Strategy Analytics on Automotive Electronics Trends

We recently interviewed two of the industry's most experienced and best informed market analysts about the state of automotive electronics: Chris Webber, vice president in charge of Strategy Analytics' automotive practice, and Ian Riches, director of the automotive practice. Founded in 1988, Strategy Analytics provides market intelligence and demand forecasts on electronics modules, semiconductors, sensors, control systems, telecommunications and infotainment systems.

Our experts noted that while global car production is growing at about 3% to 4% per year, automotive electronics and semiconductor revenue totals are expanding at a rate of 8% to 10% annually, with semiconductor sales growing a few percent faster than ECU sales. One key driver of this growth could be the increasing penetration of active safety systems. Strategy Analytics recently completed some extensive testing of active safety systems. Strategy Analytics recently completed some extensive

Turn to Strategy Analytics, page 3

Driver Distraction Offers Huge Safety Opportunity

Volvo and Toyota Lead the Way

“Seventy-eight percent of all crashes and 65% of all near crashes involved the driver looking away from the forward roadway just prior to the onset of the conflict.” That is one of many important results of the widely praised 100-Car Naturalistic Driving Study, which is already influencing safety and human-factors experts around the world. Prior to these results, inattention was widely thought to contribute to perhaps 25% of all crashes, although some experts believed the number was higher. Sponsored by the U.S. National Highway Traffic Safety Administration and conducted by the Virginia Tech Transportation Institute, the 100-Car Study kept track of drivers and their vehicles over 12 to 13 months, recording five channels of video during approximately two million miles of driving.

Even before the 100-Car Study was completed, Toyota was well on its way to implementing technology that will help drivers avoid the sort of crashes caused by visual distraction. In March 2006, Toyota introduced the Lexus GS 450 hybrid a driver monitoring system that uses a digital camera mounted on the steering column to keep track of the driver's face. If the driver looks away from the road for a few seconds or more, and if an obstacle is detected ahead, the system alerts the driver with a warning chime and flashing light. As the car gets closer to the obstacle, the system automatically begins to brake. Toyota will introduce the driver monitoring system, which is part of Toyota's Advanced Pre-Collision System (APCS), in Europe this December on the LS 460. APCS comes to the U.S. in late spring 2007, on the 2008 Lexus LS 600h L. The system will be added to new vehicles as they are introduced each year. Based on technology developed by Toyota Motor Corporation and Toyota Central Research Corporation, the driver monitor is manufactured by the Aisin Group, a Toyota affiliate.

Cognitive Distraction Detection

While it is a huge problem with devastating implications, visual distraction is not the only kind of distraction that leads to accidents. Experts have also come firmly to the conclusion that cognitive distraction—when your attention is diverted from the driving task—adds significantly to the safety problem.

Dr. Samantha Jamson, senior research fellow at the Institute for Transport Studies, University of Leeds, which coordinated the European Union's HASTE project on safety and the human machine interaction, believes that cognitive distraction is a significant safety problem. “Your eyes are fixated on the road, but you're thinking about the instructions your navigation system is giving you and you are not attending to peripheral events—such as a car emerging from a side road or a pedestrian stepping out.”

Dr. Trent Victor, a human systems integration engineering manager at Volvo Technology Corp., who has been working on driver distraction issues for nearly ten years, cautioned: “We have observed that a person who is concentrated on solving a problem on the phone is affected increasingly by tunnel vision. The driver loses awareness of oncoming traffic, crossing cyclists or red lights, perhaps looking straight ahead without really seeing very much. This is just as dangerous as looking away from the road repeatedly to do something else.”

Last year Dr. Victor completed his doctoral thesis with Uppsala University, Sweden. In “Keeping Eye and Mind on the
Distraction...

Road,” he suggests that equipment that measures eye movement can be used not only to identify visual distraction, when the driver looks away from the road too often, but also to detect cognitive distraction, because when drivers have cognitive tasks to perform they tend to stare fixedly at the center of the road.

