Auto Electronics
Pioneer Dennis Wilkie Speaks Out

Dennis Wilkie has seen automotive electronics from both the carmaker side and the supplier side. After completing a Ph.D. in control theory he spent 28 years at Ford, where he worked on some of the earliest developments of electronically-tuned radios, cruise and engine controls. He held key positions in Ford's Electrical and Electronics division, including assistant chief engineer, reporting to Jerry Rivard, another industry pioneer. Mr. Wilkie served as general manager of Ford's Glass division and later as director of electric vehicle programs. In 1996 he joined automotive electronics supplier Motorola, where he held a number of management positions in the Automotive and Industrial Electronics Group and was on the staff of the president of Motorola's Integrated Electronics Systems Sector. He retired from Motorola in March 2002, and in May was named senior vice president of Compass Group, a management consulting and executive search firm based in Birmingham, Michigan, and Oak Brook, Illinois. Mr. Wilkie serves as chairman of the board of the Convergence Transportation Electronics Association, which organizes the biennial International Congress on Transportation Electronics, meeting next on October 20, 2002, in Detroit.

We interviewed Mr. Wilkie in May, and he discussed some of his ideas for bringing automotive electronics closer to its potential for making vehicles safer, more reliable, more fully featured, and less costly.

Problems Between Carmakers and Suppliers

With Compass Group, Mr. Wilkie intends to work with carmakers and suppliers to help them improve systems.

Turn to Wilkie, page 2

The Hansen Report
on Automotive Electronics
A Business and Technology Newsletter

VOL. 15, NO. 5 • RYE, NH USA • JUNE 2002

FlexRay Protocol Picks Up Support

The battle over which safety-critical, by-wire communications protocol gets picked by the auto industry is heating up. As the FlexRay consortium is growing—Ford and Texas Instruments announced they will soon officially join—the competing TTA consortium counters that TTA is still very much a contender.

FlexRay was founded by BMW, Mercedes, Motorola and Philips in the fall of 2000 after M ercedes and BMW stopped working with the TTA (Time Triggered Architecture) consortium and its leading proponent T T Tech Computertechnik AG of Vienna, Austria. T T Tech owns rights to the T T Tech by-wire link.

While the final decision hasn’t yet been made, The Hansen Report has recently learned that PSA Peugeot Citroën and Honda could join FlexRay. PSA is still studying both FlexRay and TTA by-wire communications approaches, and while research people are working on a prototype by-wire system, development engineers are working on a FlexRay prototype. The development engineers now favor FlexRay, and one engineering manager close to the project told us that PSA is almost certain to opt for FlexRay. Other carmakers will do likewise, he said. PSA has signed non-disclosure agreements with both the FlexRay and TTA groups so it maintains two separate groups, one to handle FlexRay and another to handle TTA.

The TTA consortium continues to claim publicly that PSA is a consortium member, despite PSA’s requests that it not do so, and despite the news that PSA is leaning strongly toward FlexRay. TTA also claims that Audi, Volkswagen, Toyota and Renault have joined with TTA. Walter Streit, responsible for Audi’s electrical systems integration, confirmed that Audi is definitely advocating TTA, but we have been unable to confirm that Volkswagen, Renault and Toyota have chosen TTA. Engineers at Renault are divided—there are advocates there for each of the communications protocols. While Toyota is listed as a core TTA member, Ichiro Hosotani, an engineer at Toyota’s control software development center, told us that Toyota won’t decide on a particular protocol until the third quarter of 2003. In April 2002, Toyota and Volkswagen attended the FlexRay consortium meeting in Munich, Germany. Along with VW, Renault and Toyota, the TTA consortium also lists Delphi, TT Tech, Honeywell and Airbus as core members.

FlexRay carmakers Ford, GM, BMW and DaimlerChrysler account for about 21% of the world’s light vehicle production. It now seems inevitable that other carmakers will jump on the FlexRay bandwagon, making FlexRay the de facto communications standard for high-speed safety-critical automotive applications. In July of 2001, Bosch decided to become a core member of FlexRay, and in April 2002, Ford and Texas Instruments announced their intention to sign on as associate members.

