Edited by ***Kevin Jost***

VW project updates an icon

Viewed from a distance, the 1964 **Volkswagen** Deluxe Microbus temporarily parked inside the automaker's North American headquarters looks at home amid a mini-museum stocked with original Beetles and other iconic Volkswagen vehicles. But an up close inspection reveals a modernized Microbus with the latest lighting technologies, an electric propulsion system, a driver recognition sensor, and other well-concealed 21st century features.

"There are lots of hidden technologies on the vehicle, and everything is kept as unobtrusive as possible until it's needed," said Vickie Chiang, Engineer for Displays, Sensors, and Materials at Volkswagen's Electronics Research Laboratory (ERL). About 15 engineers at Volkswagen's California lab dressed up the Microbus with an array of present and future technologies.

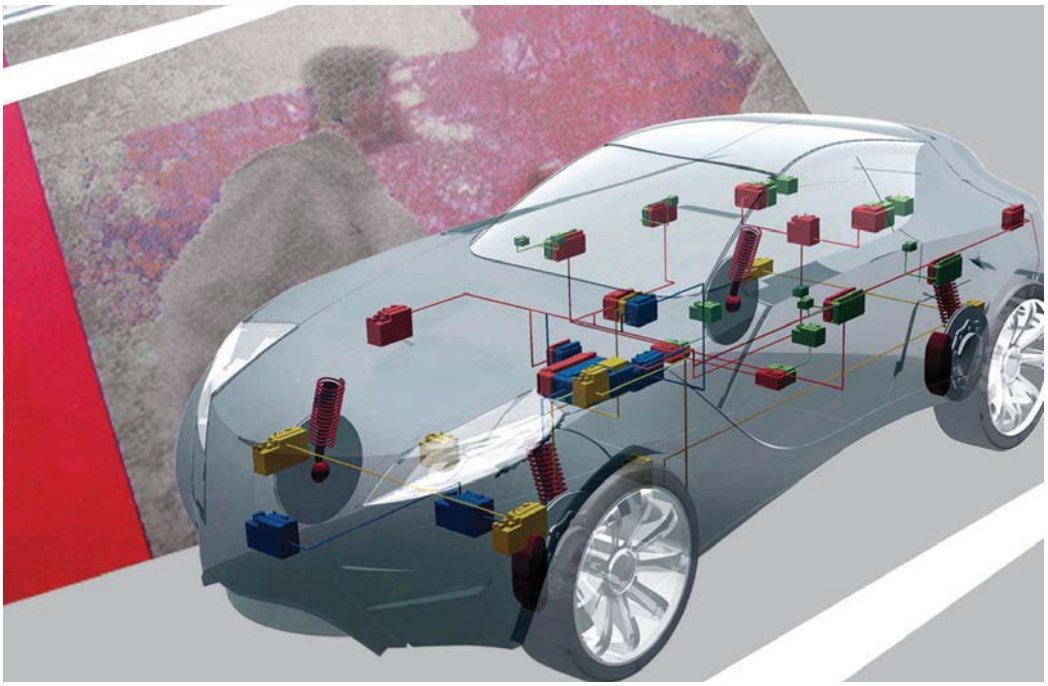
VW's Vickie Chiang was involved in retrofitting a 1964 Microbus with new technologies such as adding flexible solar cells to a roof-rack stowed surfboard. The solar cells provide supplemental power for charging the Microbus.

All of the Microbus's major lighting and signaling systems employ LED technology within the stock vehicle's housing units. For instance, eight LEDs shine through light guides in each taillamp. "The **Osram** Direct View Optics used for the taillights represent in-development technology," said Steve Sidwell, Engineering Supervisor with Osram Sylvania's Automotive Lighting group. White LED headlamps are showcased but because the LEDs run hot, the Microbus uses six individual fans inside each headlamp. "It's just a matter of time before there's a way to cool the LEDs in a more efficient and less costly manner," said Sidwell.