According to Dr. Victor’s thesis, “Reading emails and SMS messages, and changing the zoom level and language setting on a navigation system are significantly different from common in-vehicle tasks, such as changing radio stations. And there was some evidence that dialing a hands-free telephone is more difficult than dialing a handheld telephone.”

Workload Managers

Many suppliers and most carmakers around the world are developing workload managers that help limit potential distractions from the vehicle’s information, entertainment and warning systems, and from cell phones, MP3 players and other portable devices. The state of workload manager development around the world was neatly summed up in an SAE paper by Paul Green, research professor at the University of Michigan Transportation Research Institute, published by the SAE for Convergence 2004.

Since the 2003 model year, the Saab 9-3 and Saab 9-5 have had dialog managers that control the flow of non-safety-critical messages. In the 2007 Saab 9-5 the workload manager suppresses dashboard warnings and intercepts incoming phone calls when high driver workload is detected, such as during heavy braking.

Volvo, which started using a workload manager as a standard feature in 2003 on the S40 and V40 vehicles, presently deploys the feature standard on S40, V50 and S80 models. The Intelligent Driver Information System (IDIS) monitors such vehicle parameters as speed, acceleration and deceleration, turn signal on/off, braking, and turning angle. When driving demands are high, it delays incoming phone calls and vehicle-generated text messages.

What’s next at Volvo after IDIS? Robert Broström, a technical expert in the HMI systems engineering department at Volvo Car Corp., has been working on workload managers since 2001. He will present a paper on October 9, 2006, at the ITS World Conference in London, which describes the next generation IDIS concept, designed “to resolve HMI conflicts between different systems or between systems and the current driving situation.”

“It will behave like a person sitting next to you, someone taking care of the distraction level for you,” said Mr. Broström. "The reason we are looking at this kind of system is that we see increasing functional content in the car, both in-vehicle information systems like navigation and traffic as well as things like MP3 players, which all cause distraction. Adding to the workload are advanced driver assistance systems like adaptive cruise control, forward collision warning and lane departure warning.”

Volvo’s interaction manager is designed to accommodate inputs from a variety of modules that monitor the driver’s attentiveness, for example, a camera that tracks the driver’s eye and head movements, and/or a camera that keeps track of the vehicle’s position within the lane, and/or a vehicle navigation system that reports if the vehicle is approaching a difficult or dangerous intersection or rotary.

While Volvo’s existing IDIS system was fairly easy to implement because it monitors data already on the vehicle’s CAN network, the second-generation IDIS will require significant changes in the electrical architecture. Therefore, its introduction will likely be timed as new Volvo platforms are introduced.

Managing Portable Devices

According to a NHTSA press release on the findings of the 100-Car Study, the most common distraction for drivers is the use of cell phones, which distract visually and cognitively in equal measure. NHTSA reported, “The number of crashes and near-crashes attributable to dialing is nearly identical to the number associated with talking or listening.”

The problem with cell phones has reached epidemic proportions. According to NHTSA, at any given daylight moment in 2005, 10% of all drivers on the road in the United States were engaged in phone conversations using either a handheld or hands-free phone. That data is based on samples of 43,000 vehicles observed from 1,200 sites across the U.S. The survey was conducted by the National Center for Statistics and Analysis. Unless the industry can come to grips with the problem of cell phone distraction, laws prohibiting the use of handheld and even hands-free cell phones while driving will continue to proliferate around the world.

Other portable devices that drivers bring into their vehicles such as personal navigation devices (PNDs), iPods, Blackberries and Treos also bring substantial safety risks. Dr. Wiel Janssen, senior scientist at TNO Human Factors, a market-

Continued from page 1
Strategic market research that confirmed a high degree of consumer interest in active safety, but only if the price is very low.

