

by John H. Day, contributing editor

COVER STORY

Automakers agree that the technology is ready, but some question the business case.

Telematics

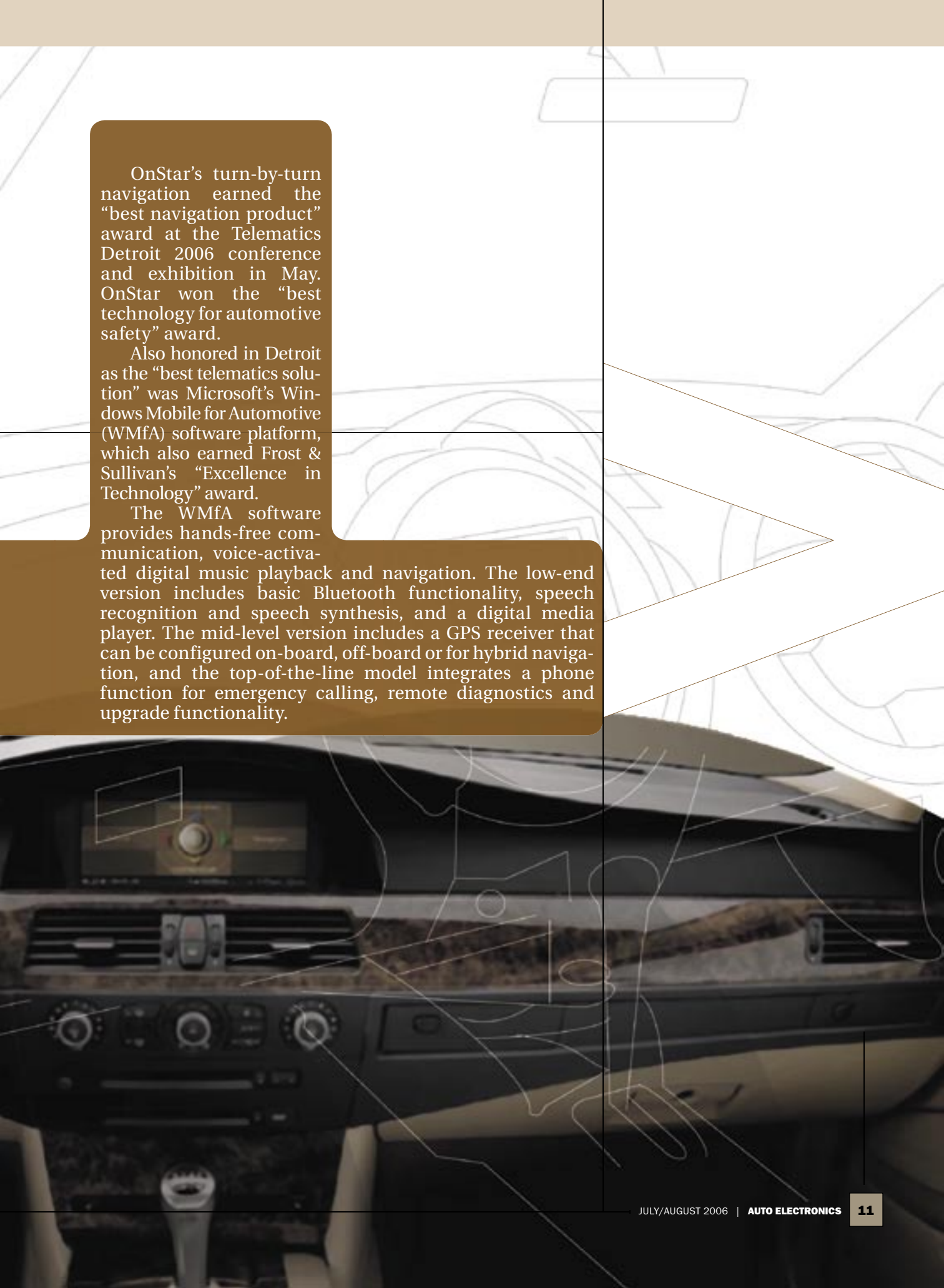
—it can save lives, but can it sell cars?

Telematics technology is available for deployment and beginning to move down market, witness General Motors' decision last year to make its OnStar system available as a standard feature on cars and trucks in North America. With features like air bag deployment notification, telematics has the potential to save lives, but can it also sell cars, or at least create a significant revenue stream?

