dSPACE NEWS

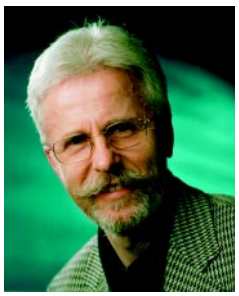
facts
projects
events

Contents

Toyota Motorsport Racing Ahead with dSPACE

Fall 2001

EDITORIAL



The majority of our business is done in industries and projects where the fun part may be somewhat limited. I am not saying that Formula One racing is not a serious business, but it also involves a lot of fun. I personally watch the races whenever I can.

So we are very excited that several Formula One teams are using dSPACE to speed up their development and testing processes. The first time dSPACE got into Formula One was in the early nineties, when Benetton rapid-prototyped traction control, among other things. Soon after – in 1994 – these kinds of electronic aids were banned, and only standard electronics were allowed. However, a few years later, in March this year, the ban was lifted.

Unfortunately, most Formula One teams who use dSPACE for quick development and testing want us to be quiet about it. Though honestly, we also don't know what magic software or hardware might have been developed to squeeze out a few milliseconds per lap. Most current Formula One teams employ dSPACE for improved testing by hardware-in-the-loop simulation, which can even take the form of driving simulators with a real steering wheel.

Because Formula One is a sensitive business, and moreover all about competition, we are very grateful to Toyota Motorsport for the article in this Newsletter.

Sometimes people talk about technology transfer from racing to the car industry in general. But technology is different in passenger cars, where safety regulations, fuel consumption and CO_2 emission have to meet stringent legal requirements. Technology development in Formula One means breaking records – as we did when we built Formula One simulators with 700 I/O channels that can handle 29,000 RPM. Will that be sufficient for the time being?

Dr. Herbert Hanselmann
President and CEO

MISCELLANEOUS

Conference on Hardware-in-the-Loop Simulation

www.hdt-essen.de

At "Haus der Technik, HdT" in Essen, Germany, Prof. Dr.-Ing. Joachim Lückel, head of the mechatronic lab of Paderborn University, and Dr.-Ing. Herbert Schütte, manager applications/engineering at dSPACE, will present the fourth German Conference on HIL Technology. On October 22-23, 2001, the participants will receive a comprehensive overview about the current use of real-time simulation for testing and developing modern electronic control units (ECUs). Fifteen speakers will present their current projects and latest findings in this field of application.

Here are just a few of the attending companies: Toyota Motorsport, Siemens Automotive, Ford, Opel and Audi. Audi will be reporting on SPEA, a complete powertrain simulation. We published a detailed article about this in the last issue of dSPACE NEWS.

Another objective is to provide a forum in which current and future users can meet, exchange ideas and talk about their experiences. Tool vendors will use the accompanying exhibition to present their latest product developments for hardware-in-the-loop systems.

For more detailed information on the HIL conference, please contact us.

dSPACE NEWS

dSPACE NEWS is published periodically by:

dSPACE GmbH
Technologiepark 25
D-33100 Paderborn
Tel.: +49 5251 1 63 80
Fax: +49 5251 6 65 29
info@dspace.de
support@dspace.de
www.dspace.de

Editor: Bettina Henking
Layout: Beate Eckert, Ute Bergmann

dSPACE Contributors: Robert Bevington, Günther Gruhn, Louise Hackett, Herbert Hanselmann, Thomas Pöhlmann, Gerhard Reiß, Christine Smith

New Offices in France and the United Kingdom

BUSINESS

With the fall season dSPACE begins a new phase in its corporate development by establishing two new European subsidiaries. dSPACE is now preparing to launch offices in Bièvres, near Paris, and Huntingdon, near Cambridge, on November 1, 2001.

Dr. Herbert Hanselmann, President and CEO of dSPACE GmbH, provides some insight into the decision.

dSPACE NEWS: **What is the reason behind the European initiative?**

Dr. H. Hanselmann: During the last two years, dSPACE recognized an increasing demand for a global presence, as numerous companies began to distribute system development globally, and are looking for partners who are available globally. So the initiative was born to open the offices in France and the UK. Our customers expect a supplier who is close by.

dSPACE NEWS: **What will be the main tasks of the offices in France and the United Kingdom?**

Dr. H. Hanselmann: The offices' main functions will be sales and support tasks. Support will cover dSPACE's entire product range, which includes systems for ECU prototyping, production code generation and system test. Sales and presales on-site consulting is becoming more and more important as customer applications are becoming more and more complex.

dSPACE NEWS: **What will be the benefits to the customers?**

Dr. H. Hanselmann: We will be offering comprehensive customer support, commissioning on site, and training on site. With the increasing demand for turn-key systems for hardware-in-the-loop simulation, a continuous interaction with the customer is required. With the offices in France and the UK, dSPACE is now well prepared to meet the present and future demands of the customers there.

dSPACE NEWS: **Who will be in charge of the new offices?**

Dr. H. Hanselmann: The new offices will be managed by Dr. Salah Aksas (dSPACE SARL), Stephen Pole (dSPACE Ltd.) and Mirco Breitwisser (dSPACE GmbH).

dSPACE NEWS: **How will the cooperation with The MathWorks continue?**

Dr. H. Hanselmann: The relationship with our development partner The MathWorks is both mutually beneficial and positive. The MathWorks has been the distributor for dSPACE products in the British and French market so far. On this sound basis customer service will continue to be coordinated between dSPACE and The MathWorks, thus maintaining ideal on-site customer assistance. We look forward to supporting our customers with a seamless tool chain consisting of dSPACE systems and MATLAB/Simulink from The MathWorks.

A bientôt à Bièvres.
See you in Huntingdon.

From left to right: Stephen Pole, Frank Mertens (dSPACE Ltd.); Dr. Herbert Hanselmann, Mirco Breitwisser (dSPACE GmbH); Susanne Köhl, Dr. Salah Aksas, Nicolas Gachadoit (dSPACE SARL).

dSPACE Ltd.
2nd Floor Westminster House
The Anderson Centre
Ermine Business Park
Huntingdon
Cambrigdeshire PE296XY
Tel. : +44 7 980 587 337
info@dspace.ltd.uk
www.dspace.ltd.uk

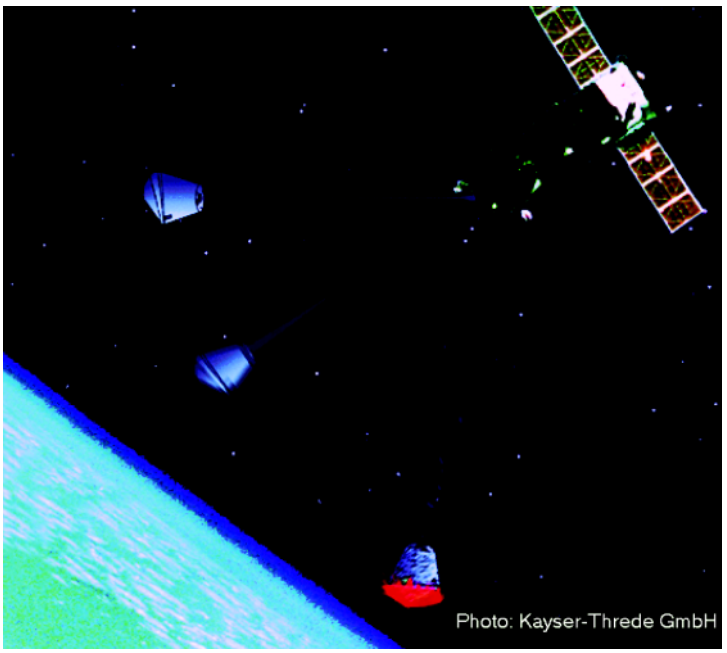
dSPACE SARL
Parc Burospace
Bâtiment 17
Route de la Plaine de Gisy
91573 Bièvres Cedex
Tel. : +33 1 69 35 50 60
Fax : +33 1 69 35 50 61
info@dspace.fr
www.dspace.fr