The new market research program, called Automotive Buyer Dynamics, uses Web-based surveys of new car buyers in the United Kingdom, France, Germany, and the United States. The research methodology is designed to mimic the way consumers actually have to choose options—bundled in various configurations by the manufacturer. “There is huge consumer interest in safety systems, but there is very little willingness to pay market prices for them as options,” noted Mr. Riches. “For a lot of features, whether it’s a fully integrated Bluetooth hands-free system, autonomous cruise control or collision avoidance, consumers were willing to pay around $200-$300.” Obviously there is a large disparity between the average willingness to pay and actual retail prices. “Our research identifies consumer segments willing to pay more, but unless option prices come down or features are made standard, many of these advanced safety systems will not reach the mass market,” Mr. Riches predicted.

While software is a key enabler of active safety, and software development cost is a major contributor to its high price, one of the ways to bring active safety to a broader market is to dramatically reduce the cost of sensors. It is Mr. Riches’ view that ten-dollar, automotive-quality, wide-dynamic-range CMOS cameras will soon begin to replace high priced radar or lidar sensors in blind-spot monitoring, lane departure warning systems and forward-looking obstacle detection systems.

Navigation prices will also be pressured downward. “There has been a big rise in the last couple of years in portable navigation systems like those from TomTom and the like,” noted Chris Webber. “That confirms the clear consumer interest in having navigation systems, but again, it comes back to the right price point.” A typical OE embedded navigation option is priced in the $1,000 to $2,000 range, but to really move the customer, the price needs to get to $500 and below.

With the anticipation of lower prices, Strategy Analytics expects penetration of OEM navigation in Europe to grow from 9% in 2005 to 18% by 2010. In NAFTA countries, penetration is expected to grow from 8% in 2005 to 14% in 2010.

Democratization of Technology

A big change in our industry Strategy Analytics has noticed is an increase in the speed with which new technology flows down from luxury vehicles to mass market vehicles. Ian Riches elaborated:

“Ten or 15 years ago, Bosch would develop new technology for the Mercedes S-Class where it would stay for three years before perhaps going into the E-Class. You could always count three model generations before Ford, Volkswagen or Chevrolet would pick it up on a mainstream model.

“That’s breaking down. The first lane-departure warning product came out on the Infiniti brand in the U.S., a luxury brand, sure, but one that’s ranked a bit below Lexus, BMW or Mercedes. In Europe it first came out on a Citroën. Adaptive front lighting was standard on the 2004 Opel Corsa, a B-segment vehicle. Why is this? Because all the vehicle manufacturers are really having to fight to differentiate their products, especially the middle-ranking brands.”

Strategy Analytics, with headquarters in Newton, Massachusetts, maintains offices in England, France and Germany. For more information please visit www.strategyanalytics.net or call Chris Webber at 44 1908 423641. ◆

Distraction... Continued from page 2

oriented research institute in The Netherlands, believes one of the hottest issues in Europe today is how to place nomadic devices under the control of the intelligence built into a car. Dr. Janssen advises manufacturers of those devices to cooperate with carmakers to solve the problem or, he predicts, carmakers will find a way in which you simply cannot connect a nomadic device to the vehicle unless you plug it into a master supervisor.

Aware of the potential harm to the cell phone industry from legislation, industry leader Motorola is trying to find a technological solution to the problem. Mike Gardner, director of intelligent systems research for Motorola Labs, sees three components to cell phone safety: “Eyes on the road, hands on the wheel and mind on the driving.” The first two issues are addressed with the hand-free phone, says Mr. Gardner, “but to address cognitive preoccupation we need nomadic devices that can change their behavior based on what the car and driver are doing. That will lead to workload managers in the vehicle and the nomadic device gateway.”