OnStar is promoting telematics aggressively, offering an opt-in e-mail vehicle diagnostics service, and more recently introducing turn-by-turn navigation. GM has demonstrated vehicle-to-vehicle (V2V) communication that allows a vehicle to detect the position and movement of other vehicles up to one-quarter mile away. GM may elect to add vehicle-to-vehicle communication to OnStar, but it is also considering other options for that technology.

Telematics Research Group estimates that OnStar's navigation feature will help the company build its subscriber base to more than 11 million users by 2010, but cautions that it may impact sales of traditional GM navigation systems.





OnStar's turn-by-turn navigation earned the "best navigation product" award at the Telematics Detroit 2006 conference and exhibition in May. OnStar won the "best technology for automotive safety" award.

Also honored in Detroit as the "best telematics solution" was Microsoft's Windows Mobile for Automotive (WMfA) software platform, which also earned Frost & Sullivan's "Excellence in Technology" award.

The WMfA software provides hands-free communication, voice-activated digital music playback and navigation. The low-end version includes basic Bluetooth functionality, speech recognition and speech synthesis, and a digital media player. The mid-level version includes a GPS receiver that can be configured on-board, off-board or for hybrid navigation, and the top-of-the-line model integrates a phone function for emergency calling, remote diagnostics and upgrade functionality.

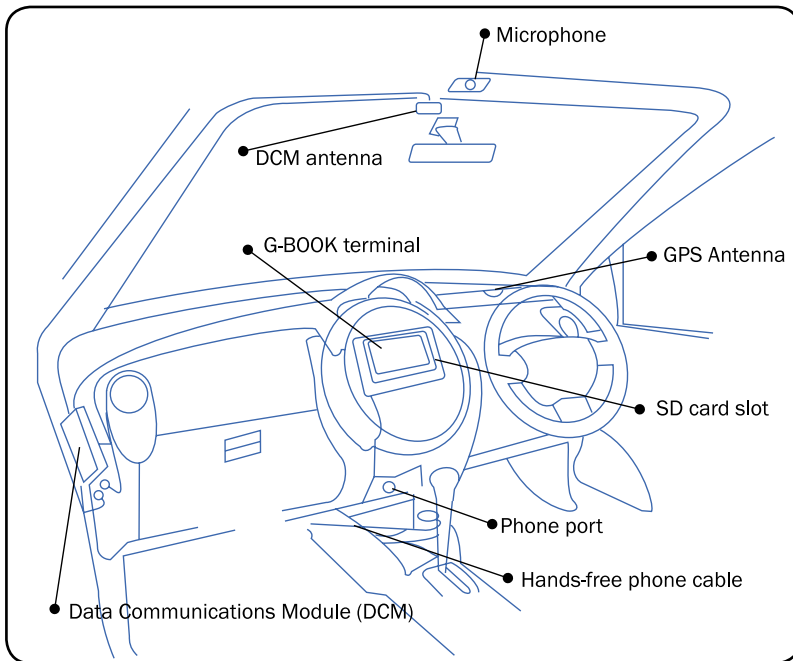


Figure 1. Toyota partnered with Matsushita, Denso and KDDI to develop G-Book.

Last year, Microsoft's Automotive Business Unit engaged Samsung Electronics, Nuance (the former ScanSoft), Siemens, SiRF, Xilinx and Magneti Marelli to develop a telematics system for Fiat, Lancia and Alfa Romeo.

System specs included diagnostic data delivered to Fiat and its dealers, Bluetooth connectivity for hands-free calling, Web services for off-board navigation and real-time traffic information and personal electronic device connectivity via a USB port. Magneti Marelli, Fiat's automotive components arm, was tasked with hardware development. The system includes Samsung's 400 MHz ARM920T-based S3C2440 processor; Xilinx' Spartan-3 FPGA; SiRF's SiRFstarII GPS chipset; Siemens' AC45 wireless telecommunications module, and Nuance's VoCon 3200 automotive voice recognition and RealSpeak synthesized speech engine.

The 90 nm Xilinx FPGA implements two UARTS, volume control, a noise suppression filter, echo cancellation, decimeters and scalars. Siemens' AC45, developed for automotive applications, enables wireless access to information on a mobile phone's SIM card via Bluetooth.

The "Blue&Me" telematics system Fiat demonstrated earlier this year provides hands-free mobile phone support, portable media player integration via Bluetooth and USB, and voice-guided navigation.