Freight Traffic in Outer Space

CUSTOMERS

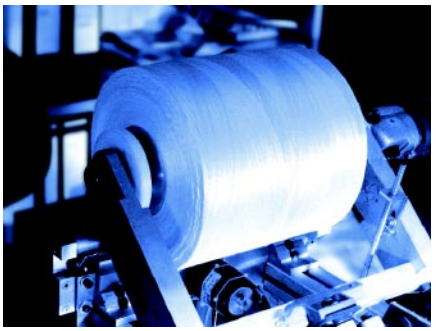
- **University of Applied Science in Remagen, Germany, does research for ESA**
- **Freight transportation cheaper than by Space Shuttle**
- **No space junk**
- **Quick experimental setup with dSPACE ACE Kit**

The International Space Station (ISS) is creating an ever-increasing need for freight transportation between space and Earth. Measurement systems, samples collected in experiments, and other items all need to be brought back to Earth. So the hunt for a cheaper alternative to the fuel-hungry Space Shuttle is on. The European Space Agency (ESA) commissioned a team of companies and university research departments to investigate a simple solution. What they have come up with is so simple, it almost seems impossible: Loads are to be lowered down from space on a thread!



The capsule on its way to Earth.

Obviously, for a job like this you need a very special thread. The material chosen is called Dyneema. It's a polyethylene compound that tolerates extreme forces. The light-weight thread has a diameter of 0.6 mm. Up to now it has been used for purposes such as fishing lines, bulletproof vests and suits for motorcyclists.



The spool with the thread: length 35 km, diameter 0.6 mm, weight 7 kg, diameter of the spool 250 mm.

In the space application, the idea is to let a capsule down from the ISS for a distance of about 35-40 km and then to cut the thread at the ISS. Because the capsule has a special braking procedure, it is brought into an elliptical orbit. It reenters the atmosphere at a height of about one hundred kilometers, without the expensive usage of fuel or engines. During the reentry the thread burns up.

Only if the capsule maintains the calculated reentry angle can it perform a soft landing in a defined drop zone, supported by braking parachutes. Afterwards it can be located by the Global Positioning System (GPS). The highly intensive ultraviolet radiation in the upper layers of the atmosphere dissolves possible remains of the thread into polymers, so there is no risk to other satellites.

Spool Winding is Crucial

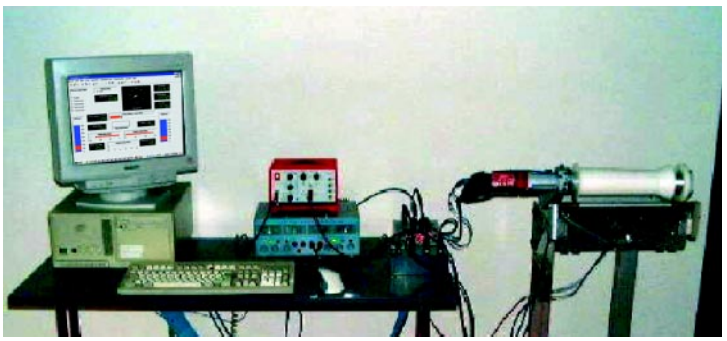
The method looks easy, but is in fact extremely challenging. At the department of electrical engineering at the University of Applied Science in Remagen, Germany, we are investigating the problem of precise layer winding on the spool, which is particularly

crucial. To solve this problem, we can benefit from the experience of the textile industry, where the challenge of winding up a sewing thread on a spool has been a subject of research. The results of that work are several standard techniques (cone, kingspool, etc.) for winding a thread onto a spool with completely even spacing. The layering styles differ mainly in the packing density of the thread.

But for the space application, the boundary conditions are more difficult. The thread must not tangle, either during acceleration and vibrations when the rocket is launched, or while being unwound in zero gravity, because if it did, the capsule with the load would be lost. To meet these requirements, the packing density of the thread must be very high. We have developed an experimental setup to reach the necessary precision of layer winding on the spool.

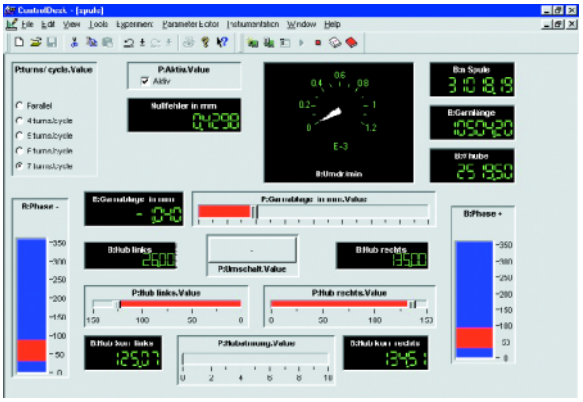
Experimental Setup

The experimental setup to reach the necessary precise layer winding on the spool consists of several modules:



Experimental setup of the spool winder.

- The device for winding up the spool, realized by a commercial standard drilling machine.
- The drive for precise thread positioning on the spool.
- The module to measure the length of the thread.
- A system to modify the forces acting on the thread.



ControlDesk layout to perform spool winding.

Key parameters like the strain on the thread caused by tractive forces and the winding velocity are controlled (at a sampling time of 0.4 ms) by dSPACE Prototyper, based on an ACE Kit university package. Because dSPACE Prototyper is so easy to handle, it was possible to set the experiment up within only three months. The algorithms were programmed graphically in Simulink. After the Simulink blocks were downloaded to the hardware, no corrections were necessary to perform a successful experiment.

First Launch into Orbit

A Russian Proton rocket will carry the first spools into orbit, and a test satellite will be let down by thread.

In this first test run the satellite will carry only a few measurement instruments. If the spool stands the test run, future transportation of loads in outer space will be more environment-friendly and cheaper than by Space Shuttle.

Following that, it would also be possible to transport humans by this method. However, in that case additional life support systems would have to be installed.

Prof. Dr. Ferdinand Hermanns
University of Applied Science
Remagen, Germany

Software on "Solutions for Control" Release 3.2

dSPACE software runs under Windows 95/98/Me/2000 and NT 4.0.