Motorola is an active participant with Volvo Technology, carmakers, suppliers, research institutes and universities in the EU-funded AIDE project, which is developing models, methodologies and human-interface technologies required for safe integration of driver assistance and information systems in the vehicle. Among its several activities, AIDE has organized the Nomadic Device Forum, which is trying to build consensus on the features and architecture of a “smart vehicle-portable device gateway,” and to address safety and commercial issues associated with vehicle-device integration. At its latest meeting, May 15-16, 2006, the forum defined use cases and wrote a definition of requirements for a portable device gateway that would make it possible to dock any standard portable device and operate it in a safe manner. AIDE must complete its work by February 2008.

According to Motorola’s Mr. Gardner, along with the Nomadic Device Forum we should also be watching developments at the Digital Living Network Alliance (DLNA), a consortium of more than 250 consumer electronics, computer and communications companies working on seamless integration through a wired or wireless network to share digital media within the home and while traveling. The prospects for extending DLNA’s interoperability standards to the auto industry were enhanced recently by the decision of BMW, DaimlerChrysler and Volkswagen to join the alliance. ◆
The Company Profile...

Omron Automotive Electronic Components

Background

Omron Corporation, established in 1933 to manufacture timer relays for x-ray machines, had sales of ¥626,782 million ($5.48 billion) in the fiscal year ending March 31, 2006, with net margin of 5.7% and return on equity of 10.7%. Omron's largest business by far is its industrial automation business, accounting for 43.5% of sales. The business makes control systems, equipment and components for factory automation. The company annually produces 700 million relays for all the industries it serves. Omron stock is traded on the Tokyo, Osaka and Nagoya stock exchanges.

Omron's growth is increasing demand for electronic control units (ECUs) for radio frequency (RF) products such as keyless entry and tire pressure monitor receivers, switching technologies to automotive applications. AEC was established in 1985 in Nagoya, Japan, originally as part of the Electronics Components business of Omron Corporation. AEC was reclassified as a separate internal company in April 2003. With sales of ¥77,593 million ($678 million) in the year ending March 31, 2006 (FY 2005), AEC accounted for 12.4% of Omron Corporation's total sales.

In the last three years, AEC has grown sales at the rate of 9.3% per year. Its aggressive sales plan for 2006 and 2007 calls for 13.5% annual growth, which means its sales are growing significantly faster than the auto electronics market. Fueling Omron's growth is increasing demand for electronic control units (ECUs) for radio frequency (RF) products such as keyless entry and tire pressure monitor receivers, for body controls and for electric power steering.

Automotive Electronic Components

Omron AEC brings Omron's core sensing and controls technologies to automotive applications. AEC was established in 1985 in Nagoya, Japan, originally as part of the Electronics Components business of Omron Corporation. AEC was reclassified as a separate internal company in April 2003. With sales of ¥77,593 million ($678 million) in the year ending March 31, 2006 (FY 2005), AEC accounted for 12.4% of Omron Corporation's total sales.

In the last three years, AEC has grown sales at the rate of 9.3% per year. Its aggressive sales plan for 2006 and 2007 calls for 13.5% annual growth, which means its business is growing significantly faster than the auto electronics market. Fueling Omron's growth is increasing demand for electronic control units (ECUs) for radio frequency (RF) products such as keyless entry and tire pressure monitor receivers, for body controls and for electric power steering.

The automotive business lost ¥2 billion ($17.5 million) in fiscal 2005, as a result of rising raw materials costs and the expansion of manufacturing facilities in St. Charles, Illinois, and Oakville, Ontario. AEC plans to improve profitability in FY 2006 by sharing R&D expenses and components with other Omron business segments, by increasing production in China and by expanding sales of high value-added products like laser radar.

AEC describes itself as a directed source. Mike van Gendt, senior general manager for AEC Inter-Americas and executive officer of Omron Corp., said, "We consider ourselves almost a tier one-and-a-half, with a lot of our products being showcased at the OE level. In many cases, the negotiations are done at an OE level and then directed to tier ones where appropriate."

