Satellite Radio

Since its launch of service in September 2001, XM Satellite Radio had enrolled more than 6 million subscribers as of year-end 2005 and continues to forecast a subscriber base of 20 million by 2010.

Sirius Satellite Radio, which began broadcasting nine months after XM, reported 3.3 million subscribers at the end of the year, 2.2 million of them added in 2005. Satellite radio service at $12.95 per month ranked thirteenth in consumer interest in J.D. Power and Associates’ 2005 U.S. Automotive Emerging Technologies study.

Beginning in 2006 Hyundai will start implementing its plan to make satellite radio standard in all models. Delphi Corp. will supply receivers for the Santa Fe, Azera and Elantra models.

Bosch-Denso JV Delivers T-Engine Infotainment Platform

T-Engine Infotainment Platform

The infotainment market is about to get a whole lot more competitive. The Hansen Report recently learned that the Bosch Blaupunkt-Denso joint venture chartered in July 2003 to develop a new multimedia computing platform for its parents is delivering a platform based on T-Engine, an all-encompassing development environment created by the Japanese electronics industry. Blaupunkt and Denso will almost certainly make the specially developed T-Engine platform the basis for almost every new navigation and multimedia product planned for the future.

With a standard platform in place and much of the engineering work already on the shelf, Bosch and Denso will be able to quickly respond to OEM market opportunities with full-featured, highly competitive product offerings. The first new Blaupunkt and Denso products based on T-Engine could ship as soon as the end of 2006 or early in 2007.

Before selecting T-Engine, the 50-50 joint venture by Denso and Bosch known as ADIT (Advanced Driver Information Technology) had considered a number of operating systems. Denso engineers favored Linux, WinCE and T-Engine, while Bosch engineers supported VxWorks, QNX and T-Engine.

Unlike other candidate operating systems WinCE from Microsoft, VxWorks from Wind River and QNX from Harman International, the T-Engine operating system—called T-Kernel—is royalty-free. And no less important, since T-Kernel is a follow-on to the vastly popular micro-ITRON operating system, the platform will have wide industry support from tool vendors and other providers. Programmers with experience in ITRON will easily be able to adapt to T-Kernel. According to the T-Engine Forum Web site, “ITRON is the world’s number-one adopted standard in the field of embedded systems.” Based on proven technology, T-Kernel is robust and, like micro-ITRON, it has a small footprint, which minimizes memory and computer overhead.

According to the T-Engine Forum, while ITRON standardized the API (application programming interface) for basic functions of the operating system, it lacked standards or guidelines for hardware, device drivers and a development environment. T-Engine widened the scope of standardization so that T-Kernel enables the distribution of middleware on top of the existing basic ITRON RTOS (real-time operating system) functions. The biggest goal of T-Engine was to enable distribution of software resources independent of CPU architecture.

Some legal questions surrounding the Linux general public license influenced ADIT’s choice of an OS. T-Kernel licensees are under no obligation to make altered T-Kernel code open to the public, which means they can safeguard their product know-how. Versions of the T-Kernel standard are maintained by the T-Engine Forum.

The ADIT platform’s two main microcontrollers were developed jointly by ADIT and NEC; NEC will be the sole supplier of the two ASICs (application specific integrated circuits) designed specifically and exclusively for Bosch and Denso’s use. In order to provide scalability from mid- to the very high-end price/performance, the platform’s architecture can accommodate a one- or two-microcontroller chip solution; one chip delivers 800 million instructions per second and

Turn to T-Engine, page 2
Microsoft Targets Infotainment

Since Harman International acquired operating system maker QNX, Harman’s competitors in automotive audio and infotainment such as Visteon, Delphi and Johnson Controls, who have developed products based on QNX’s software, are re-examining their OS options, according to Peter Wengert, global director for the Microsoft Automotive Business Unit. Windows Automotive is definitely an available option, and Mr. Wengert admitted, “Microsoft is getting a lot more phone calls,” from suppliers seeking an alternative platform.