FlexRay Membership
Core Members
BMW
Bosch
DaimlerChrysler
General Motors
Motorola
Philips
Premium Associate Member
Ford (will join soon)
Associate Member
Texas Instruments (will join soon)

Turn to FlexRay, page 8
Wilkie...

engineering and help them work together more productively. He believes the two sides can do a better job harmonizing their efforts. “Today,” said Mr. Wilkie, “the two sides behave as if there is an impedance mismatch between them.” Impedance is opposition to the flow of alternating current. When there is a mis-match, energy is wasted. Likewise in the automotive electronics market, “It’s difficult for each side to overcome the impedance mismatch between electronics and the car,” said Mr. Wilkie. That mismatch leads to many of the problems carmakers and suppliers have with each other. For example:

◆ Suppliers tend to over-promise. “One of the things that bothers me the most is when suppliers grossly underestimate the difficulty of the automotive environment,” declared Mr. Wilkie. Much of the disappointment within the telematics industry is a result of suppliers who promote new technology and features that are not truly ready for automotive use. “You’d get tantalized by what could get done and believe them, but then they wouldn’t deliver,” he said.

◆ Suppliers don’t appreciate the automotive prove-out process. “There’s a kind of arrogance among electronics suppliers that auto industry guys are a bunch of hammermechans and that electronics is on a higher plane, more intellectual,” explained Mr. Wilkie. “But it isn’t the intellectual mistakes that can kill you, it’s the simple stuff that can’t live in a car environment, or cross-talk within networks. … People don’t appreciate the auto industry and the development process and timelines and the discipline of meeting dates with quality,” he said.

◆ Carmakers have less clout with electronics suppliers. “OEMs are used to dealing with a supply base whose very existence relies on key relationships with a few carmakers,” said Mr. Wilkie. “That’s not true with many major electronics suppliers—they also serve other, larger markets.” But despite their lack of leverage, carmakers try to dictate requirements and terms to those suppliers.

◆ Carmakers put too much pressure on supplier margins. “Too much heat and energy is burned up in negotiations; and there is too much wrangling,” declared Mr. Wilkie. “The OEMs think the electronics guys are trying to rip them off and maintain egregious margins. … It’s hard to overcome the mindset of some carmakers who believe electronics suppliers should not have higher margins than the carmakers. That’s not right.” Mr. Wilkie believes that to stay competitive, electronics companies need to maintain a higher level of investment in R&D than do carmakers. “Lately, it’s as hard as it’s ever been for suppliers to make money in automotive electronics. More suppliers are on the ragged edge of walking from the auto industry.”

◆ Carmakers tend to over-control their suppliers. This over-control mindset relates to the enormous cost associated with quality problems and recalls. However, this makes it difficult for the best suppliers to improve designs and combine functions in order to reduce costs, and it significantly delays progress.

Systems Engineering

Good top-down systems engineering would solve many of the problems that limit the potential of using more electronics in the vehicle. “The industry has used the words “systems engineering” for years, but unfortunately true systems engineering has not been happening on a vehicle level as it needs to,” said Mr. Wilkie. “To get the proper outcome, systems engineering must be done pervasively and thoroughly at the total vehicle level.”

Each carmaker should have a dedicated vehicle system office that manages the electronic and mechanical configurations of the car. That office should establish the fundamental architecture for the vehicle and specify which protocols and interfaces should be used. “You really need to start systems engineering at the very top of the design process in order to make each part function cohesively within the system.”

One of the many obstacles to true systems engineering is carmakers’ belief that if they outsource a system to a particular top-tier supplier, they will lose clout and won’t be able to keep costs down. Another obstacle is the lack of knowledge about systems engineering. “Upper management at the carmakers and at the suppliers really needs to have a more thorough understanding of electronics and its potential. … Carmakers like BMW and Mercedes seem to have a better grasp of systems engineering,” said Mr. Wilkie, “but even these two carmakers could benefit from a greater application of it.”