Omron AEC employs approximately 4,000 people worldwide, including 916 in North America. Operations in North and South America are under the management of the Inter-Americas Automotive Electronic Components group. Mr. van Gendt also serves as president of Omron Dualtec Automotive Electronics, based in Ontario, Canada. Omron purchased Dualtec Electronics from Magna International in 1991 and used this acquisition to create a North American manufacturing base for automotive relays. Omron Dualtec expanded its manufacturing base for automotive relays.
facilities in Ontario in 2005 to support increased business with North American OEMs and tier ones for ECUs, HVAC panels, flashers and switches.

Omron has benefited from increased vehicle sales in the United States by its Japanese OEM customers. AEC’s North American sales grew 37% in FY 2005, accounting for 37% of the segment’s sales; in FY 2006 the company expects North America will account for 40% of AEC sales. Europe, according to Mr. van Gendt, has been a tougher market to break into. “We started later in Europe and the market there has been more focused, with each country supporting its domestic OEMs. We are making inroads,” he said.

In July 2004 Omron acquired the automotive relay division of Bitron Industrie S.p.A., Torino, Italy. Bitron, which at the
time managed eight factories in Europe, including four in Italy, was ranked third in the European market for plug-in type automotive relays. Along with micro ISO, mini ISO relays and glow-plug relays, Bitron manufactures engine temperature switches and panel switches.

The company created an automotive relay joint venture, Omron Bitron Automotive Electronics, in Alatri, Italy, in October 2004. Omron holds 75% of the joint venture now but will take over 100% of the company in March 2007.

Omron and Bitron created a second joint venture in February 2006, Omron Bitron Componentes Automotivos Ltda. in Itapevi, Brazil, which manufactures power window switches and HVAC switch panels.

While the majority of AEC’s technology comes from inside the company, its acquisitions of Dualtec and Bitron expanded the company’s global reach. AEC is open to other small acquisitions, in the range of $5 million to $30 million, if the target fits with Omron’s core interests in sensors and controls.

Some years ago, Omron identified China as a growth opportunity and in January 2006 began operating a new automotive electronics production facility in Guangzhou, China, a global hub for the automotive industry. Staffed initially with 80 employees and set up to produce keyless entry systems and power window controllers, shipments from the facility reached ¥100 million ($874,000) in the first year (January through March 2006) and are expected to rise to ¥1 billion ($8.7 million) in FY 2006 and ¥15 billion ($131.1 million) for FY 2010. Omron expects vehicle production in China to grow at more than 10% per year, to the point where it will top Japan’s annual production of 7 million vehicles by 2007 or 2008.

Products

ECUs for RF

AEC’s line of electronic control units generated 52% of sales in fiscal 2005, and the majority of those ECUs end up in RF products in features such as remote keyless entry (RKE), passive entry, remote start, immobilizers and tire pressure monitors (TPM). Omron is the number-one supplier of RKE in Japan and claims it will be the number-one RKE supplier in North America by 2007.

The company attributes much of its success in RF systems to its technical expertise in hardware design, including packaging, and antenna design. Omron AEC’s ability to deliver competitively priced, high-quality wireless components is also related to the parent company’s huge industrial automation business.

According to Jerry Bricker, vice president and general sales manager of Omron
Automotive Electronics Inc., “Omron’s corporate specialty is factory automation. Part of our technology advantage is that we not only design and develop the components, but we also are experts in high-volume, automated production equipment.” Omron Corporation designs most of its production and test equipment in-house. RF integrated circuits are purchased from outside suppliers.

Another advantage of Omron’s RF receivers, said Mr. Bricker, is their ability to receive signals from various inputs. Most AEC customers use a single receiver, which can be either a stand-alone unit or integrated into a body control module, depending on the carmaker’s specifications. An integrated receiver can receive transmissions from a key fob for keyless entry, passive entry, engine immobilizer and remote start as well as from tire pressure monitors. Omron supplies only the receiver end of TPM, not the sending units. The company has not seen much demand for TPM beyond the mandated U.S. market, except for a few high-end vehicle applications.