Microsoft’s Automotive Business Unit has been developing software for the automotive industry for more than a decade. Its first venture, the Windows CE-based AutoPC, developed with Clarion as an aftermarket product, never gained wide acceptance with consumers. In 1998, Microsoft decided to market just the underlying software from the AutoPC, which it called Windows CE for Automotive, to tier one and aftermarket navigation and telematics developers. By the fourth release of the software, Microsoft shortened the name to simply Windows Automotive. Version 5 of Windows Automotive followed in July 2005. According to Microsoft, Windows Automotive-based navigation and entertainment systems are shipping today in “61 preinstalled, dealer option and aftermarket devices from 18 world-class automakers and suppliers,” including Alpine, Panasonic, Mitsubishi Electric, Pioneer, Kenwood and Clarion. The company estimates between 300,000 and 500,000 navigation systems in the U.S. today are running on Windows Automotive.

Alpine Electronics selected the Windows Automotive platform for all its mid-term AVNC (audio, video, navigation, communications) products under development for both OEM and aftermarket applications. At the 2006 Consumer Electronics Show, Alpine demonstrated its new Blackbird portable navigation device based on Windows Automotive and Windows Automotive-based navigation systems on the new Honda Odyssey, Ridgeline and Civic models.

Turn to Microsoft, page 8
At CES, XM demonstrated in-car satellite video using On2 Technologies’ video compression technology. The demo car was also equipped with Voice Command, co-developed with VoiceBox Technologies, which allows you to control XM Radio features by speaking the channel selection or music genre. XM’s NavTraffic feature, already standard on the Acura RL since MY 2005 and an option on the Cadillac CTS, could in the future be enhanced with ParkingLink, a feature designed to locate available parking places in designated facilities.

Satellite Radio Competition

Offering a viable challenge to satellite radio and to iTunes is Motorola, with its announcement at CES that iRadio service is now available to U.S. wireless carriers. Consumers should be able to subscribe to the service later this year for a monthly fee comparable to or less than the $12.95 charged by XM and Sirius for their basic plans. Motorola plans to launch the service internationally later in 2006. According to Motorola, iRadio will launch with 435 commercial-free Internet radio channels covering all types of music, talk radio and news. Subscribers need a special iRadio wireless phone—due later this year—with a memory storage card and a high-speed Internet connection on a USB-equipped PC running Windows XP. Users can download from their PC to their phone up to six channels of content from the iRadio catalog: for example five radio stations and one playlist, or 6 playlists. Users have the option of listening via Bluetooth adapters through their home or car audio speakers. With the radio content cached on the phone, there is no interruption when the phone is moved from car to home or connected to earphones, and the music pauses when a call comes in. With Internet radio programming, iRadio is free of the bandwidth limitations faced by XM and Sirius. The satellite radio providers are each allocated 12.5 MHz of the S band by the Federal Communications Commission (FCC).

iBiquity Digital, the sole technology provider in digital AM and FM broadcasting, enthusiastically reported that the number of on-air HD Radio stations had reached 634 at the end of 2005. The rollout was aided by a commitment from the leading broadcast groups to eventually convert 2,000 stations. More companies are supplying HD Radio receivers to the aftermarket including Alpine, Fujitsu Ten and Panasonic. According to iBiquity, more than 10 new products were announced in 2005. At CES iBiquity also announced a new reference design for a “tuner box” that allows any satellite-ready head unit to receive digital radio signals—AM, FM and FM Multicast. After purchasing an HD Radio receiver, there are no further costs to consumers. In the 2005 J.D. Power and Associates Emerging Technology survey, consumers ranked HD Radio with a price of $150 for the receiver at number 3 in the list of features they would like in their next vehicle. BMW offers factory-installed HD Radio receivers on the 2006 model year 6- and 7-series.