- RTI 4.1
- ControlDesk 2.1
- MLIB/MTRACE 4.3
- RealMotion 1.1 (Windows NT only)

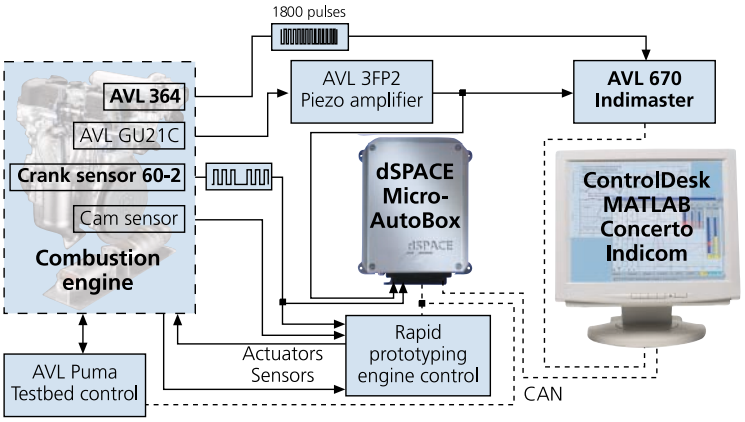
For more detailed information, please refer to *www.dspace.de*.

AVL Analyzes Cylinder Pressure with MicroAutoBox

CUSTOMERS

- Online cylinder pressure calculation
- Exact calculation with standard crankshaft signal
- MicroAutoBox as the proven in-vehicle solution

Today, engines have to meet the growing demands of rigid legislation in terms of exhaust emissions and fuel consumption (CO_2 emission). In order to achieve these objectives, it is necessary to optimize conventional combustion as well as to develop new combustion processes. AVL List GmbH, located in Austria, is working on a way to do this using advanced engine control algorithms that process additional combustion information provided by calculating in-cylinder based signals.



Integration of MicroAutoBox in engine test bed.

Real-Time Cylinder Pressure Processing

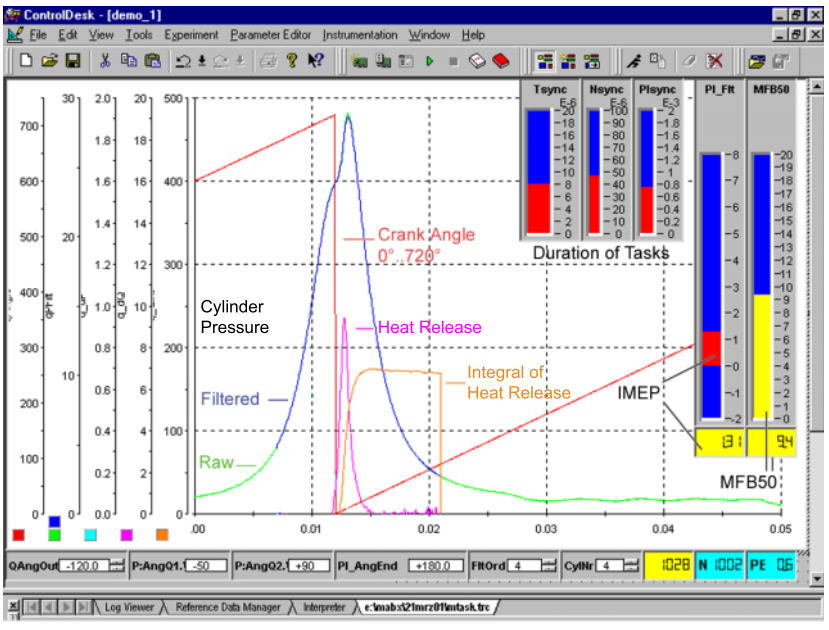
Algorithms were developed as graphical models in MATLAB/Simulink to process the combustion signals based on the cylinder pressure. At the same time a system had to be chosen that allows to test and optimize these algorithms, first on engine test beds and finally in the vehicle.

MicroAutoBox as In-Vehicle Solution

The demanding requirements for an in-vehicle solution, like compact size, stand-alone system with real-time hardware, automatic boot-up, and signal conditioning, were met by dSPACE's MicroAutoBox. For testing the algorithms AVL integrated MicroAutoBox into the engine test bed. With the help of dSPACE's Real-Time Interface, the code of the Simulink algorithms was implemented on MicroAutoBox with minimum effort.

Signal Processing

In order to verify the new algorithms on MicroAutoBox, signals were sent simultaneously to the indicating system AVL 670 Indimaster and to MicroAutoBox. A cylinder pressure signal was supplied to MicroAutoBox and the indicating system. A crankshaft signal generated by a conventional crankshaft sensor wheel (60-2) was then supplied to MicroAutoBox, whereas for comparison purposes the signal of an optical crank angle encoder (1800 pulses) generated a high-resolution signal for the indicating system. MicroAutoBox calculated the relevant combustion parameters, like the indicated mean effective pressure (IMEP) and the heat release, in real time



Combustion parameters calculated by dSPACE's MicroAutoBox.

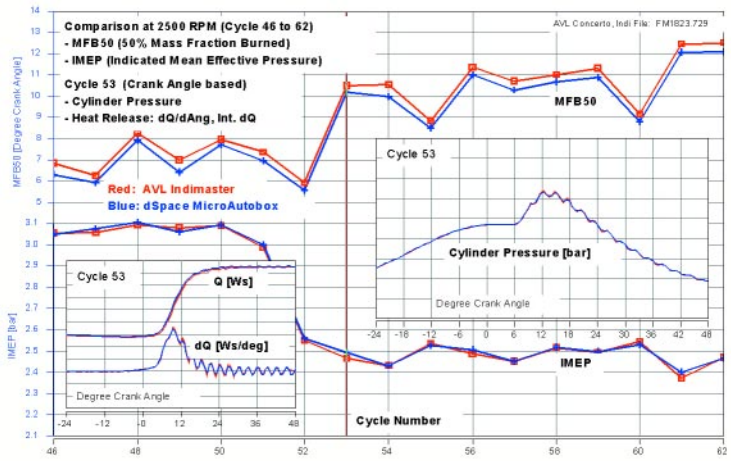
Papers

H. Hanselmann, F. Schütte: "Control System Prototyping, Productionizing and Testing with Modern Tools" (PCIM 2001)

English **04**

T. Michalsky, M. Büdenbender: "Testing Transmission ECUs with Integrated Sensors"

English **05**



Verifying the cylinder pressure analysis results of MicroAutoBox (blue) by comparison to that of the indicating system (red).

even with the low-resolution crank angle signal.
The combustion parameters were then supplied via CAN to the engine control in order to influence the fueling and charging for the next combustion cycle.

Experiment Visualization

The ControlDesk user interface was used for the visualization of signals like the cylinder pressure, the resulting combustion curve, and cycle based parameters like the IMEP, as well as for parameterization.

Verification

With the AVL software Indicom it was possible to access simultaneously the data of the indicating system (standard interface) and MicroAutoBox by using the IndiCom-MATLAB interface and MLIB/MTRACE, the MATLAB-dSPACE interface.
The online analysis of the cylinder pressure with the algorithms implemented in MicroAutoBox supplied combustion process information with a very small difference to that of the indicating system. Because of its high computing power and wide range of interfaces (CAN, analog and digital I/O), MicroAutoBox is a helpful tool for testing and optimizing the new algorithms later in the vehicle.

More MicroAutoBoxes Planned

MicroAutoBox was integrated into the AVL engine test bed and enabled us to conveniently analyze and use the new cylinder-pressure-based control algorithms. Both the positive test course and the support from dSPACE will enhance the use of further MicroAutoBoxes for engine optimization.

