly in the automotive industry, but also in many other areas, such as aerospace or medical engineering, make dSPACE a competent partner for developing and validating software for embedded systems. Experienced specialists who are successfully working on projects around the world can quickly analyze processes and identify potential for optimization. Their knowledge of relevant standards, development tools, and best practices can help you establish lean and efficient processes.

Features at a Glance
- Comprehensive knowledge of creating and testing standard-compliant processes
- Experience with the commonly used tool chains
- Support from dSPACE, independent of the tools used

More Information
www.dspace.com/go/consulting

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<thead>
<tr>
<th>Typical Service (Examples)</th>
<th>Description</th>
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<tbody>
<tr>
<td>Benchmarking, process analysis, and optimization</td>
<td>dSPACE Process Consulting analyzes existing processes and compares them with best practices from various industries. The specialists identify optimization potential and make suggestions for implementing new processes. If required, dSPACE also supports the implementation efforts.</td>
</tr>
<tr>
<td>Creating and implementing standard-compliant processes</td>
<td>dSPACE Process Consulting advises on working with development and test environments to comply with standards such as ISO 26262, ISO/IEC 15504, and IATF 16949.</td>
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<tr>
<td>Proof of suitability for verification environments when working on safety-critical projects</td>
<td>dSPACE Process Consulting evaluates processes and, if required, recommends adjustments.</td>
</tr>
<tr>
<td>Introducing model-based development and virtual validation</td>
<td>dSPACE Process Consulting determines if and how you can profit from the benefits of model-based development and virtual validation, and supports you in the implementation, if required.</td>
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</table>
Automotive Standards

dSPACE products support the relevant technical standards for automotive software development. This ensures versatility, quality, and the interoperability of tools. Standards reduce complexity and increase the efficiency of your development processes. dSPACE actively participates in standardization efforts to share its long-standing experience of working with processes, methods, and tools in automotive software development.

Extract of the Standards Supported by dSPACE:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
<th>Benefits for dSPACE Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADASIS</td>
<td>An open forum for defining a standardized interface to allow access to predictive road data for map-based, predictive advanced driver assistance systems and systems for autonomous driving.</td>
<td>- Model-based development of application functions using ADASIS v3 Horizon Reconstructor Blockset on dSPACE prototyping platforms and VEOS. The blockset uses the ADASIS v3 Protocol to provide an interface to the electronic horizon.</td>
</tr>
<tr>
<td>ASAM</td>
<td>An incorporated association to coordinate the development of technical standards (protocols, data models, data formats, and interfaces) with the aim to achieve compatibility of development tools and tool chains across all manufacturers.</td>
<td>- A seamless tool chain based on standardized exchange formats such as A2L, FIBEX, and ODX. - Open interfaces, such as XIL API and MCD, for a well-functioning interplay of development tools. - Standard protocols, such as XCP, for accessing virtual and real ECUs.</td>
</tr>
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<td>AUTOSAR</td>
<td>Development alliance of companies in the automotive industry that cooperate to establish a standardized electrics/electronics architecture concept.</td>
<td>- Modeling the functional behavior and generating code in accordance with AUTOSAR using TargetLink. - Modeling AUTOSAR-compliant system architectures and generating virtual ECUs using SystemDesk. - Simulating virtual ECUs. - Creating AUTOSAR-compliant communication descriptions for configuring HIL test systems.</td>
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<td>FMI</td>
<td>Open standard for exchanging, integrating, and reusing models from different modeling environments.</td>
<td>- Easily integrating models in PC-based or real-time simulation. - Seamless interaction between the dSPACE tool chain for HIL and SIL testing, and a large number of modeling environments based on Functional Mock-up Units (FMUs).</td>
</tr>
<tr>
<td>ISO 26262</td>
<td>Standard for safety-relevant electrics/electronics systems in road vehicles to ensure their functional safety.</td>
<td>- dSPACE AutomationDesk and TargetLink are certified to be used for testing safety-related systems or for development of safety-critical functions in accordance with ISO 26262 by the technical inspection association TÜV SÜD. - Consultancy services to comply with the standard and implement its requirements efficiently. - Supporting the introduction and improvement of model-based development and code generation, also for safety-critical systems. - Supporting the development of an ISO-26262-compliant validation strategy. - Evaluating the suitability of customers’ HIL verification environments for all Automotive Safety Integrity Levels (ASIL).</td>
</tr>
<tr>
<td>OPEN Alliance</td>
<td>Special interest group (SIG) for establishing Ethernet networks for automotive networking applications.</td>
<td>- Providing test environments that match the current industry standard for automotive Ethernet.</td>
</tr>
<tr>
<td>OSLC</td>
<td>An open initiative for developing specifications for integrating software development tools.</td>
<td>- SYNECT enables communication and interactions with other systems that support OSLC, such as application or product life cycle management systems (ALM/PLM).</td>
</tr>
</tbody>
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From Paderborn to the World

The very livable city of Paderborn in Westphalia, Germany, has been home to dSPACE since its founding in 1988. With a renowned university and a string of major IT companies, Paderborn is a great place for working on new ideas.

Many of our customers are global players and cooperation does not stop at the border. Wherever our customers go, wherever they develop their products, we’re there too. In addition to our Paderborn location and three Project Centers in Germany, dSPACE has regional dSPACE companies in the USA, France, the UK, Japan, China, and Croatia. Distributors in numerous countries ensure the global availability of dSPACE products and fast response times.

Our international team of close to 1,700 employees from 34 countries, works hand in hand to inspire and learn from one another. Engineers and information scientists work side by side with customers. A modern business management team coordinates projects smoothly across country borders.

Cooperating with dSPACE accelerates success – all around the globe.