Network Computing

Mr. Wilkie sees huge potential for what he calls the networked car. “I would love to see the vehicle electronic architecture behave much like the Internet behaves—where mechanical, electrical, electronics or software components could be added to the vehicle without a lot of reconfiguration and reengineering.” He elaborated: “There are a number of fundamental design approaches using active networks, functional decomposition and shared computing, which could be borrowed from the computer industry. These approaches would allow true plug and play, the ability to upgrade vehicles already in service, and to lower cost and improve reliability through low cost redundancy, shared information and computing power.”

While implementing this approach to vehicle architecture will admittedly be difficult, Mr. Wilkie believes that it is doable and well worth the effort: “It will yield cost reductions, improvements in reliability, improvements in vehicle functions and updating capabilities even after the car is on the road. The first automaker to do this will reap huge benefits.”

Continued from page 1
Joining the many companies turning away from automotive electronics, NEC recently announced its intentions to get out of the business of developing and manufacturing electronic control units (ECUs) for vehicles. NEC will focus on businesses that fit better with its core competencies, for example LSI (large scale integrated circuit) semiconductors for vehicles.

The NEC Automotive Electronics division and its roughly 200 employees will be merged with ECU maker Nestec Co., Ltd., a Honda company, which has about 100 employees. Based in Utsunomiya, Tochigi, Japan, Nestec's annual sales are approximately ¥3.7 billion ($29.8 million) or 2.1% of sales, compared with a change from FY 2000 of up 8.3%. NEC's Automotive Electronics division's sales have been about $22.5 billion ($180 million) per year. The merged business will begin operations in the fall of 2002. Honda will increase its investment in Nestec, making it a Honda subsidiary, and NEC may end up owning one-third of Nestec.

NEC's Automotive Electronics division makes electronic control units for ABS, traction control, airbags and electronic stability control systems. NEC Automotive Electronics' largest customer is Honda, which accounts for 60% of sales. The company mainly serves Japan, which accounts for about two-thirds of total sales, and North America.

In addition to ECUs, NEC Automotive Electronics has developed electric-field sensors that detect seat occupancy and the size of the passenger. That information is used to suppress airbag deployment when the seat is unoccupied and to prevent the airbag from injuring a small passenger. Seat sensors account for 25% of NEC Automotive Electronics' sales in North America, a percentage that will grow. For the 2004 model year, the Nestec will begin shipping passenger seat sensors to GM, Ford and Chrysler. NEC is already shipping seat sensors to Honda. In the States, seat occupancy sensors are mandated on 35% of all vehicles produced in the 2004 model year.

---

2001 Roundup of Japanese Auto Electronics Suppliers

For this article, fiscal year 2001 is the period from April 1, 2001 through March 31, 2002.

### Aisin Seiki

**FY 2001 Consolidated Sales:** ¥1,221.9 billion ($9.8 billion)

**Change from FY 2000:** up 8%

**FY 2001 Net Profit:** ¥25.7 billion ($206 million) or 2.1% of sales, compared with a loss of ¥7.2 billion ($58 million) in fiscal 2000.

**FY 2002 Estimated Sales:** ¥1,310 billion ($10.6 billion)

**FY 2002 Estimated Profit:** ¥40 billion ($321.3 million)

In July 2001, Aisin Seiki, Denso, Toyota and Sumitomo Electric Industries formed a brake manufacturing company named Adivcs. Aisin Seiki holds 40% of the joint venture, which will be based in Ichi, Japan, at Aisin Seiki's headquarters. In May 2002, Aisin set up a JV with Bosch to produce CVTs (continuously variable transmissions) in Japan. Aisin Seiki is a Toyota Group company.

### Alpine Electronics

**FY 2001 Consolidated Sales:** ¥196.1 billion ($1.6 billion)

**Change from FY 2000:** up 8%

**FY 2001 Net Profit:** ¥3.9 billion ($31 million), 2.0% of sales; slightly better than last year's 1.8% margin.

**FY 2002 Estimated Sales:** ¥200 billion ($1.6 billion)

### Calsonic Kansei

**FY 2001 Consolidated Sales:** ¥460.5 billion ($3.7 billion)

**Change from FY 2000:** up 7%

**FY 2001 Net Profit:** ¥8.1 billion ($65.5 million), 1.8% of sales.

In February 2001, subsidiary company Calsonic Adivcs Technology, which develops Calsonic's in-vehicle computing systems, was spun off as Zandiant Technologies (Lake Forest, California).