Bernhard Breitegger,
Christian Roduner,
Eduard Unger,
Alois Fürhapter
AVL List GmbH
Austria

Engine Control Based on Cylinder Pressure

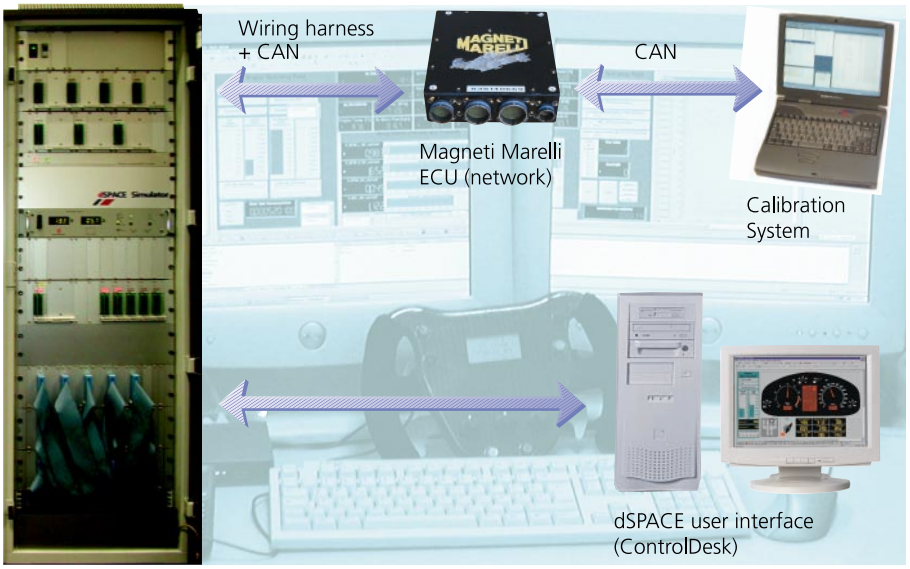
Engine controls that use only standard sensors no longer allow major improvements in fuel economy and the reduction of vehicle emissions. Another challenge is to maintain emission compliance throughout the entire vehicle life.
New engine control concepts, with the cylinder pressure as the basic feedback variable, provide an excellent base for solving these tasks.
Cylinder pressure signals give much more detailed information about the combustion process. This facilitates improved engine management and the reduction of vehicle emissions. Gasoline engines with cylinder-pressure-based engine control feature an improved cold-start behavior, better warm-up of the catalytic converter, and enhanced control of ignition time, air-fuel ratio and exhaust-gas recirculation. These features all play a key role in reducing vehicle emissions, that is, particulates and NO_X. In addition, excellent knock signal detection, misfire and partial burn detection can be achieved. Cylinder-pressure-based controllers for diesel engines feature, above all, improved engine management and a much better idle speed control .
The likelihood of cylinder-pressure-based controls being present in high-volume cars is coupled, of course, with the availability of less expensive pressure sensors in the future.

Toyota Motorsport Races with dSPACE

CUSTOMERS

- Simulation replaces expensive tests
- dSPACE Simulator with 450 I/O channels
- New generation of Formula One control system

To guarantee smooth, simultaneous development of ECU and vehicle, the electronic control units of Toyota's new Formula One racing car require testing at an early stage. At this time, tests on the road would be too dangerous, too expensive and not satisfactory as only a small portion of all possible failure conditions could be detected. Several tests are not possible as most measuring devices do not fit in the small racing car. The solution is hardware-in-the-loop simulation with dSPACE Simulator, which checks all specification requirements *"off-road"* in the lab.



Test stand with dSPACE Simulator Full-Size.

Our Formula One racing car is entirely designed and built in-house in Cologne, Germany, by a team of more than 550 talented engineers. We were looking for a modular concept for testing ECUs in the software design and integration phases of development, and for acceptance tests later. In order to meet these demands, we decided to use the turn-key dSPACE Simulator for the complete powertrain, covering the entire I/O of the ECU network, as well as the engine (V10 engine) and chassis signals. The test stand consists of dSPACE Simulator Full-Size, ECUs, and Magneti Marelli Vision32 calibration system.

The simulator was completely engineered at dSPACE. It was then quickly installed at our own facilities where our Toyota Motorsport engineers found it easy to start the simulation process.

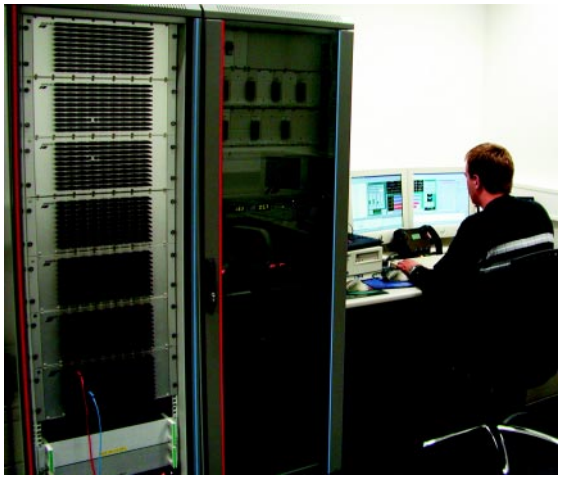
More than 20,000 RPM

The simulator is suitable for all engine (closed loop) and chassis (stimuli) signals, with a total of more than 300 I/O channels, which was recently increased to 450. This makes enormous demands on real-time hardware. To simulate the dynamic behavior of the engine and its components, the en-DYNA engine model from TESIS, Munich, is integrated into the simulation process. The Simulink-based engine model is ideally suited to dSPACE Simulator. Communication between dSPACE Simulator and the ECU is via three DS2210 HIL I/O Boards that simulate and measure all the signals for the 10-cylinder engine. The boards can even generate crankshaft and camshaft signals of up to more than 20,000 RPM (1 rev. = 3 ms). These features make the DS2210 unbeatable in racing applications.

More ECUs, Less Weight

We are using the distributed control system "Step 10", supplied by Magneti Marelli, in the Formula One racing car. That means there are 10 ECUs in the racing car and some additional ECUs in the test car for additional controls and measurements. Step 10 is a flexible system and can handle a large number of I/Os, without increasing the complexity of the wiring harness. The system is used for engine management, transmission control and data acquisition. For example: Upright boxes measure wheel speed. This is important in terms of traction control as it reduces engine power to prevent wheel spin. The Master ECU reacts by enhancing traction and maintaining vehicle stability. After a gap of a few years traction control was approved for Formula One again and has been in use since this year's Spanish

Grand Prix in Barcelona – making electronics even more important in racing.



Simulator operation by steering wheel.

Gearshift in Less than 40 ms

In racing cars, gears are shifted by hydraulic actuators under ECU control. The driver just presses the "upshift" or "downshift" button on the steering wheel to initiate the gearshift sequence. Several closed-loop controlled systems must be regulated during the shifting sequence. For instance, during upshift the engine speed is reduced by closing the throttle and cutting the ignition, the clutch actuator then opens. The gear actuator engages the next gear, and the power is reinstated by opening the throttle and closing the clutch. This gearshift control sequence is done in less than 40 ms. With dSPACE Simulator, the strategies for gear-shifting, clutch control and engine control are tested thoroughly. Only with a real-time closed-loop model is it possible to test the time characteristics of the strategies.