BMW and Mercedes Benz are also strong proponents of telematics. BMW Assist and Mercedes' Tele Aid are powered by ATX Group. "The market for telematics is continuing to grow," said ATX president and chief executive officer Steve Millstein. "I'm not aware of a significant OEM in North America that is not at some stage of planning for telematics."

Toyota has offered G-Book telematics services in Japan since 2002. G-Book technology (Figure 1) was developed by Toyota with help from units of Matsushita, Denso and KDDI.

G-Book uses CDMA2000 1x EV-DO communications technology to achieve 2.4 Mb/s performance. G-Book provides HELPNET emergency call

service and enables voice communication via an onboard microphone and speaker. A G-route search function combines vehicle information and communication system (VICS) traffic information with statistical data to forecast road conditions and suggest alternate routes. G-Security includes a cell phone e-mail service to notify drivers if they forget to lock their car doors. G-Book users with Bluetooth phones can connect to G-Book Alpha and access its services.

In the United States, Toyota offers a branded version of OnStar called LexusLink on four Lexus models, according to Jon Bucci, corporate manager in the advanced technology department at Toyota Motor Sales USA. The service is available at three plan levels:

1. Safety, including airbag deployment notification (an automatic emergency call from a dedicated onboard cell phone); stolen vehicle location assistance; emergency services notification; roadside assistance; remote door lock/unlock; remote horn and lights; accident assist (from the call center), and playback of advisor instructions.
2. Directions, including turn-by-turn routing to specific destinations; information and convenience services, and ride assist.
3. Personal concierge, including personal/business travel arrangements, reservations and event tickets.

LexusLink provides personal calling, and will provide weather information, traffic reports, and a customized stock market report, but it doesn't send e-mails to let owners know how efficiently their vehicles are operating.

Bucci said further deployment of telematics in the United States depends less on technology than on the business case. "It's not easy to justify driving the (telematics) feature and service set down

through the model lineup," Bucci said, adding that Toyota conducts in-depth studies to determine how much buyers are willing to pay for telematics services. "Corolla and Scion buyers have other things north of telematics that they're (more) concerned about. Vehicle quality, reliability and dependability rank much higher."

Safety and security features attract attention to telematics, according to ATX Group's Millstein, but the real value in the technology, at least for OEMs, is the ability to interact with customers. "We're starting to see the benefits of that now," he said, adding, "Over time, telematics will morph from something that the subscriber pays for to something that the OEM pays for, because of the value of the data. In the future, we see connection being

more important than content."

Toyota recognizes the value of obtaining real-time information on the "health" of a vehicle, but the cost of connect time for each contact with a vehicle is a consideration, and owner privacy is also a concern, since vehicular monitoring could, at least theoretically, keep tabs on customers' driving habits. "If we did offer (vehicle diagnostics), it would have to be on an opt-in basis. It's not something we're going to bolt in," said Bucci. "There's no value to us if we're perceived like 'Big Brother.'"

"As a technology with life-saving potential, telematics doesn't come near that of side air bags and electronic stability control," observed John Krafcik, vice president of product development and strategic planning at Hyundai Motor America.

This fall, however, Hyundai plans to roll out XM satellite radio, and expects to have a communications channel through which it can send messages to Hyundai owners. Krafcik said the channel will open opportunities for traffic avoidance, and will plug into forthcoming navigation systems.

Hyundai plans to offer a factory-installed navigation system in its 2007 Azera, but Krafcik also praised Garmin's nüvi personal navigation device for the quality of its user interface. Garmin added Bluetooth functionality to its nüvi devices earlier this year. Krafcik said that Hyundai plans to offer a nüvi interface at the top of its center stack storage compartments.