### Clarion

**FY 2001 Consolidated Sales:** ¥188 billion ($1.5 billion)

**Change from FY 2000:** down 0.4%

**FY 2001 Net Profit:** ¥1.3 billion ($10.4 million) or 0.7% of sales.

In February 2001, subsidiary company Clarion Adivcs Technology, which develops Clarion’s in-vehicle computing systems, was spun off as Zandiant Technologies (Lake Forest, California).

### Denso Corp.

**FY 2001 Consolidated Sales:** ¥2,401.1 billion ($19.3 billion)

**Change from FY 2000:** up 19.2%, due in part to a change in the fiscal year for some subsidiary companies in Japan. As a result, 15 months of sales are counted for those companies. Without that change, group sales rose 8.3%.

**FY 2001 Net Profit:** ¥72.3 billion ($583 million) or 3% of sales, the same margin as in FY 2000.

continued on page 8
Microsoft Automotive Business Unit

Background
Microsoft began working on Windows CE for small footprint, embedded devices in 1994, and a derivative of Windows CE, the AutoPC, in 1995. In early 1999, after a later than expected start, Clarion shipped the first AutoPC to the aftermarket in the United States, but sold only about 1,000 units that year. In January 2000, Citroën was the first carmaker to introduce the AutoPC on a model line, about 4 because support can easily be flown in from headquarters in Redmond, Washington. Developers are all in Redmond, Washington.

Regional Teams: Tokyo, Japan for Asia/Pacific market; Munich, Germany, for European market; Detroit, Michigan, and headquarters in Redmond, Washington, for North and South America

The fifth version of Microsoft's automotive software platform will be released in the fall of 2002. This newest version will be based on Windows CE .NET, which reflects Microsoft's view that future mobile computing will stem from the Internet.

Looking to the Future
The fifth version of Microsoft's automotive software platform will be based on Windows CE .NET operating system, which assumes the Internet as the starting point of all mobile communications. Regardless of where the consumer is and what device she is carrying, Microsoft is hoping its .NET technologies will be there. "We are now talking about more than just a particular device, we are also talking about the [general] platform that will allow many hardware and software developers as well as service providers to add value," pointed out Bob McKenzie, general manager, Microsoft Automotive Business Unit.

Microsoft's .NET technologies for developers do not require Microsoft operating systems, either at the client or at the server, nor any particular programming language. They provide a universal format that allows easy sharing, adapting or transforming of data over any device with any programming language. The company will sell .NET web infrastructure software, server and device software plus web content and services, for example, through its MSN content aggregator Carpoint.com.

The emerging market for telematics software and services, as well as mobile hardware, has been pegged by some analysts at anywhere from $30 million to $100 billion annually, five years from now, but according to M r. Bustillos, a more realistic number is between $10 billion and $15 billion. However, he emphasized that...
Windows CE for Automotive 3.5

Microsoft’s fourth-generation telematics, navigation and multimedia platform, WCEfA 3.5, was introduced in November 2001, and reflects Microsoft’s latest view that the Internet is going to be the center of computing. Windows CE for Automotive version 3.5 uses an XML (Extensible Markup Language) web parser, which allows many applications, regardless of operating system or programming language, to communicate and share data over the Internet. The next-generation Windows CE for Automotive software platform will be based on the Windows CE .NET embedded operating system and will support a wide array of next-generation web services. Microsoft expects to ship this newest automotive software platform in the fall of 2002.