Beyond Radio

There are plenty of options for bringing your personal music and entertainment selections wherever you go. While many carmakers provide MP-3 compatible car stereos, aftermarket suppliers are way ahead of OEMs with a flood of iPod (audio and video) docking devices, multimedia drives, TVs and video game players. Antenna-maker RaySat recently introduced TeleRay, which it says is the world’s smallest satellite TV antenna for vehicles. Measuring just one inch thick and 16 inches in diameter, TeleRay is compatible with all the mobile TV receivers currently on the market in Japan. Sales will begin later in 2006.

KVH, another antenna supplier, partnered with Microsoft to create a mobile Internet receiver with MSN TV service for mobile Internet access in cars. Visteon’s market research revealed that video gaming ranks among the most desirable in-car entertainment options. Visteon’s Aftermarket division added Nintendo Game Boy capability to its Dockable Family Entertainment system. The National Highway Traffic Safety Administration (NHTSA) estimates driver distraction contributes to 25% of all police-reported traffic crashes.

eMOST in the Works

For now Mercedes has decided to stick with plastic optical fiber for its MOST multimedia communications bus but will eventually switch to copper. A year ago Mercedes was considering a move to glass fiber. “We had two problems,” explained Stephan Wolfsried, Mercedes’ top electrical engineer. “One was insufficient robustness against mechanical damages, and the other was insufficient temperature range.” The stability problem has been fixed and the temperature range of the plastic has been improved to as high as 95 degrees F, with expectations that getting beyond 100 degrees F is possible. Since the physical advantages of glass are not much greater than plastic, Mercedes has decided not to make the expensive engineering switch. “We will stay with the improved plastic until the electrical solution is available,” said Mr. Wolfsried.

Having pioneered in the development of the fiber-optic MOST physical layer, Mr. Wolfsried is now content to let Toyota take the lead in developing a protocol that can be transmitted over copper wires without excessive electromagnetic noise. Two protocols are under consideration, one from Panasonic and the other from Harman-Becker.

According to Toyota’s top manager of electronics, Takashi Shigematsu, the MOST E5 working group has not yet decided between the two protocols, though he did say that the Harman approach has better noise performance. A decision from the E5 working group is expected soon, after which Toyota will consider the possibility of replacing its proprietary AVC (audio video communications) protocol with MOST. According to one well-placed source, that could happen as soon as the 2008 model year.
The Company Profile... Harman International

Background

Harman International’s roots go back to 1953, when founder Sidney Harman partnered with Bernard Kardon to form Harman Kardon. Harman Kardon’s first product was an FM tuner, followed in 1954 by the world’s first hi-fi receiver, a monaural unit that incorporated a tuner, control unit and power amplifier in the same chassis. A stereo receiver debuted in 1958. The company expanded through the next two decades, acquiring the speaker-maker JBL in 1969. Dr. Harman reassembled the company as Harman International Industries, a holding company, in 1980 and began acquiring companies and technologies that enabled its expansion into the automotive sector. In the 1990s, Harman acquired AKG (microphones), Lexicon (digital audio signal processing), Becker GmbH (automotive head units), Madrigal Audio Labs (Mark Levinson audio systems), Oxford (automotive speaker supplier to Chrysler) and Audio Electronics Systems (speaker supplier to European carmakers). Dr. Harman served as CEO until 1998 and as chairman of the board until 2000, when he became executive chairman. Harman International stock has been traded on the New York Stock Exchange since 1986 under the symbol HAR.

In FY 2005 the automotive group accounted for 70% of Harman’s sales, while the consumer and professional groups roughly split the remaining 30%. According to Dr. Harman, that breakdown will stay nearly the same for the foreseeable future. Each segment of Harman’s business feeds the other segments. For example, some of the Harman brands now popular in the automotive industry were first made popular in the high-fidelity audio consumer market.

Harman’s high stock market valuation, with price to earnings ratio currently at 26.7, is a direct result of respectable margins. For the most recent quarter, ending September 30, 2005, Harman yielded an operating margin of 10.2%, and it has won more infotainment systems bookings outside of Asia than any of its competitors. Harman says it will be the exclusive or nearly exclusive infotainment system supplier to Porsche, Audi, PSA and Chrysler and the principal supplier to Mercedes and BMW. Harman expects its infotainment sales to grow 18% per year from FY 2005 through FY 2008.