Omron’s biggest competitors in RF ECUs are Siemens VDO, Bosch, TRW, Valeo, and in Japan, Alps and Denso.

### ECUs for Body Control Modules

Omron’s very close, long term relationships with its Japanese customers and its expertise in integrating electromechanical relays were the company’s entrée into the body control module (BCM) business. BMs comprise the second largest segment of Omron AEC’s electronic control units business. AEC supplies BMs for Mitsubishi as well as for the Honda Accord, Legend and Acura RL.

Body control modules integrate control functions such as door locking, lighting, security systems and memory seat functions, reducing the number of ECUs required and simplifying wiring. While the trend at carmakers such as GM and Chrysler has been to integrate body control functions into a single module, Mr. Bricker said that is by no means an industry-wide approach: “The trend is definitely changing. Carmakers really want to use electronics and software as a way to differentiate their vehicles, and doing a heavy amount of integration into a single module can be pretty costly. Today it is all about platform engineering, and if you have a platform designed to go across a wide range of vehicles, from very low-cost with low feature content to high-end vehicles with a lot of features and functions, it may penalize the lower end vehicle to have that single [body control] module. Some carmakers want more modules so they can add or subtract hardware, and therefore, cost. Others are going the other way—where they want to integrate more into a single module.”

### ECUs for Electric Power Steering

Electrical power steering (EPS) is the third largest part of the company’s ECU business and the fastest-growing product line, according to Mr. Bricker. Omron expects that EPS penetration will reach 25% of new vehicles globally by 2012, compared with less than 5% penetration today. Driving that growth is the migration of EPS into larger, heavier vehicles as carmakers seek greater fuel efficiencies. Future EPS drive motors are likely to be AC motors, which can provide the additional power required by larger vehicles and hybrids. Omron’s ability to reduce the size of the override electromechanical relay used in this application is one important key to the company’s success.

Omron is the major tier-two source of EPS controllers for a Japanese EPS-maker, its principal EPS account. Omron’s EPS control modules are currently used in the Toyota Corolla in Europe, the Ford Escape hybrid in the U.S. and by two customers in Japan. The company is in the final stages of development of EPS controllers for larger vehicles and says it will soon have a system ready for a full-sized, eight-cylinder car or truck. Omron’s EPS uses a unique control algorithm the company has been developing and refining over the last 20 years.

AEC also supplies ECUs for closure controls—for power sliding doors and power tailgates.

#### Relays

An electromechanical relay is an electrically activated switching device with which a high-current circuit is controlled by a low-current switch. Typical automotive applications of relays include the control of motors, lamps, engine cooling fans, HVAC and window defrost systems. The number-one relay supplier to the North American auto industry, Omron’s relay product line includes both plug-in relays, typically used in the vehicle wiring harness and in junction boxes, and printed circuit board (PCB) relays, used in low-current applications such as body controllers, power window switches and memory seat modules.

According to Jerry Bricker, while approximately 60% of AEC’s relay business today is plug-in types, the fastest-growing segment is PCB relays. Within the next five years, he expects PCB types will be used in the majority of applications. Several factors are driving the conversion. Suppliers can integrate PCB relays into smaller, stand-alone modules independent of the overall electrical architecture or wiring harness system. Further, the reli-
ability and quality of electromechanical relays has improved significantly in recent years. “For us it is under 1 PPM [plant rejects] today,” said Mr. Bricker, so the ease of replacement that plug-ins provided is no longer as big an issue with engineers. More efficient motors, which draw less current, also allow the smaller PCB devices to be used in more applications.

As a result of AEC’s continuing improvements in relay technology, it can provide customers with smaller devices that can handle higher loads by shortening current paths and using fewer interconnects. With rising materials costs, especially for the copper used in relay contacts, Omron has developed smaller products that use less material.

According to Mr. van Gendt, Omron has “very limited” business today in solid-state relays. Of the $550 million global automotive relay market, he estimates only about 5% is solid-state devices, largely because of their price, which can be up to five-times higher than electromechanical relays. And in some instances, he said, carmakers have actually tried solid-state relays in functions such as lighting, fuel pump and fan control and later switched back to electromechanical.