WCEfA 3.5 has these features:

- A platform configuration that enables developers to create compact devices with limited storage capacity; developers can start small and build as much or as little as required by the carmaker.
- Hands-free communications that allow natural speech, not just commands; supports SAPI (Speech Application Programming Interface), a global standard interface for speech engines; uses a natural sounding, phonetics-based speech-recognition and text-to-speech technology called SUI (Speech User Interface) in XML file format; is open to a variety of speech engines.
- Driver distraction control, which can prevent access to certain applications and functionality when the vehicle is moving.
- High-resolution graphical user interface that allows carmakers to focus on brand differentiation.
- Fast drawing, using GDI-Sub, for navigation maps.
- Audio and video support.
- Microsoft Mobile Explorer, a wireless communication platform, is a compact version of the Internet Explorer browser’s software; WCEfA 3.5 also has a full-featured GenIE browser, a speech-enabled browser container that delivers the core HTML control for customers and Internet service providers.
- Customized development tools which include flexible, scalable building blocks from which to choose a variety of development systems, such as ActiveX Controls and Visual Basic, to create low-end to high-end applications based on car manufacturer requirements.
- Power management architecture that eliminates the need for a backup battery and ensures rapid startup and shutdown without data loss.

the revenue Microsoft receives from telematics in the next five years is not the important point: “We are committed to automotive because automotive is so very core to what Microsoft’s vision is for the long, long run.” Telematics is changing the way we talk of mobility. And mobility is the core of Microsoft’s greater strategy.” In addition to the 80 people working in the Automotive Business Unit, another approximately 500 people in other groups are available to support the development of Windows CE and .NET for automotive applications.

For Microsoft, mobility means marketing software that spans many industries as devices connect in the future in undreamed-of ways. The current company-wide direction is less device-oriented, moving away from “a PC on every desktop” to web applications and web services, crucial to the company if its revenues are to grow as they have in the past. The revenue growth rate for the entire company was 29% in fiscal 1999, 16% in fiscal 2000 and 10% in fiscal 2001.

Big Investment in .NET

The 2001 annual report stated that the core of R & D efforts is Microsoft .NET, a new computing model built around XML web services. In a surprisingly bold statement, the annual report called Microsoft .NET “an innovative effort as significant in the development of computing as the graphical user interface and the introduction of the Internet.”

Microsoft intends to invest heavily to make its .NET products successful. The 2001 annual report pointed out that in addition to new product-launch expenditures, the company intends to invest approximately $5 billion in fiscal 2002 in research and development “At the center of our R & D efforts is Microsoft .NET ... [which] will create new opportunities for Microsoft and for thousands of developers and industry partners by enabling constellations of PCs, servers, smart devices and Internet-based services to collaborate seamlessly,” noted the annual report: “Over the next five years, as we infuse XML Web Services into all our businesses, we see the opportunities for growth continuing. This transformation is key to expanding our revenue stream moving forward.”

Sales

When we suggested that Microsoft’s reluctance to give us any sales numbers hinted at embarrassingly low revenues for the Automotive Business Unit, Mr. McKenzie told us: “Our customers have not sold enough to have clear numbers as this is just beginning. And you know, it really doesn’t matter at all to us how much we do today, because we are building relationships, winning designs and shipping products. … Our business is going to increase for the next decade— that’s for sure. We’ve seen steady progress each year.”

Today, Microsoft software is used in production vehicles manufactured by four carmakers: PSA, Citroën, BMW, Volvo and Toyota. Shipments will also go to these seven aftermarket suppliers sometime in 2002 or 2003: Borg, Bosch, Clarion, Denso, Mitsubishi, MCIPanasonic and Nextech.

According to Mr. McKenzie, Denso and Bosch are committed to using Microsoft software for all their product line in telematics, multimedia and navigation— everything that requires an operating system. While it has been widely reported that Bosch lost all its Mercedes navigation business to Harman International,
Next-Generation Mobile Information Management: Microsoft’s Car .NET

Car .NET solutions will connect the vehicle to the Internet. They will allow easier exchange of information between devices and servers. Microsoft’s .NET technologies are based on non-proprietary, industry-supported standards. Car .NET combines the Windows CE for Automotive platform with .NET technologies, for use in telematics applications.