Harman’s well-respected high-fidelity audio brands including JBL, Infinity, Harman/Kardon and Mark Levinson also distinguish the company from its competitors, as does Harman’s technology, says Erich Geiger, chief technical officer and executive vice president of Harman: “We have the largest portfolio of [infotainment] technologies under one umbrella.” Since 2002 Harman has acquired several relatively small companies, each with important pieces of infotainment technology. These include: Xsys, CAA, Temic Speech Engines, Mapi Systems, Wavemaker, QNX and PhatNoise. Dr.
Sidney Harman built one of the world’s leading audio companies. I asked Sidney Harman how at age 87 he still manages to run Harman, a multibillion American company that is thriving in two of the world’s toughest industries: automotive parts and consumer electronics. “I am in superb physical condition,” said Dr. Harman. “I have exercised every single day for 60-odd years. And I’m not very interested in food. I drink almost no alcohol. I have a vivid appetite for lots of stuff including, but not limited to business. I have young kids ... a very active life.”

Harman’s liquidity is good. In September 2005, Standard & Poor’s gave Harman a BBB/watch positive credit rating. Companies rated BBB have adequate capacity to meet financial obligations but are more subject to adverse economic conditions than A-rated companies. Watch positive companies have near term potential for a positive change in their credit rating, though change “will likely be limited to one notch, to BBB+,” says S&P. On September 30, 2005, Harman’s ratio of current assets to current liabilities was 1.7 with $505 million of working capital.

Sidney Harman not only built one of the world’s leading audio companies, but he was also a pioneer in progressive business management strategies that recognize the value of employees. He is an educator, a prolific writer, a public servant and a patron of the arts. I asked Sidney Harman how at age 87 he still manages to run Harman, a multibillion American company that is thriving in two of the world’s.
the S-Class infotainment system, Harman sold a voice control feature to carmakers for hands-free operation of the telephone and navigation system as a separate add-on function for about $150. It included an extra processor, memory, software and connectors. In place of that, Harman now provides Mercedes with a $20 voice control software module, which along with the audio signals, runs entirely on the infotainment system’s host computer located in the head unit. Likewise, a navigation software module or a noise-cancelation software module can also run on the host processor.

With responsibility for the entire infotainment system including audio and rear-seat entertainment, Harman’s S-Class content amounts to more than $2,000 per vehicle. More than 60,000 S-Class vehicles are sold each year.

Can Harman Further Penetrate the Infotainment Market While Maintaining High Margins?

While Harman’s S-Class infotainment system is impressive, it’s not clear at this point how quickly and how deeply infotainment systems will penetrate into the lower-priced vehicle segments and whether Harman will be able to compete with the world’s major infotainment players as it tries to expand its business beyond Europe, beyond German-owned DaimlerChrysler and beyond the luxury car segment. Harman’s top three customers for all its products are Mercedes, BMW and Lexus (audio only) with Audi coming on strong.

Harman has little prospect of penetrating Ford or GM in North America or Europe, or of winning domestic Japanese business with Toyota, Honda and Nissan, while Japanese suppliers are slowly gaining market share in Europe at Harman’s expense. Executives close to Mercedes’ sourcing decisions tell us that Harman will not win high-end navigation for the 2007 C-Class or the 2009 E-Class. And Alpine will continue to supply navigation for the M-Class in Europe. Alpine also supplies navigation for the E-, S- and C-Class in the United States.

Still, Harman has landed most of the infotainment business available in the West. The company says it owns 80% of Mercedes’ infotainment system bookings worldwide and 100% of audio bookings. According to Harman, “Mercedes has committed itself across the board to all Harman/Kardon branded audio systems.” Harman has also booked all of PSA’s and Audi’s future infotainment business, from luxury vehicles down to entry level.