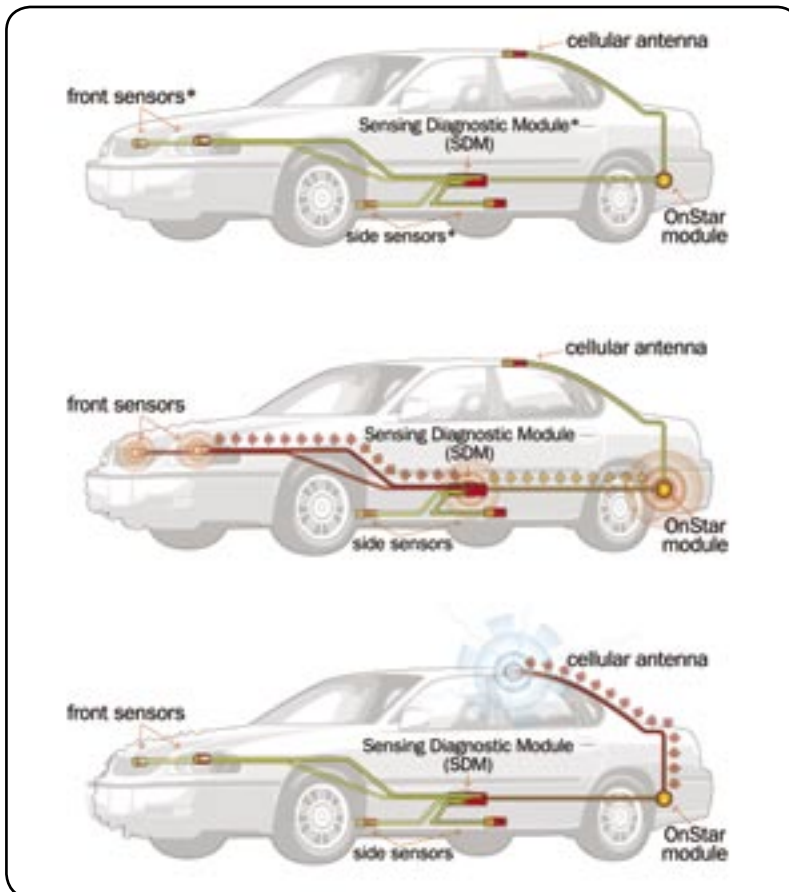
"There will continue to be a market for factory-installed navigation

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systems, but over the medium term, the evolution will increasingly be more toward personal navigation systems,” Krafcik said. “Most people will have an MP3 player, so is it necessary for us to have a CD slot? We can take the cost saving and provide an (MP3) input jack. We’re thinking the same way with portable navigation systems.”

Royal Philips Electronics reportedly plans to introduce personal navigation devices this fall, and Audiovox recently introduced the NVX406, an XM satellite radio-ready portable navigation device with a 3.5-inch touch-screen and turn-by-turn voice prompts. The device offers 4 GB of flash memory with six million points of interest in maps of North America.

Traditional GPS vendors are enhancing their product offerings. In February, SiRF Technology introduced the SiRFstarIII-LT GSC3LT and GSC3LTi, navigation engines fabricated on 90 nm CMOS and 0.25 μ BiCMOS process technologies for smaller size (33% and 50% respectively) and half the power consumption of earlier SiRFstarIII navigation engines in GPS-enabled consumer mobile devices. The 3LT and 3LTi provide position, speed, heading and time information with tracking mode power of less than 50 mW. Both chips support SiRFInstantFix, which reduces TTFF to less than 10 seconds.

Also in the GPS category, u-blox AG introduced A-GPS technology that reduces GPS receivers’ time to first fix. Standard GPS requires orbital position data from at least four satellites, but poor

signal conditions can hinder or prevent data from downloading. A-GPS accesses positioning data from a global network of u-blox GPS receivers that collect data from satellites and send it to a dedicated server. The server calculates the assistance data and transmits it to customer terminals or a client’s proxy server.

Chipmakers are targeting telematics applications. Renesas, for example, is targeting cost-sensitive telematics applications with its 540 MIPS/2.1 GFLOPS SH7397 “Euclid” telematics chip (Figure 2). Based on a 300 MHz SH-4A superscale core, the SH7397 is upward code-compatible with the 200 MHz, SH-4-based SH7760 (Camelot). The new chip is at the high end of Renesas’ “compact solutions” line. The firm also offers scalable and highly integrated solutions.