Eliminating Expensive On-Road Tests

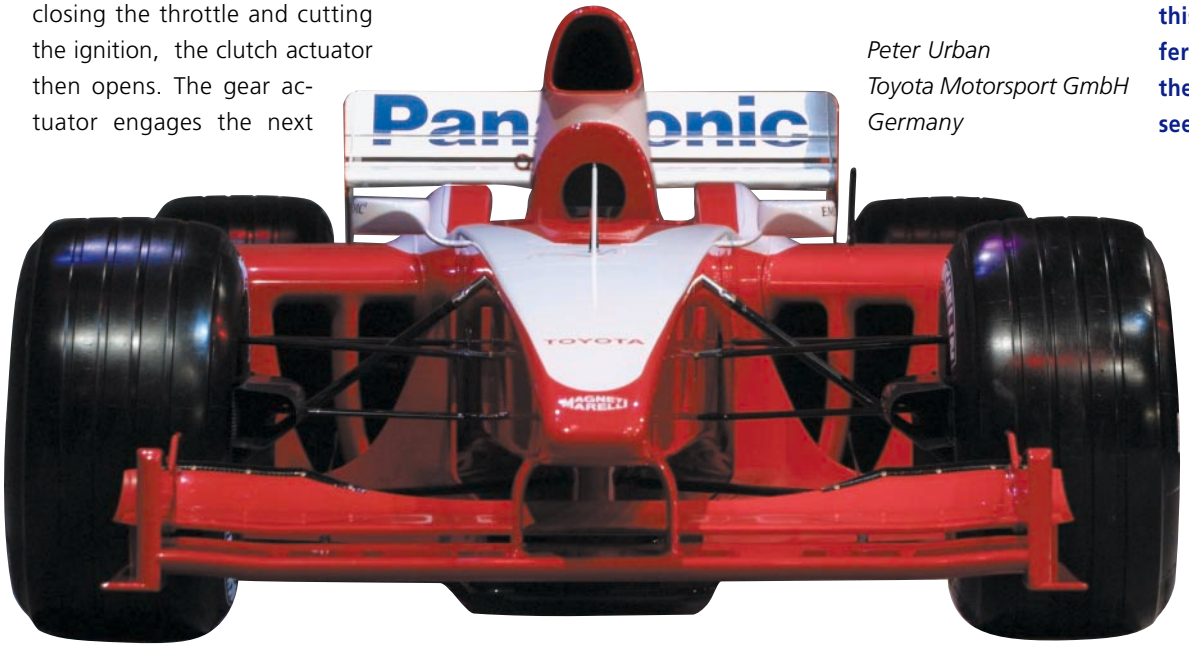
Hardware-in-the-loop tests with dSPACE Simulator Full-Size are easy to perform with test automation. This is important for testing the diagnosis functions of ECUs systematically within an extremely short time. Communication between ECUs (via CAN) as well as all ECU functions and channels are tested automatically in a closed control loop before the test drive and afterwards. This gives the engineers detailed information about ECU behavior in normal situations and in the event of an error.

Further Simulators Ordered

Simultaneous engineering is made possible with the turn-key dSPACE Simulator Full-Size, enabling us to develop and test electronics in parallel with engine and racing car development. Moreover, we don't need a resident engineer – the simulator makes it easy for us to add in our own know-how. With the aid of dSPACE Simulator Full-Size, we are cutting the duration and cost of tests, and getting detailed information about our ECUs that could not be obtained in any other way.

As proof of the successful cooperation with dSPACE we have already ordered further dSPACE Simulators.

Peter Urban
Toyota Motorsport GmbH
Germany



Peter Urban will discuss this topic at the "Conference on Hardware-in-the-Loop Simulation", see page 2.

TargetLink: A Driving Force at Honda

CUSTOMERS

- TargetLink code controls electric power steering
- Production code generated for complete application part
- Convincing execution speed thanks to the efficient code

INFO 01

A significant step in the development process of electronic control units (ECUs) is production code generation. Honda applied TargetLink to set up electric power steering (EPS), and found the generated code highly satisfies the conditions required for production code.

What is EPS?

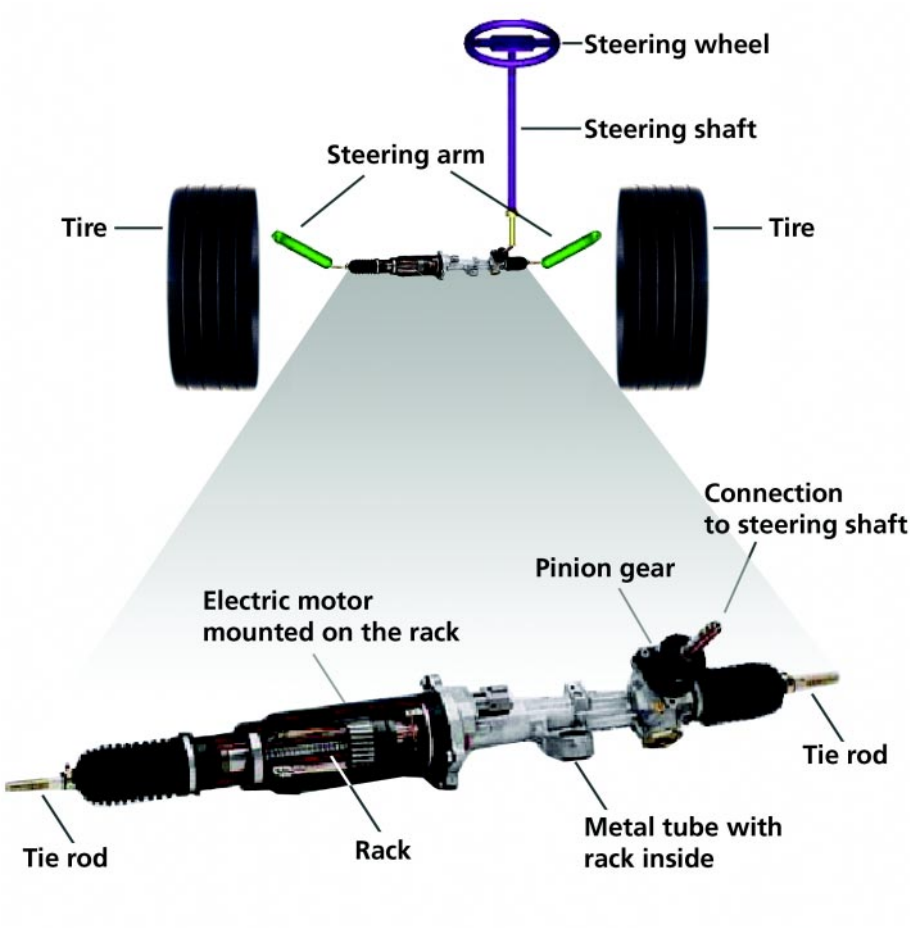
Normally, steering power is supplied by a hydraulic pump driven by a motor. With EPS, an electric motor, mounted on the rack, provides the driver with power assisted steering. Sensors on the steering wheel tell a control system where the driver is steering, and the electric motor provides steering power accordingly.

Modeling and Offline Simulation

First of all, we designed the new control functions in a block diagram using the modeling tool MATLAB/Simulink. We then converted the Simulink model into a TargetLink model, a simple process involving only a few mouse-clicks. This allowed us to add production code information to the Simulink model like scaling for fixed-point variables or variable classes. In addition, offline simulation was performed to check for possible computation overflows during floating-point simulation and to analyze the effect due to quantization errors during fixed-point simulation. TargetLink performed these tasks effectively.