Windows CE for Automotive supports the following wireless connectivity technologies:

- 802.11: high-bandwidth, local-area networking (about 100 meters)
- GPRS and CDMA: moderate high bandwidth, cellular-based, wide-area networks (cities and interstate), for transmitting complex information and graphics
- CDPD (Cellular Digital Packet Data): low bandwidth, cellular-based, wide-area networking (cities and interstate)
- Bluetooth: high-bandwidth, personal area network (about 10 meters) for communications to handheld devices and service tools, or for connection to cell phones as a gateway to wide-area coverage

Retail prices for devices and systems currently shipping range from $400 for entry level up to $3,000 for end-to-end solutions in luxury vehicles.

Mitsubishi Electric Corp. (MELCO) today builds the in-car device for Volvo. The primarily function of WCEfA in Volvo is navigation. SiemensVDO is the navigation supplier to BMW and uses W CEfA in the control display for the iDrive functions in the MY 2002 7 Series. According to M r. McKenzie, greater than 90% of BMW 7-Series customers worldwide pick the navigation option. At the end of the first quarter 2002, BMW had sold about 10,000 of the new 7 Series.

Windows CE .NET

“Our philosophy at Microsoft is that the Internet is going to be the computer,” declared M r. Bustillos. Microsoft .NET web technologies will facilitate interaction among various manufacturers’ servers, home and office PCs, vehicles and small mobile devices. Microsoft .NET uses open global web standards set up by W 3 C (the World Wide Web Consortium). Some products and services based on .NET technology have been shipping for a couple of years; Car .NET is the adaptation for the car industry.

“Microsoft’s software encompasses services, and moving forward, services and applications are basically one,” said M r. Bustillos, referring to Microsoft’s new view that its products will involve the Internet much more than in the past. Car services and content could be accessed through www.carpoint.com, the auto channel for MSN’s 270 million users. The most browsed of all car web sites, according to Microsoft, is carpoint.com. The most browse for the car site, according to Microsoft, is carpoint.com. The subject line of your email can be sent using .NET technology. Microsoft will develop products that build on what they do best; there are no plans, for instance, to do vehicle diagnostics.

Wireless Infrastructure

Many of the things Microsoft talked about five years ago, like Instant Messaging, hands-free telephony and location-based services are now possible. Mr. Bustillos told us, “Anywhere in the U.S., wireless data technology is already mature enough so that many of the services that depend on that wireless link are feasible today, unlike five years ago.”

In the future, multiple wireless links will be available to the vehicle; some will continue with limited bandwidth, and some will use always-on communications technologies like GPRS (General Packet Radio Service), 3G (third generation mobile services) and paging networks. Currently, low bandwidth wireless links can bring small amounts of data into the vehicle, like instant messaging, simple diagnostics and traffic information. The play for Microsoft is that the vehicle software must be capable of discerning how the links are connected and when which ones are needed.

Telematics to Multimedia Continuum

As Microsoft sees it, there is no clear distinction between the services provided by telematics and those provided by multimedia products, so that telematics broadly includes hands-free email and voice-mail delivery, electronic commerce, automated parts/service updates, real-time traffic updates, satellite radio subscriptions, real-time Internet browsing as well as streaming audio and video. The key will be a general-purpose, in-car computer that can be scaled up very quickly to more complex multimedia products. Microsoft intends to use the Car .NET umbrella of technologies as a way to add value to products by working with some customers on entry-level devices, followed later by more advanced devices that will provide a richer in-car experience.

Key to Success in Telematics is...
Scalability
To accommodate the range from telematics to multimedia products, Windows CE is scalable from two perspectives, hardware and software. On the hardware side, you can scale up and down by changing memory, the CPU and some of the I/ O’s, allowing carmakers to add or even reduce connectivity in future models. That is an advantage in getting products to market quicker. On the software side, Microsoft Car .NET can scale up or down to receive more information, new applications, as well take on a new user interface. Microsoft’s customers are able to consider a wide range of product offerings, and today, Microsoft’s customers use a range of technologies, with some thinking about phone docking and others about Bluetooth wireless.