Hybrid Technologies supplied the electric drive system that is powered by a 10 lithium-polymer battery pack from **Kokam** Co. Ltd. having 29.6-kW·h capacity. "At full charge the 320-V system will provide an approximate 100-mi driving range," said Chiang, noting that a full recharge takes about eight hours and is channeled through a tailpipe cord that plugs into a 220-V outlet.

The inside of the fuel door has been fitted with a touch-less **Fujitsu Technologies**' palm vein sensor to determine if a pre-authorized person is being scanned. If a match is made, the system sends a signal for the doors to be unlocked. "It's very hard to duplicate," said Chiang, pointing out that in order for an authorization match to be made the person must have blood moving through his or her veins.

A custom rear-seat entertainment system, with a 40-in diagonal screen from **Sony**, is concealed within a seatback. "Sony's patented screen technology absorbs and reflects select light wavelengths to create a higher contrast, higher brightness image. This is especially useful in a



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Osram Sylvania LEDs illuminate the Microbus's updated instrument cluster. More than 15 new technologies are featured on the Microbus.

Microbus that has 21 windows," said Chiang.

The Microbus also features new spins on existing technologies. For instance, series production parking sensors—six in the rear bumper and six in the front bumper—use new software code that enables directional object detection. "Each sensor takes a distance reading, and that individualized data can tell more specifically where an obstacle is located, like the vehicle's left rear side or the vehicle's right rear side," said Chiang.

Although Volkswagen will launch a new minivan in 2008—a variant of the next-generation **Chrysler** minivan—the technologies showcased on the updated Microbus were done without any special vehicle application in mind. "The ERL had never done a technology showcase of this magnitude before this project," said Chiang. "But we knew this would be a good way to present the different technologies and capabilities of the ERL to our fellow colleagues and VW enthusiasts."

Kami Buchholz

ADI processor aids traffic-sign recognition

One of the main hindrances for the use of mainstream consumer electronics innovations in the car is the vast gap in product life cycles: Components and technologies specified these days for oncoming vehicle models will be used in cars that will not go onto the market before 2009 or beyond. In other words, by the time the development of a new model is finished and production commences, its electronics are outdated. Software is one way out of this dilemma as its use offers the flexibility and updateability needed to bridge the life-cycle gap.

Analog Devices Inc. (ADI) is a proponent of software solutions and has developed its Blackfin platform of telematics processors accordingly. They are designed with an architecture that offers programmability and scalability. The ADSP-BF54x's performance, for instance, will span low power versions beginning at 400 MHz/400 MIPS/84 kB RAM and no peripherals up to symmetrical dual-core units with 500 MHz/1000 MIPS and up to 532-MB internal bus bandwidth and 260-kB RAM plus peripherals.

At electronica 2006, the big Munich multi-industry electronics event held in November, ADI presented the new Blackfin dual-core processor family that combines higher computational performance with low energy consumption. The new processors also offer a variety of peripherals including CAN and MOST, integrated security functions to protect software and up to 152 general-purpose I/O ports.

The first member of the new Blackfin BF54x works at 500 MHz, has 260-kB on-chip memory (level 1 and 2), and supports up to two CAN controllers (2.0B). To prove the potential of its programmable processors, ADI chose a processing-intensive application. At the electronica show, the company demonstrated an embedded prototype system for traffic-sign recognition based on a single Blackfin processor.

The processor interprets an incoming signal from a 30 frames-per-second grayscale CMOS (complementary metal oxide semiconductor) image sensor. The CMOS signal is transmitted directly to one of the processor's video interfaces. One of the Blackfin cores executes the traffic-sign recognition application, CAN communication, and controls the whole system; the second core controls the dashboard monitor including graphic overlays. The system is based on a software flow that consists of an initial Sobel filter, followed by a Hough transform, clustering, and search for possible circles in the image. By matching of circular patterns, German-type prohibition traffic signs are recognized and the identified traffic sign is displayed on a monitor.