TargetLink for the Application

The application part is coded by TargetLink, whereas the hardware related parts are generally handcoded. We clearly separated the application part from the hardware part, which enabled us to develop both ECU programs concurrently with application engineers (control algorithms) and software engineers (I/O and OS). The automatically generated application code was delivered to



The components of electric power steering.

The Principle of EPS

EPS is a system which generates steering power by means of an electric motor. It is a form of direct electric steering where no hydraulic pump is necessary. An electric motor is mounted directly on the rack to provide the driver with the power assisted steering.

The illustration shows that this EPS is based on a rack-and-pinion steering system.

This rack-and-pinion gearset is enclosed in a metal tube, with each end of the rack protruding from the tube. A tie rod is connected to each end of the rack.

When the driver turns his steering wheel, the steering shaft, which is attached to the pinion gear, turns the pinion, thus moving the rack.

The rotational motion of the steering wheel is converted into a linear motion.

The electric motor, which is controlled by an ECU assists the driver with an additional force at the linear motion part, thanks to the direct mounting on the rack.

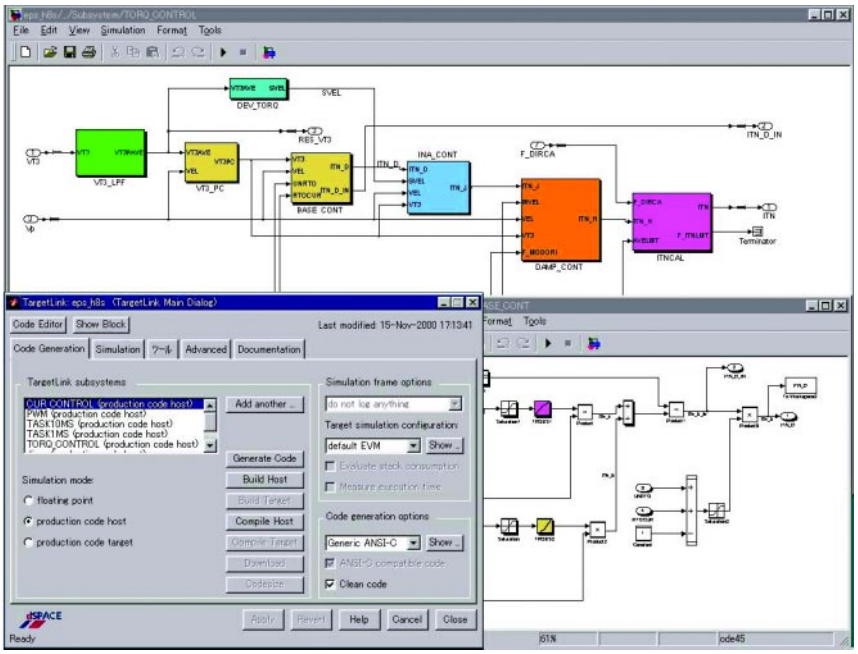
the software engineer, who compiled, linked and implemented it. We finished this work in only 2 months. This confirmed that TargetLink dramatically shortens the time required for the implementation process including documentation, coding and debugging.

Highly Reliable Code

We verified the proper behavior of automatically generated code by performing offline fixed-point simulation (production code host simulation). This provided us with time histories of input/output data to and from the control algorithm. The behavior of the test ECU was identical to the one we obtained by fixed-point simulation, which was a result of the highly reliable code generated by TargetLink.

Convincing Execution Speed

We tested the performance of the generated code on two types of target processors, a 32-bit RISC CPU and a 16-bit CPU, supplied by Hitachi. Because the sampling period of the EPS plant was very short, in the order of a few hundred microseconds, the requirements for execution speed were very strict. The fixed-point simulation mode (production code target simulation) showed that 32-bit microprocessors fulfilled the requirements for both execution speed and code size. This convinced us that the generated code is at the level required for implementation on the production-type ECU. By slightly optimizing the Simulink model, we would have got similar results even on the 16-bit CPU.



TargetLink block diagram.

A Perfect Solution

We achieved considerable improvements in development efficiency by applying TargetLink. The evaluation of TargetLink convinced us that TargetLink has completely solved the technical problems of automatic code generation and meets industrial needs perfectly.

Yukihiro Fujiwara
Honda R&D Co. Ltd.
Tochigi R&D Center
Japan

dSPACE Training

For more details, please visit *www.dspace.de* or check the corresponding field on your response card. Further dates available on request.

dSPACE Systems

Paderborn, Germany:
- November 6-7, 2001

Detroit, USA
- September 13-14, 2001
- October 11-12, 2001
- November 15-16, 2001

ControlDesk Basics

Paderborn, Germany:
- September 11, 2001
- November 20, 2001

ControlDesk Advanced

Paderborn, Germany:
- September 11-12, 2001
- November 20-21, 2001

Test Automation

Paderborn, Germany:
- September 12-13, 2001
- November 21-22, 2001

HIL Simulation

Paderborn, Germany:
- October 10-11, 2001
- December 11-12, 2001

TargetLink

Paderborn, Germany:
- October 18, 2001
- November 29, 2001

Detroit, USA:
- September 11-12, 2001
- November 13-14, 2001

Trendsetting – Connecting Simulink to OSEK

PRODUCTS

- **Operating system functionalities can be mapped as early as the function design phase**
- **TargetLink code OSEK/VDX-compliant soon**
- **OSEK/VDX is gaining acceptance as an operating system standard**

INFO 02 *English*
INFO 03 *German*

What impact are real-time operating system standards such as OSEK/VDX having on production code generation? This is just one of the questions ECU developers are asking today.

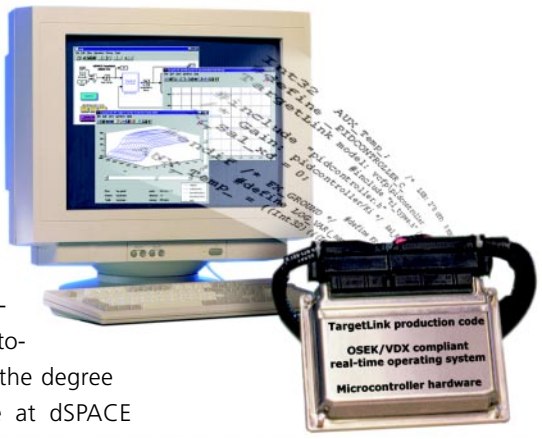
What Is OSEK/VDX?

OSEK is the German abbreviation for "open systems and the corresponding interfaces for automotive electronics", and VDX stands for "Vehicle Distributed eXecutive". The OSEK/VDX operating system standard describes a static real-time operating system whose objects (tasks, events, messages, resources, etc.) are all created at the time of compiling. These operating system objects are defined in the OIL database (OIL: OSEK/VDX Implementation Language).

Working Hand in Hand: TargetLink and OSEK/VDX

As an open system, TargetLink already allows the manual implementation of production code together with every real-time operating system, including those which are OSEK/VDX compatible. When using a code generation tool in conjunction with the OSEK/VDX standard, significantly more implementation work can be automated. To improve the degree of automation, we at dSPACE made a major decision on this issue: We plan to completely integrate the OSEK/VDX operating system standard into TargetLink's code generation process within one year. The main new features of TargetLink will be to generate:

- an executable OSEK/VDX application automatically
- function calls for all necessary operating system services
- the OIL database



Why Is dSPACE Supporting OSEK/VDX?