In 2004, Harman was awarded Chrysler’s NTG 4 system business, Chrysler’s first infotainment system, slated for model year 2007. In May 2005 Harman picked up Chrysler’s new entry-level entertainment system beginning with model year 2008. That system will integrate AM-FM, DVD, rear-seat video, backup camera and hard disc drive with “jukebox music management functions.” “We have all of Chrysler’s infotainment business,” declared Dr. Harman.

According to Dr. Harman, Siemens VDO has been awarded infotainment system business at Volkswagen and Renault. In 2004 Fiat and Microsoft announced a long-term alliance to develop telematics systems that use Bluetooth to wirelessly connect to portable phone or music player devices. Magneti Marelli will supply that hardware.

Entry-Level Integrated Embedded Infotainment Will Be Limited

Harman forecasts that 17% of its infotainment sales in fiscal 2008 will be entry-level systems. Dr. Harman said he expects that “ultimately some expression
of integrated infotainment systems is going to be found in just about all of the vehicles built worldwide.” That just isn’t going to happen, at least within the next decade or two. Infotainment systems usually combine navigation with radio and CD player, the most expensive piece of which is navigation. But increasingly, portable navigation devices like those made by Garmin and TomTom, as well as smart mobile phones with navigation capability will greatly bite into demand for embedded navigation systems. Portable navigation devices cost as little as $199 and can be used in any vehicle or while navigating on foot.

Harman’s so-called entry-level product includes a radio, display, CD player, some sound processing and an RF-only GPS receiver. For this carmakers will spend anywhere from $280 to $420, depending on the size of the display and whether it is color or monochrome. Not inexpensive, the basic device would retail for between $560 and $840, at least. Navigation can be added to the system at the dealer by plugging in an SD-card or some other Flash memory device that contains navigation software and the map data. A similar plug-in module provides Internet and phone connectivity; another module provides hands-free phone capability.

Telematics devices like those made by Motorola ACES for OnStar also preclude demand for the sort of navigation-infotainment expertise to pursue opportunities in driver assistance systems, diagnostics and connectivity to outside of the vehicle.

### Parallel Processing

Among the basic research projects underway at Harman, Dr. Geiger is especially keen on research to connect infotainment computing platforms in real time and thereby avoid bus systems like MOST or CAN, which are expensive. “Our goal is to have two [infotainment] boxes in the car, one in the front and one in the rear,” he explained. “In between we will have a QNet link (from QNX) which is able to connect several core processors in parallel.

Harman’s OEM Price Categories for Infotainment Systems:

- Entry $300–$500
- Mid $500–$800
- High $800+

### New Products

Harman says its automotive segment will stay focused on infotainment systems to the exclusion of vehicle control and body electronics for many years to come. However, the company will use its infotainment expertise to pursue opportunities in driver assistance systems, diagnostics and connectivity to outside of the vehicle.

“We already have the display, we already have the [MOST] bus structures with bit rates of 150 Mbps to 500 Mbps. We already handle digital video and audio, we handle all of the gateway functions to the body, it is very natural that we get this extra functionality on our platforms,” asserted Dr. Geiger.

Dr. Harman believes Harman International’s greatest and continuing challenge is “to continue to understand the technology and interpret it creatively. Not to let engineers do whatever they can with it, but to exercise the kind of discipline that makes the product of their efforts altogether useful.”