Typically an application like this would require an FPGA (field programmable gate array), a control unit, and digital signal processing. The Blackfin processor integrates all these function in one embedded system that is cheaper and offers faster time to market, claims Analog Devices.

Audi is one of the customers that uses Blackfin processors. "System performance has turned into an important parameter as audio, video, and hands-free telephone applications keep asking for more computational power," said Peter Kohlschmidt, Director Development Infotainment at Audi AG in Ingolstadt. "The Blackfin processor has proven a suitable solution for our head units."

As the Analog Devices system processor is software-based, it could be used within a number of additional functions such as lane-departure warning, night vision, blind-spot detection, park control, and adaptive cruise control.

Jörg Christoffel

Analog Devices' traffic-sign recognition prototype is based on embedded computing; a single processor accomplishes the task.

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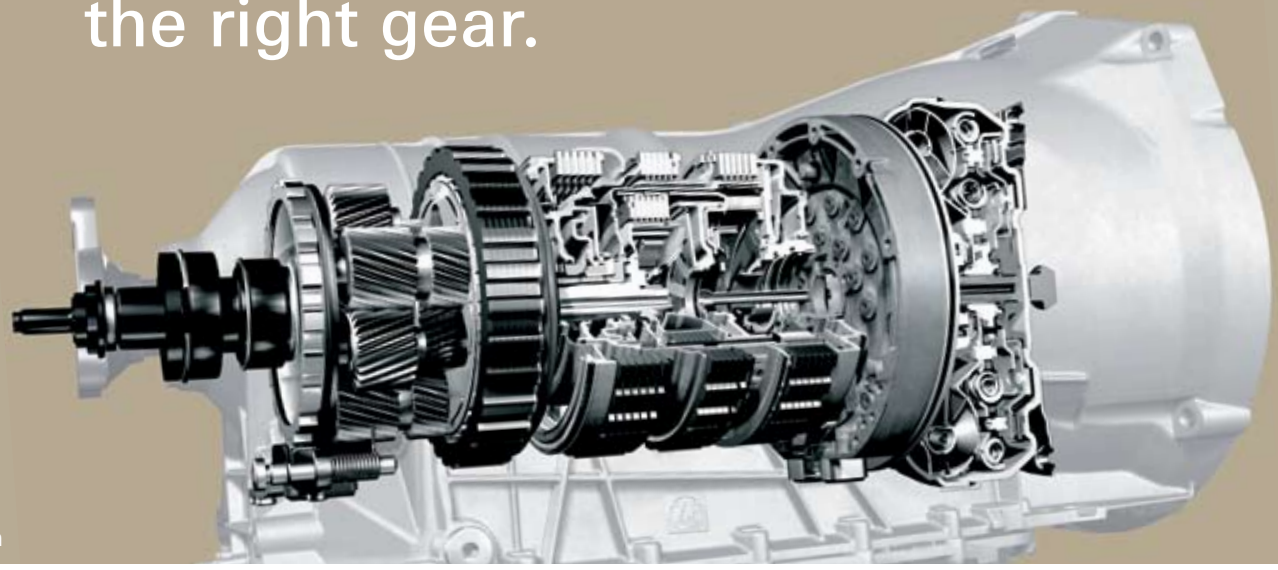