The SH-4A core has two separate 32-Kbyte, four-way set-associative cache memories, one for instructions and the other for data. Paul Sykes, product marketing manager for telematics, said the combination boosts throughput by improving the cache hit rate. On-chip, fast-access 16 kb RAM

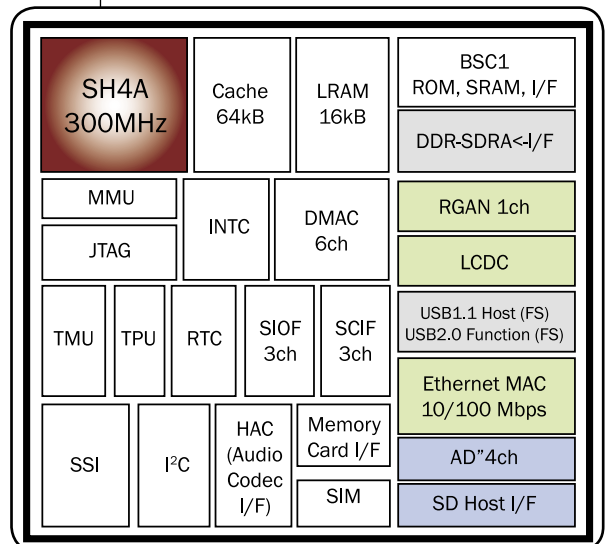


Figure 2. Renesas’ 540 MIPS/2.1 GFLOPS SH7397 Euclid telematics chip is based on a 300 MHz SH-4A superscale core.

also speeds processing.

Other features include a built-in floating-point unit, a dedicated bus for connection to external high-speed DDR SDRAM, a color LCD controller capable of approximately 64,000 colors on an 800 x 600 pixel LCD panel, and a USB interface with a v1.1 host and a v2.0 function controller. The controller enables connections to mobile phones, portable music players, and other consumer devices. Peripherals include a four-channel 10-bit A/D converter, real-time clock (RTC), six-channel timer (TMU), interrupt controller, and six-channel direct memory access controller (DMAC) for high-speed data transfers to and from memory.

The SH7397 has a serial sound interface and an audio CODEC interface for transmission/reception of voice and audio data in

hands-free applications. Memory card interfaces support MultiMedia-Card, SD memory card, PC card and smart card for exchange and storage of multimedia and other data. The chip includes a CAN interface, and an Ethernet controller that can be used as a general-purpose LAN interface and as a link for software debugging. It also has a three-channel serial communication interface with FIFO (SCIF), a three-channel serial I/O with FIFO (SIOF), and a two-channel I2C bus interface.

Renesas' Sequoia reference platform provides external memory; debug ports; peripheral functions for audio, display and CAN; USB, PCMCIA, MMC, smart card, SD memory/IO card and Ethernet interfaces, and support for real-time operating systems (VxWorks, WindowsCE and embedded Linux) and middleware. QNX Software plans to add support for Sequoia to the QNX Neutrino RTOS.

Freescale Semiconductor's 885 MIPS MPC5200B (Figure 3), introduced at Telematics Detroit last year, is pin- and software-compatible with the MPC5200. It's based on Freescale's mobileGT architecture/infrastructure (Wind River, QNX and Green Hills Software), and supported by the Media5200 development system, the Lite5200B evaluation board and various third-party firms.

Application development aids include PowerTAP run control tools; the OSEKturbo operating system; CodeWarrior development studio mobileGT edition; and a Linux board support package (BSP) optimized for the mobileGT architecture and Media5200 development platform.

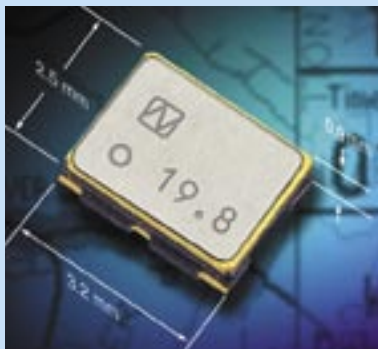
The Media5200 includes 128 MB DDR SDRAM and 64 MB flash; an

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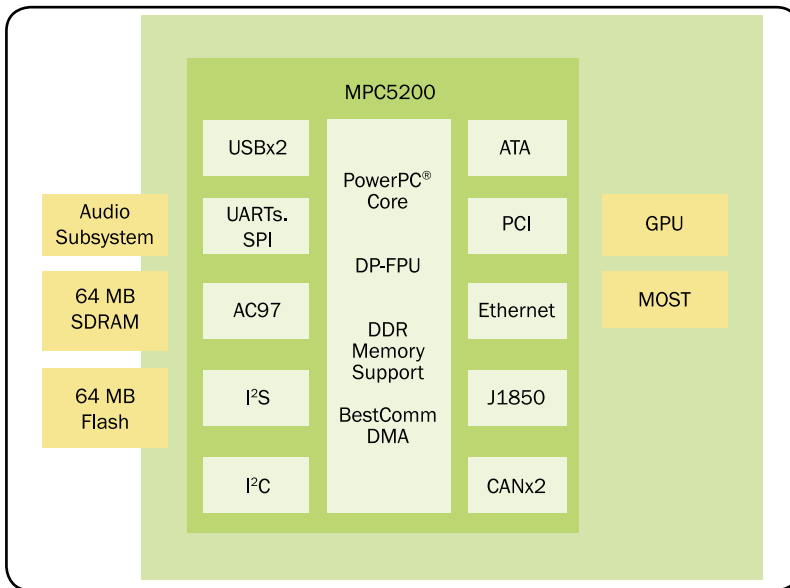