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**Recent Acquisitions**

<table>
<thead>
<tr>
<th>Company</th>
<th>Acquired</th>
<th>Technology</th>
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</thead>
<tbody>
<tr>
<td>Xsys (Villingen, Germany)</td>
<td>1998</td>
<td>Video signal processing</td>
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<tr>
<td>CAA (Filderstadt, Germany)</td>
<td>June 2002</td>
<td>Automotive PC systems</td>
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<tr>
<td>Temic Speech Engine (Ulm, Germany)</td>
<td>April 2002</td>
<td>Speech recognition</td>
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<td>Wavemaker (Vancouver, Canada)</td>
<td>2003</td>
<td>Noise cancellation</td>
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<td>Margi Systems (Fremont, California)</td>
<td>September 2003</td>
<td>Multimedia software*</td>
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<tr>
<td>QNX (Ottawa, Ontario, Canada)</td>
<td>October 2004</td>
<td>Embedded operating systems</td>
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<tr>
<td>PhatNoise (Los Angeles, California)</td>
<td>August 2005</td>
<td>Multimedia hardware and software</td>
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*For handheld devices

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**Principal New Infotainment Awards**

<table>
<thead>
<tr>
<th>Company</th>
<th>Award</th>
<th>Sales value when programs are fully launched</th>
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<tbody>
<tr>
<td>Mercedes</td>
<td>FY 2007</td>
<td>Entry, $200 million</td>
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<tr>
<td>FY 2006</td>
<td></td>
<td></td>
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<tr>
<td>S-Class sedan, $175 million</td>
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<td>M-Class Europe, $50 million</td>
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<td></td>
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<td>B-Class, $25 million</td>
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<td></td>
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<tr>
<td>R-Class, $40 million</td>
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<tr>
<td>FY 2007</td>
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<td></td>
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<tr>
<td>S-Class coupe, $20 million</td>
<td></td>
<td></td>
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<tr>
<td>C-Class sedan mid, $65 million</td>
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<tr>
<td>FY 2008</td>
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<tr>
<td>BMW</td>
<td>FY 2008</td>
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<tr>
<td>FY 2006</td>
<td></td>
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<tr>
<td>3 Series wagon, $17 million</td>
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<tr>
<td>Audi</td>
<td>FY 2006: Q7 Europe, $15 million</td>
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<tr>
<td>FY 2007: Q7 U.S., $15 million</td>
<td></td>
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<tr>
<td>FY 2008: All, $350</td>
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<tr>
<td>Porsche</td>
<td>FY 2008</td>
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<td>FY 2008:</td>
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<tr>
<td>Carrera, $35 million</td>
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<tr>
<td>Cayenne, $45 million</td>
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<tr>
<td>Chrysler</td>
<td>FY 2007</td>
<td></td>
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<tr>
<td>Mid/High, $350 million</td>
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<tr>
<td>Hyundai</td>
<td>FY 2007: Dynasty, $70 million</td>
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<td>FY 2008:</td>
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<td></td>
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<tr>
<td>All Platforms, $250 million</td>
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<tr>
<td>Peugeot Citroën</td>
<td>2008</td>
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<tr>
<td>All Platforms, $250 million</td>
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You could have a head unit in the front of the car and an extension box somewhere in the trunk or in the body, with all of the [audio] power electronics, antennas and things.” Each box's MCU would have full access to the resources at each box, for example, a telephone circuit or DVD changer. The two MCUs would work as a single processor with one operating system. First prototypes of this concept have been demonstrated. Actual production of such a system wouldn’t begin for at least five years, says Harman. QNX is a division of Harman.
QNX Advances in Automotive

**Headquarters:** 175 Terence Matthews Crescent, Ottawa, Ontario K2M 1W8 Canada; Tel: 1-613-591-0931; www.qnx.com

**2005 Sales:** $50 million, roughly

**Ownership:** Wholly-owned subsidiary of Harman International

**Key Markets:** Automotive, Control & Automation, Medical, Networking & Telecom, Security & Defense.

**Key Products:** Real-time embedded operating system software, tools and engineering

**Employees:** 280

Founded in 1980 by partners Dan Dodge and Gordon Bell, QNX, originally named Quantum Software Systems, released the first commercial PC operating system to use microkernel architecture, in 1981.

After a decade of building a business around real-time operating systems for PC/x86 platforms, QNX saw opportunity in adapting its OS architecture to run on other platforms. The list of supported platforms now also includes PowerPC, other platforms. The list of supported platforms now also includes PowerPC, MIPS, SH-4, ARM and StrongARM.