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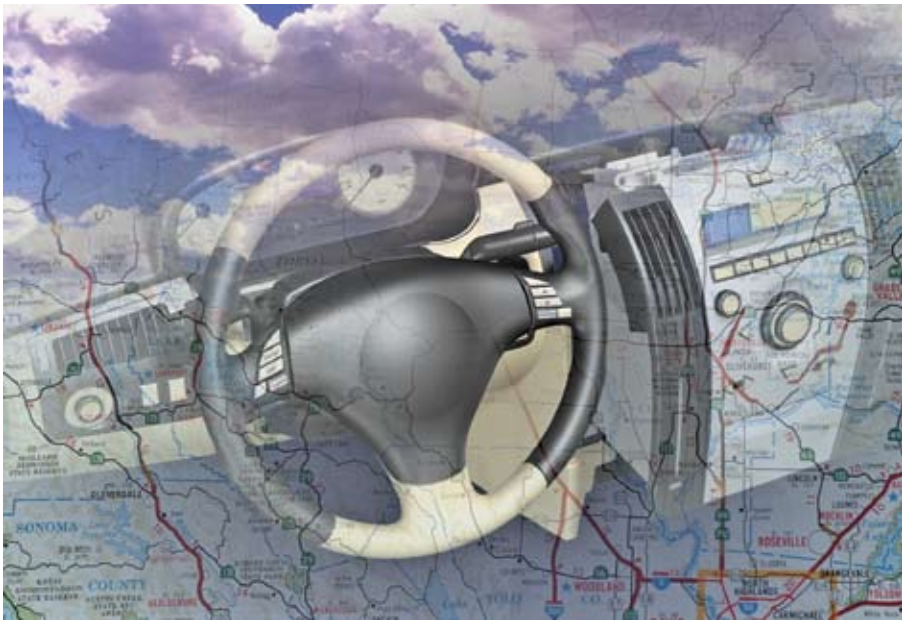
Driveline and Chassis Technology

Software simplifies adoption of consumer tech

Commercial software operating systems are moving to increase their role in automotive applications by making it easier for engineers to respond to changes driven by the semiconductor industry. **Green Hills Software** is addressing the move to multi-core CPU (central processing unit) architectures and increasing memory sizes. The company's Integrity 10 real-time operating system (RTOS), which celebrates the 10th anniversary of the royalty-free RTOS, comes as carmakers rely more on RTOSs to address the many consumer products lumped together under the infotainment banner.

Integrity 10 will facilitate the move to multi-core CPUs that is well under way in PCs. A few chipmakers have unveiled automotive-grade multi-core chips, and more are expected as the technology evolves.

A key benefit of multi-core devices is reduced power consumption, since mul-



As infotainment options expand, RTOS providers are addressing trends in consumer technologies.

tiple processors can run at slower clock speeds. Slower clock rates make it possible for successive generations to continue providing more processing capability without the dramatic increases in power consumption and heat generation that came with faster clock speeds.

Integrity 10 supports both this symmetric multiprocessing (SMP) and the related shift to non-uniform memory architectures. The software's SMP features include load balancing across processors, while NUMA (nonuniform memory access) support includes memory allocation and memory partitioning. Together, these technologies help ensure that the system failures associated with PCs do not migrate to vehicles.

The partitioning ensures that memory will be available for all tasks and also prevents problems with one task from impacting other chores. Memory partitioning augments CPU allocation, which ensures that one job will not consume all the system's processing capabilities.

The advances come as the role of RTOSs is also changing, especially in infotainment, one of the applications that is adopting commercial operating systems fairly quickly. Fast software responses can help carmakers meet the demand for more infotainment options and improved safety features by letting a processor handle infotainment tasks until it is needed by safety software.

"When the car is driving along smoothly, most of the CPU power goes to infotainment. When the system detects a possible unsafe system, all resources are dedicated to safety. To do that, you need an RTOS that has very fast context switching times," said Eric Jensen, Project Engineer at **Volkswagen** Electronics Research Lab.

Development time, a critical aspect for integrating consumer technologies into vehicles, is also addressed by a number of tools. A debug agent simplifies application debugging with minimal real-time overhead, improved performance, and additional control. The Multi EventAnalyzer provides a graphical view of system behavior, including context switches, interrupts, system calls, and interprocess communication. "We have faster event logging so you can see what happened before a software crash," said Mike Santos, Green Hills' RTOS Engineering Director.

Integrity 10 is integrated with version 5 of the Multi integrated development environment. It includes a new project manager that simplifies the creation and management of complex processes. Also included are new kernel awareness debugging features that provide more visibility into kernel object state during application development. "It's easier now to interact with the operating system directly from the debugger," Santos said.

Terry Costlow