Figure 3. Freescale's 885 MIPS MPC5200B, with 128 MB DDR SDRAM and 64 MB flash, includes an integrated graphics system, multichannel audio subsystem, GPS and networking support.

integrated graphics system with an 8.4-inch color LCD; a multichannel audio subsystem with an AC'97 sound card; camera input; GPS; integrated CAN, J1850 and MOST networking support; two PCI and one mini-PCI connectors, and ATA, USB, Ethernet, S/PDIF and multiple serial connections.

Anand Ramamoorthy, general manager of Freescale's infotainment, multimedia and telematics business, said the MPC5200B's single (PowerPC) core is more efficient and less expensive than multicore alternatives. The chip features a double precision floating point unit; a memory management unit-based architecture with DDR memory support; integrated PCI, ATA and USB buses; multiple serial channels; up to three I2S interfaces, and Ethernet support.

Because all applications execute on a single core, Ramamoorthy said that, for example, features like front-seat navigation can work in tandem with rear-seat entertainment. He added that the MPC5200B can support audio compression decode/encode, as well as video decode.

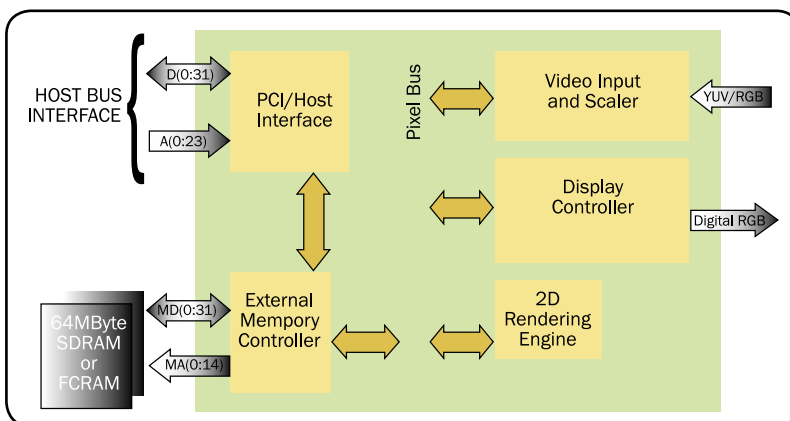


Figure 4. Fujitsu Microelectronics America's MB86276 can drive two connected displays with identical resolution using two independent interfaces or one interface with multiplexing logic.

National Semiconductor offers the CP3SP33SMR for automotive telematics applications. The chip is said to perform key functions of the audio signal path for Bluetooth and non-Bluetooth hands-free systems, telematics platforms, and automotive multimedia gateways. It integrates a complete audio path as well as connectivity modules including CAN, UART and USB 2.0.

Fujitsu Microelectronics America focuses on the graphic display requirements of telematics systems with products like the MB86276 (Figure 4). "Design activity in the United States still centers on 2-D and below, including implementations that don't render graphics but take bitmaps that are stored in memory and place them on the screen as icons, such as menu indicators, arrows for direction or logos," said Dan Landeck, product manager for graphics display/navigation controllers.

"Most of the design teams involved in these basic systems are realizing that they need more horsepower, and they are looking to step up to rendered graphics," Landeck said. "Designers in Japan and Europe planning high-end systems are tending to keep the graphics processor separate from the display controller to optimize performance, and to use a secondary media processor for A/V codecs." He added that fluctuating A/V requirements are providing significant opportunities for chip suppliers. ■

ABOUT THE AUTHOR

John Day writes regularly about automotive electronics and other technology topics. He holds a BA degree in liberal arts from Northeastern University and an MA in journalism from Penn State. He is based in Michigan and can be reached by e-mail at jhday12@sbcglobal.com.