Since its acquisition by Harman International, QNX no longer reports sales numbers. However, Linux operating system supplier Green Hills Software has reported that QNX sales were about $24 million in 2004. We estimate QNX's 2005 sales at $50 million, roughly. Harman International purchased QNX in October 2004 for $138 million.

QNX first targeted the automotive industry about four years ago and since then has grown automotive sales from zero to 30% of total revenue, according to Andrew Poliak, automotive business manager. The basis for QNX's penetration in the auto industry is its QNX Neutrino real-time operating system, which is used in a variety of infotainment applications around the world, most notably those produced by Harman International. Presently, however, QNX receives its greatest automotive revenues from Visteon, which makes Bluetooth hands-free kits installed in some 2006 Nissan vehicles.

The QNX operating system also powers Bluetooth hands-free car kits installed on Acura TL, Audi A8L and Chrysler Pacifica models. NAVIS chose QNX for a navigation system it makes for Daewoo. QNX can also be found in a navigation system produced by Hyundai Mobis and in an infotainment system used in the Saab 9-3 in Europe and the United States. LG Electronics opted for a QNX operating system to run a small-footprint telematics platform it supplies for a limited number of OnStar applications.

In Japan, the QNX operating system has found its way into ten 2006 Toyota models, where it runs an infotainment feature supplied by Denso. The company is picking up additional automotive business in Japan. Indeed, QNX recently signed a memorandum of understanding with Hitachi subsidiary, Akita Electronics Systems, a systems integrator active in automotive electronics. Akita already has five engineers working on QNX projects.

QNX is confident its longstanding relationship with Renesas will benefit its growing business in Japan. Renesas is the world's number-one supplier of MCUs for car navigation and ranks Honda, Nissan and Toyota its top three end-use customers. According to QNX, tier one suppliers in Japan consider Renesas the leader in Japan for infotainment, navigation and telematics products. QNX is well-positioned as Renesas' lead RTOS vendor, and the two companies worked together to define a technology roadmap for future products. Mr. Poliak noted, “They are making a strategic investment in us as an architecture, to work with us for the Japanese market.”

In OEM applications in particular, QNX's main competition in Japan comes from the ITRON operating system but according to Mr. Poliak, ITRON may be reaching its limit. “You can make voice recognition, TCP/IP, Bluetooth, things like that run on ITRON but as more functionality is added, complexity gets to the point where it is difficult to debug. The automakers are now saying, ‘What is the next operating system?’”

Over the next several years QNX will be in a shootout with other operating systems for infotainment applications worldwide. At least five operating systems will be contenders: QNX, WinCE, VxWorks, ITRON (T-Kernel) and Linux.

One of the best things about QNX is that it is based on standards. “We are POSIX compliant,” said Mr. Poliak, which is similar to Linux. So if you are familiar with Linux you can quickly program for QNX. QNX's tool suite conforms to Eclipse, an industry standard tool integration platform. Another benefit particularly important to automotive customers is the operating system's reliability. “We are pretty much the definition of hard real time,” declared Mr. Poliak.

Microsoft...

Microsoft offers Windows Mobile for Automotive as a solution for connecting consumer electronics devices such as Bluetooth mobile phones, digital music players and portable navigation in the car. Mr. Wengert refers to Windows Mobile for Automotive as “a category in which we include the software and hardware reference designs to actually make a consumer electronic gateway box in the car—more of a turnkey solution.” With such a gateway box, any Bluetooth phone can connect with the car audio system and steering wheel controls. With an added USB port, any digital music player can be connected to the audio system, including an iPod if the carmaker has licensed the proprietary Apple protocols.

Windows Mobile for Automotive is the product of Microsoft’s collaboration with the Fiat Group to develop a low-cost telematics software platform and hardware reference design. Fiat will introduce the first implementation at the Geneva Auto Show in March 2006, eventually rolling out to all 23 Fiat, Lancia and Alfa Romeo models.