“There are different solutions—but different costs associated with those solutions, and there is a big push in the industry on cost containment and reduction. OEMs continue to favor electromechanical devices over solid state unless it’s a more sophisticated control application, or they need pulse width modulation, or slow start, or some function other than a direct on/off.”

✦ Switches

AEC takes parent Omron’s depth in switch technology and focuses it on automotive applications—in power seat switches, power window controls and any accessory switches the driver or the passenger touches in the doors, the seats, instrument panel and elsewhere. Omron’s switch assemblies are built using standard, high-quality, low-cost “switch cells” on the inside, with customized knobs or buttons on the outside.

Power window switches incorporate Omron’s PCB relays, and the company’s anti-pinch controller meets U.S. safety standards described in FMVSS 118.

✦ New Products

✦ Lidar

Omron AEC believes that sensors will become more and more important as the demand for driver assist systems grows. The company has developed a lidar (light detection and ranging) sensor that uses Omron optics technology and proprietary target acquisition software algorithms. Lidar measures the time delay between transmission of a pulse of light and detection of the signal reflected off the vehicle or object ahead to calculate speed and distance. Omron’s lidar sensor can function as a “three in one” device: long distance forward sensing for ACC, short range sensing for low-speed following and stop-and-go driving (in Japan) and pre-crash sensing for braking and seatbelt pretensioning.

The current product offers two-dimensional scanning: a wide field of view, 30 degrees horizontal and 10 degrees vertical, which compensates for elevation changes as the vehicle travels over uneven terrain. The wide field of view makes it possible to track the target around curves in the road.

Omron noted it was the first company to produce and market a lidar sensor, beginning in 1996 in Japan. Omron’s lidar sensors today are used for adaptive cruise control on the new Nissan Fuga in Japan, and on the new Infiniti M35/45. While lidar, unlike radar, is limited by its inability to see through heavy snow and rain, its cost advantage promises greater demand for the technology. Mr. Bricker observed, “When we first went to market, I think it was half the price [of radar]. The gap has closed, but there is still definitely a significant cost advantage, somewhere between 50% and 25% less.”

✦ High Dynamic Range CMOS (HDRC) Image Sensor

In 2002 Omron formed a joint venture called IMS Vision with the Institute for Microelectronics Stuttgart to develop car-mounted HDRC cameras. Omron acquired 100% of IMS Vision in May 2005 and renamed the business Omron Automotive Electronics Technology GmbH. A new research and development center in Lindau, Germany, was set up at the end of 2005 to support ongoing HDRC development efforts.

Omron refers to one of those efforts as “sensor fusion,” in which it combines the image sensor with lidar to more accurately discriminate between objects and pedestrians in the vehicle’s path in low light and backlit conditions. Omron’s HDRC camera detects light levels over an intensity range of 170 dB, the highest dynamic range on the market, according to company literature, compared with CCD cameras, which typically have a limited dynamic range of just 60 dB. No production orders have yet been booked; the product is not likely to come to market until after 2010. ◆
2007 Feature Highlights

Safety and convenience features continue to trickle down from luxury cars to mainstream vehicles. According to Bosch, the penetration of electronic stability control (ESC) in the U.S. is around 35% today, and Bosch expects that figure to double by 2010. Consumer Reports says ESC is available, either standard or optional, on 65% of 2006 vehicles, compared with 60% in 2005.

NHTSA recently announced a phased-in ESC mandate, but most major carmakers have already committed to including ESC as a standard feature across their model lines, eventually. All GM SUVs and vans will have StabiliTrak standard by the end of 2007; all GM cars and trucks by end of 2010. Ford said that all Ford, Lincoln and Mercury models for the U.S. will come with standard ESC by 2009. DaimlerChrysler now delivers ESC standard on more than 70% of Chrysler models including all SUVs. Toyota SUVs come with ESC, and Toyota says that all models will eventually, but the carmaker did not make ESC standard on the newest generation of the Camry, America's top selling midsize sedan.