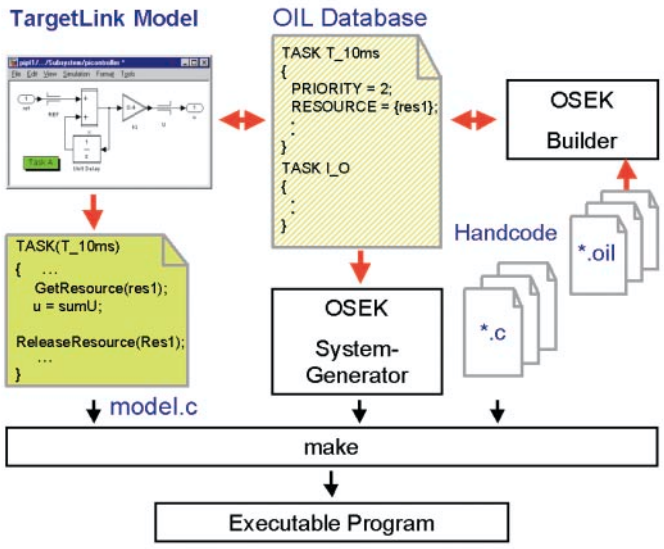
The OSEK/VDX standard defines a uniform operating system functionality and a uniform programming interface for the operating system services. This enables the code generator to automate the connection to this software layer. With proprietary real-time operating systems, connection can only be done by additional manual programming. OSEK/VDX is now widely used in the automotive industry, and there are a number of highly efficient commercial operating systems that meet its standards. As a result, users would also like automatic connection of code generation to their OSEK/VDX-compliant real-time operating system.

What Are the Objectives of OSEK/VDX?

- To speed up development times
- To enhance software quality by reusing software models that have already been tested
- To optimize memory utilization by means of scaling
- To reuse software in different environments

Cooperation Speeds up the Process

To make interaction between the OSEK/VDX operating system and TargetLink seamless, dSPACE is closely cooperating with OSEK/VDX vendors. This, and dSPACE's membership as an OSEK/VDX Committee Partner, is helping dSPACE to achieve optimum integration of real-time operating systems in TargetLink's code generation process.



Interaction of the development tools.

dSPACE Software Follows MATLAB Release 12.1

PRODUCTS

- dSPACE software will support new features of MATLAB R12.1
- Ready for shipment in September
- TargetLink 1.3

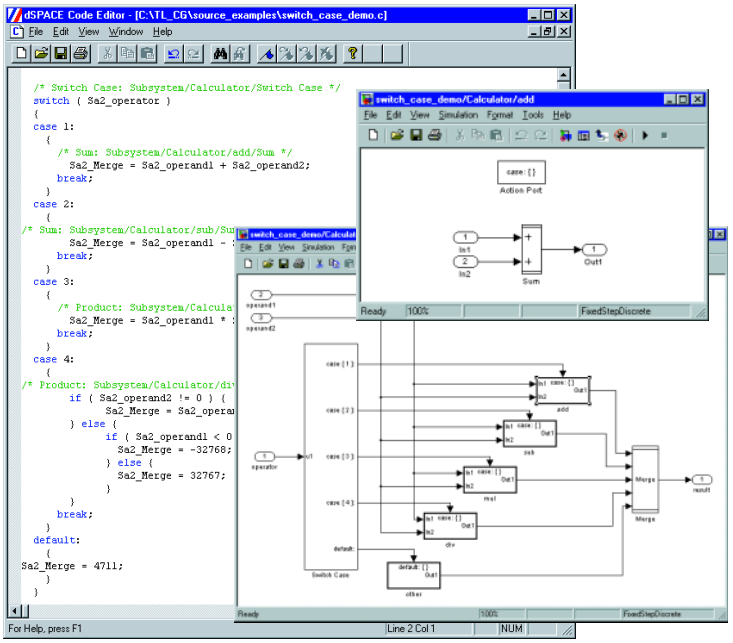
dSPACE plans to provide a compatibility upgrade for its whole product range within two months of MATLAB Release 12.1.

What Will Be New to dSPACE Software?

The upgrade will support, in the main, an extended Simulink block library containing the following new blocks:

- If block, Switch Case block, Action Port block
- For Iterator block, While Iterator block
- Assignment block
- Bus Creator block

Semantical changes in the Simulink block library and Stateflow have also been implemented in the new TargetLink version.



Screenshots with Switch Case block and an excerpt of an authentic code example which will be generated by TargetLink.

dSPACE products related to MATLAB R12.1 software, like Real-Time Interface and ControlDesk, will be available on CD as Release 3.3. TargetLink will be released on a separate CD and have the new version number TargetLink 1.3.

Teaming Up with Motorola

BUSINESS

Motorola Inc., a leading supplier of semiconductors to the automotive industry, and dSPACE plan to boost efficiency and cut the time necessary for developing software for electronic control units (ECUs).

The dSPACE TargetLink tool and its processor-specific optimization modules make it possible to adapt automatically generated code perfectly to a special processor architecture.

Motorola will provide the needed information on new microprocessors to dSPACE at the stage before the first engineering samples of new processor architectures are available. In exchange, dSPACE will implement evaluation board support and target optimization modules for Motorola processors in TargetLink. The simultaneous development of processors and corresponding code generators (at first planned for Motorola's STAR12 and PowerPC MPC555 families) anticipates production-quality code generation from TargetLink to be available at almost the same time as new processors enter the market. "It is impressive how the TargetLink optimization module harnesses the potential performance of our microprocessors – both the PowerPC family and the HC12 family," states Salim Momin, director Motorola Virtual Garage.

Salim Momin, Motorola.

"As processors become increasingly sophisticated, their complexity increases. TargetLink will help software developers in the embedded industry meet the challenges of that complexity, while also helping them benefit from the advances in technology."

New Engineering Center in Stuttgart

BUSINESS

Our customers in southwest Germany now have the convenience of on-site dSPACE support since we recently opened a new Project Center in the business park "Geopark" in Stuttgart.

Our main intentions are to offer engineering services for turn-key hardware-in-the-loop systems, TargetLink applications, and rapid control prototyping applications. An example of an extensive ongoing HIL project in Stuttgart deals with a multi-ECU virtual car system for testing body electronics in addition to the complete powertrain of a future car.

Some of our support engineers. From left to right: Falko Mierke, Julian Rösner, Jürgen Paule (lead engineer applications), Ulf Homann.

dSPACE GmbH
Projektzentrum Stuttgart
Geopark
Max-Eyth-Str. 35
71088 Holzgerlingen
Tel.: +49 7031 67794 60
Fax: +49 7031 67794 888

Stuttgart Project Center located at Geopark, Stuttgart.

Business park entrance.

Other projects that our engineers in Stuttgart will be responsible for are dedicated to modern engine management ECUs and climate control systems. The area around Stuttgart is especially suitable for a Project Center, as key customers like Daimler-Chrysler are located nearby. This close cooperation between dSPACE and the automotive development departments is our response to the increasing demand for turn-key systems.