Japan Consortium
Microsoft’s Windows CE for Automotive Forum in Japan, has 106 companies with W CEfA programs. The forum is a consortium of companies working together to share drivers, components, A P I s and a common platform across devices, beyond just navigation systems. Forum members include the top five or six tier-one suppliers, such as Denso, and many suppliers who support the tier-ones.

Windows CE: Real-Time RTOS
The need for RTOS ( Real-Time Operating Systems) arises with the definition of an embedded application: What takes priority? How many programs are running at the same time? How fast can they respond? Real-time operating systems must be based on reliable embedded, real-time or fault-tolerant technologies. Mr. Bustillos told us that Windows CE for Automotive 3.5 does not have problems with RTOS performance, but that perhaps some developers have issues with the implementation of the OS technology and applications. He explained, “A automotive developers need an RTOS as a basis for creating reliable, high-quality devices, but the OS is not the only thing responsible for achieving real-time performance. The developers must also ensure that the applications and device drivers they write to run on top of the RTOS are also written to real-time quality standards. The hardware must also correctly support real-time operation.”

Dedicated Systems Experts ( Brussels, Belgium) is a research group that specializes in development support for the information systems sector, and in particular, dedicated systems. In a technical evaluation of Windows CE 3.0, Dedicated Systems Experts noted: “Windows CE 3.0 has, as far as real-time features and behavior are concerned, made tremendous progress compared to previous releases. It can now be considered an RTOS.” In that evaluation, QNX RTOS v6.1, from QNX Software Systems ( Ottawa, Ontario, Canada) was said to live up to its reputation in the industry “as a high-quality RTOS... throughout the tests, it performed fast and predictable, and never showed any signs of instability.”

A more recent Dedicated Systems Experts’ evaluation of three RTOS, all run on Intel x86 platforms, included Windows CE .NET, the successor of Windows CE 3.0. The evaluation stated that Windows CE .NET “exhibited real-time behavior,” and further, “none of the stress tests exposed any problems concerning stability and robustness.” On the other hand, tests of Wind River Systems’ latest RTOS product VxWorks AE 1.1 “did expose some acute problems.” The third product compared was QNX RTOS v6.1, which was found to be “fast, predictable and reliable at all times... the only RTOS that has a true message-based client-server architecture well-equipped to handle today’s requirements concerning distributed processing, high availability, etc.” (Its website states that QNX makes the leading RTOS for PCs, and “a fully optimized Java VM” can be derived from QNX RTOS.)

No Support for A-MIC or Java
As its new motto suggests, Microsoft supports open standards: “Any Time, Any Place and on A ny Device.” If that has a familiar ring to it, remember that Java promises “Write Once, Run Anywhere.” The industry is certainly interested in independent CPU s and operating systems. Unfortunately, Mr. Bustillos told us: “A-MIC, which stands for standardizing an open interface for the car, has chosen a specific technology that we cannot support—Java. We have legal reasons why we cannot. Lawsuits from Sun prevent us from doing that.” There are also technical reasons. Mr. Bustillos’ position is because the Java platform ( J2ME) requires extra memory for the virtual machine and extra processor power for running Java code, it is at a disadvantage in many automotive applications.

Nevertheless, Microsoft also insists it stands for an open interface for the car. Mr. Bustillos elaborated: “If a partner wants a Java virtual machine running on a Windows CE technology, that can be done, absolutely, and if a customer comes to us and says they want to do that, then fine, I can send them to 2 or 3 companies, like Insignia Solutions or NSIcom, that do that. However, the concept of using virtual machines goes a little bit deeper than that because it is not necessarily Java that the industry is looking for. We have exactly the same thing [as Java]... You can abstract the OS and you can abstract the hardware, just as Java is promising.”
Why FlexRay

In a May 2002 press briefing, the FlexRay consortium wrote:

Before carmakers decide on a particular protocol, they should consider these FlexRay attributes:

◆ FlexRay is open for everybody (OEMs, suppliers and tool vendors).
◆ In FlexRay there is no exclusivity.
◆ No royalties
◆ Qualification will be made through conformance testing.