Toyota has updated its Advanced Pre-Collision System (APCS), which detects objects and oncoming vehicles. The new system, available now in Japan and coming later this year to Europe and to the U.S. next year, uses two forward-facing cameras aided by infrared projectors in the headlight to determine if a pedestrian is in the car's path. Another camera mounted in the steering wheel keeps track of the driver's head position to minimize accidents caused by distraction. If the driver fails to respond to the system's alerts, APCS applies the brakes.

In Japan, Lexus models will offer a rear-looking millimeter-wave radar that can detect collisions approaching from behind, alerting the driver with a warning light. Sensors in the headrests detect the position of the driver and front passenger and adjust the headrests to minimize whiplash. The rear-end crash system will not be immediately available in the U.S., and plans for Europe are undecided.

The hybrid GS 450h, launched in Japan in the spring of 2006, has Toyota's NAVI/Al-AVS (Navigation/Artificial Intelligence-Adaptive Variable Suspension) system, which automatically dampens the suspension based on road information obtained from the navigation system.

Along with a host of electronic performance, safety and convenience features including stop and go adaptive cruise control and night vision, Mercedes' ninth-generation S-Class, introduced in the spring of 2006, includes an iDrive-like multifunction controller and display for Mercedes' Comand cockpit controls. The device has not generated the rancorous reviews that followed BMW's first generation iDrive, and reportedly Mercedes will use the controller in the all new 2008 C-Class, due in the spring of 2007.

Mercedes' new automatic braking system, Pre-Safe Brake, is available in an option package on the new S-Class and CL-Class. As in the previous version, if the near range radar sensors in the front bumper detect a possible collision, the system alerts the driver and calculates the brake force that will be required before the driver hits the pedal. What's new is that if the driver fails to act, Pre-Safe Brake applies autonomous partial braking equivalent to 40% of the maximum braking force.

Mercedes' adaptive brake lights flash in emergency braking situations to warn drivers approaching from behind. Studies have shown that rapid flashing helps reduce drivers' reaction times.

Audi's multifunction controller, the MMI (Multimedia Interface) appears in Audi's new full-sized SUV, the Q7. The Q7 also offers Side Assist blind spot detection and a rear view camera and parking aid that share the MMI display.

While inexpensive parking aids that use a variety of sensors and rearview cameras are widely available from carmakers and as aftermarket add-ons, more sophisticated systems are appearing on high-end cars. Toyota's Advanced Parking Guidance System, which was first introduced in 2003 on Prius in Japan, uses sonar, a camera and electric power steering to automatically parallel park a Lexus LS 460; it requires only braking by the driver. Mercedes' Park Assist system on the S-Class determines if the parking space is big enough and guides the driver through parallel parking with a rear-looking video image overlaid with a graphic of the rear of the car.

BMW demonstrated an automatic parking system that uses ultrasound sensors in the bumpers to guide the car into a garage, but it does not parallel park.

BMW will provide lifetime, free, real-time traffic data to U.S. customers who purchase a navigation system on select BMW models, beginning in the fall of 2006. Traffic data will come from Clear Channel Radio. In Europe BMW has provided traffic data linked to the navigation system, which allows for dynamic rerouting, for several years.

Hard drives are finding their way into more cars. The Lexus LS 460 has a 30 GB hard drive to store not only navigation data (optional), but also music and Gracenotes artist and title information. Infiniti G35 for 2007 has a hard drive for music storage, and Chrysler's optional MyGig infotainment system from Harman, offered in the 2007 Sebring, Dodge Nitro and Jeep Wrangler, has a 20 GB hard drive for navigation and music storage. Harman also supplies a 20 GB hard drive as part of the Mercedes S-Class navigation system.