With business starting on August 1 in Stuttgart, we aim to be as successful as the Project Center in Munich, offering even more knowledge transfer through our dSPACE consultants on location. The fact that we are close by is much appreciated by customers like BMW and Audi, where successful projects have already been carried out. The Audi SPEA project (see last dSPACE NEWS) proves the high efficiency of the combination of dSPACE's real-time tools and on-site engineering services in the field of powertrain simulation.

dSPACE GmbH on Expansion Course

It was only in the fall of last year that we reported we had expanded to a third building at our headquarters in Paderborn. Since then, 70 new colleagues have started working with us, and we realized we needed to find yet more new facilities.

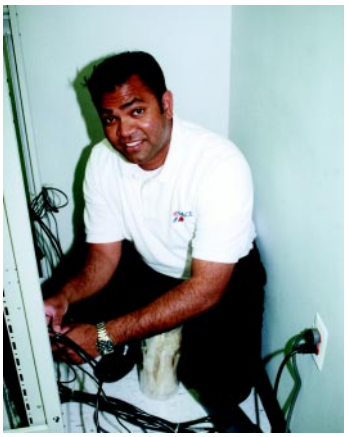
And so we did! On July 1, 2001, we expanded our office space by 1,500 square meters (16,000 square feet). The facility, with numerous, comfortable offices, is situated close to the main building. As the sales and customer services departments have grown considerably, a boost in space was vital, and eventually 66 employees moved into the new facility. Now, with 280 colleagues in Germany, we are continuing our successful business at our headquarters in Paderborn as well as at our Project Centers in Munich and Stuttgart.

More comfortable offices for dSPACE Paderborn.

dSPACE Inc. Grows and Moves

dSPACE Inc. is proud to announce the opening of the all-new and expanded North American headquarters in Novi, Michigan, on July 1, 2001. The growing number of dSPACE Inc. colleagues, increasing sales, and more requests for engineering services resulted in the need for more space!

Since we established the North American office in Detroit in 1991, the US office has grown from 1 to 30 employees, and expects to grow by 20 new employees within the next years. On July 25, 2001 dSPACE Inc. held an open house to celebrate its growth within this rapidly expanding industry and its 840 square meters (9,000 square feet) of expanded space. All in all we have nearly tripled our previous size. In addition to the expanded office area, we now offer a drive-in garage for in-vehicle testing, an expanded lab and a dedicated training room.



Drop by and visit us!

dSPACE Inc.
28700 Cabot Drive · Suite 1100
Novi · MI 48 377
Tel.: +1 248 567 1300
Fax: +1 248 567 0130
info@dspaceinc.com
www.dspaceinc.com

The dSPACE Inc. team in front of their new building.

Events

Europe

ASIM Jahrestagung
September 11-14
Paderborn, Germany
Paderborn University

Elektronik im Kfz
September 27-28
Baden-Baden, Germany

HIL in der Fahrzeugtechnik
October 22-23
Essen, Germany
HdT Essen

USA

SAE Engine and Powertrain Controls
TOPTEC
December 3
Detroit, MI

CDC-Conference
December 3-7
Orlando, FL
The Hyatt Regency Grand Cypress

Representatives

Australia
CEANET Pty Ltd.
Level 4, 2 Bligh Street
Sydney NSW 2000
P.O. Box R202
Royal Exchange NSW 1225
Tel.: +61 2 9232 3699
Fax: +61 2 9232 3332
info@ceanet.com.au
www.ceanet.com.au

China
China HiRain Tech. Co. Ltd.
Shangfang Plaza No. 27
Room 620
Bei San Huan Zhong Lu
100029 Beijing, P.R. China
Tel.: +86 10 82 02 19 50
Fax: +86 10 62 07 36 00
www.hirain.com

Czech and Slovak Republic
HUMUSOFT s.r.o.
Novákových 6
180 000 Praha 8
Tel./Fax: +420 2 684 41 74
info@humusoft.cz
www.humusoft.cz

France
The MathWorks France
20 rue Troyon
92316 Sevres Cedex
Tel.: +33 1 41 14 67 14
Fax: +33 1 41 14 67 15
info@mathworks.fr
www.mathworks.fr

India
Cranes Software Intern. Ltd.
29, 7th Cross, 14th Main
Vasanthanagar
Bangalore - 560 052
Tel.: +91 80 2381 740
Fax: +91 80 2384 317
info@cranessoftware.com
www.cranessoftware.com

Israel
Omikron Delta (1927) Ltd.
10 Carlebach St.
Tel-Aviv 67132
Tel.: +972 3 561 5151
Fax: +972 3 561 2962
info@omikron.co.il
www.omikron.co.il

Japan
LinX Corporation
1-13-11 Eda-nishi
Aoba-ku, Yokohama-shi
Kanagawa, 225-0014 Japan
Tel.: +81 45 979 0731
Fax: +81 45 979 0732
info@linx.jp
www.linx.jp

Korea
Darim System Co. Ltd.
Expo VentureTown 3rd Fl.
DoRyong-Dong 3-1
YuSung-Gu
Taejon
Tel.: +82 42 601 1366
Fax: +82 42 864 4749
ksh@mail.darimct.co.kr

Netherlands
TSS Consultancy
Rietkraag 37
3121 TC Schiedam
Tel.: +31 10 2 47 00 31
Fax: +31 10 2 47 00 32
info@tsscon.nl
www.tsscon.nl

Poland
ONT
ul. Obozna 11
30-011 Kraków
Tel.: +48 12 632 32 60
Fax: +48 12 632 17 80
info@ont.com.pl
www.ont.com.pl

Sweden
FENGCO Real Time Control AB
Hallonbergsplan 10, Kompassen
Box 7068
174 07 Sundbyberg
Tel.: +46 8 6 28 03 15
Fax: +46 8 96 73 95
sales@fengco.se
www.fengco.se

Taiwan
Scientific Formosa Incorporation
11th Fl. 354 Fu-Shin N. Road
Taipei, Taiwan, R.O.C.
Tel.: +886 2 2505 05 25
Fax: +886 2 2503 16 80
info@sciformosa.com.tw
www.sciformosa.com.tw

United Kingdom
The MathWorks Ltd.
Matrix House
Cowley Park
Cambridge CB4 0HH
Tel.: +44 1 223 423 200
Fax: +44 1 223 423 255
info@mathworks.co.uk
www.mathworks.co.uk

Headquarters in Germany
dSPACE GmbH
Technologiepark 25
33100 Paderborn
Tel.: +49 5251 1638-0
Fax: +49 5251 66529
info@dspace.de
www.dspace.de

USA and Canada
dSPACE Inc.
28700 Cabot Drive · Suite 1100
Novi · MI 48377
Tel.: +1 248 567 1300
Fax: +1 248 567 0130
info@dspaceinc.com
www.dspaceinc.com

France
dSPACE SARL
Parc Burospace
Bâtiment 17
Route de la Plaine de Gisy
91573 Bièvres Cedex
Tel.: +33 1 69 35 50 60
Fax: +33 1 69 35 50 61
info@dspace.fr
www.dspace.fr

United Kingdom
dSPACE Ltd.
2nd Floor Westminster House
The Anderson Centre
Ermine Business Park
Huntingdon
Cambridgeshire PE296XY
Tel.: +44 7 980 587 337
info@dspace.ltd.uk
www.dspace.ltd.uk

From Nov. 1, 2001, contact our new dSPACE offices in France and the UK.

dSPACE