While FlexRay advocates say they like FlexRay because of the way it performs and because it can be flexibly applied to a broad range of vehicles, they like it best for its commercial attributes. Simply put, FlexRay is a much better business deal than TTA. “There are no royalties linked with using or implementing any piece of the technology, declared Ben Baker, who runs GM’s Electrical Center. “In the FlexRay consortium, all members agree to provide for free whatever intellectual property is relevant.” Before making the decision to join the FlexRay consortium, General Motors shopped for the right communications protocol that would satisfy its requirements, both technical and commercial.

There is an important consideration, which for now favors TTA: Companies can test prototype TTA systems using existing silicon chips provide by TTA member, austriamicrosystems. FlexRay won’t be able to supply engineering samples until 2004. Those will be provided by FlexRay members Motorola, Philips and Texas Instruments. TTA lists no other chip provider members besides austriamicrosystems.

Safety Critical By-Wire Applications

Whether carmakers choose FlexRay or TTA, a safety-critical communications network is an essential ingredient in brake-by-wire and steer-by-wire systems, which do away with all hydraulic components. The first of these systems to come to market will probably be electromechanical brakes (EMBs), and they won’t appear in production passenger vehicles until 2007, at the earliest. Electric brakes do away with hydraulics and power the brakes with powerful, quick-response electric motors. According to Ben Baker, compared with regular hydraulic brakes, electromechanical brakes are far easier to build, are more serviceable, more reliable and the response time between the driver’s foot and the brakes will get faster. “The response time is improved by a couple orders of magnitude, and that enormously improves the link between the driver’s intentions and the braking maneuver,” noted Mr. Baker. A nother benefit of EM Bs is they are much easier to integrate with other chassis systems. A nd since with EM Bs there is no direct link between the brake pedal and the brakes, the disconcerting feedback felt on the brake pedal when A BS pulses during emergency braking will not be an issue.

As with any new technology, cost is a major obstacle in bringing electromechanical brakes to market. All but the smallest cars will require 42-volt power systems in order to actuate the brakes with good dynamics. Forty-two-volt systems are expensive and will stay that way at least until 2007. A nother major cost factor comes with the redundancy required with EM B systems. Extra components need to be added to the braking system so it will operate 100% of the time, without the possibility of failure.

Roundup...

FY 2002 Estimated Sales: Denso is forecasting an 8.4% drop in sales, to ¥2.2 trillion ($17.7 billion).

Sales in Japan in fiscal 2001 grew 4.1% to ¥1,643.1 billion ($13.2 billion). In the Americas (North, South and Central) sales grew 37.6%, to ¥643 billion ($5.2 billion). Excluding the effects of the change in the reporting period, sales in the Americas grew 9.5%.

Nippon Seiki
FY 2001 Consolidated Sales: ¥111.7 billion ($896 million)
Change from FY 2000: nearly flat, up just 0.6%
FY 2001 Net Profit: ¥4.8 billion ($39 million) or 4.3% of sales, vs 1.5% of sales in fiscal 2000

Pioneer
FY 2001 Consolidated Sales: ¥651.3 billion ($5.2 billion). Car electronics sales grew 6.7% to ¥261.2 billion ($2.1 billion).
Change from FY 2000: 3.4%
FY 2001 N et Profit: ¥8.05 billion ($64.8 million), which is 1.2% of sales, down from 2.8% of sales in FY 2000.
FY 2002 Estimated Sales: ¥720 billion ($5.8 billion)
FY 2002 Estimated N et Profit: ¥11 billion ($88 million) or 1.5% of sales

Domestic sales grew 6.9% mostly due to increased sales of hard disk drive navigation and DVD navigation systems. Contributing to Pioneer’s 6.5% overseas growth was increased sales of digital satellite radio tuners in the United States.

Tokai Rika
FY 2001 Consolidated Sales: ¥222 billion ($1.8 billion)
Change from FY 2000: up 3.8%
FY 2001 Net Profit: ¥9.3 billion ($74.6 million) or 4.2% of sales