2007 Roundup: Magneti Marelli, ZF, Brose

Magneti Marelli
2007 Net Sales: 5,000 million euros
Change from 2006: up 12.2%
2007 Operating Profit: 209 million euros, 4.2% of sales
S&P Credit Rating: BB+/B/Positive, a non-investment rating

In 2007 each of Magneti Marelli’s five major business lines increased sales, most of which are to parent Fiat Group. Fiat’s unit sales grew nearly 13% worldwide. Sales by business segment break down as follows: Lighting, 32% of total sales; Suspension Systems, 24%; Engine Control, 19%; Exhaust Systems, 12%; Electronic Systems, 11%; Other, 2%.

Electronics Systems sales increased 4% over the prior year, although telematics sales were flat. In addition to Fiat’s Blue&Me telematics system, the Electronics division will be supplying radio navigation and eCall hardware for PSA, the in-dash computer for the Ford Works telematics systems in North America, and instrument clusters for Volkswagen/Audi and PSA.

In the Lighting division, where sales were up 15% over last year, non-Fiat sales were a significant factor, according to Fiat’s annual report. Magneti Marelli supplies the new Audi R8’s full-function LED headlights, the first production application of LEDs for low and high beams, daytime running lights and turn signal indicators.

In line with its plans to expand in new markets, Magneti Marelli entered into several joint ventures. In Russia, the company will work with Avtopribor to develop and manufacture electronic instrument clusters. Magneti Marelli holds 51% of a joint venture in India, which later in 2008 will begin producing instrument clusters. Magneti Marelli will work with Avtopribor to develop and manufacture electronic instrument clusters. Magneti Marelli will work with Avtopribor to develop and manufacture electronic instrument clusters.

Turn to Roundup, page 3

AUTOSAR’s Global Adoption Very Slow

Even AUTOSAR Pioneers Take Step-by-Step Approach

Almost everyone you talk to about AUTOSAR has positive things to say about the software architecture being promoted by the German auto industry. It will let carmakers and suppliers reuse proven software, and that will save development time and money as well as warranty expenses. Automakers could potentially realize savings in the billions of dollars each.

With AUTOSAR, developers can decouple software functionality from the hardware and run the software in any ECU, wherever it makes the most sense. Multiple software applications, from different suppliers, could run on a single ECU. “That ability to mix IT is incredibly important,” said Scott Kirchner, General Motors’ director of software engineering. “It will let us reduce the number of ECUs in the vehicle, take the costs down, take the energy consumption down, take the mass down, and let us run software from different suppliers on the electronic control unit. The software doesn’t have to come from the ECU supplier.”

Despite the promised savings, carmakers aren’t rushing to implement AUTOSAR in production vehicles. And those who are going forward with implementations are each approaching the process a little differently. “Some are introducing a complete set of AUTOSAR [basic software] modules; some are going step by step, some are using only the communications stack,” said Walter Grote, senior vice president at Bosch. “The strategies are quite different.”

The slow global adoption of the AUTOSAR standard is making it difficult for suppliers to make good business cases. “It is a question of the effort necessary to make the software reusable. You need to sell the software enough times to pay off the investment in making it reusable. You have only 20 OEMs to whom you can sell the software—that makes it a little bit difficult to get this commercially successful case,” noted Dr. Grote. Nevertheless, Bosch is completely committed to AUTOSAR and is making efforts to promote its use beyond Germany.

Most of the early AUTOSAR implementations involve the body control module. And there is wide agreement that AUTOSAR will also be applied to the chassis and powertrain domains. But the infotainment system remains a question. “Personally, I think there is no need to have AUTOSAR for infotainment,” declared Dirk Diekhoff, senior manager of international business development at EB.

“Infotainment systems have completely different requirements from the rest of the vehicle, different micros and different operating systems. Why bother with AUTOSAR? If you need hardware abstraction, Java is available.”

Still, there might be reason to apply AUTOSAR to the infotainment system where it connects to the rest of the vehicle. “We don’t want to make Microsoft, Linux or QNX compatible with AUTOSAR,” noted Michael Würtzemberger, a top electrical engineer at BMW. “That makes no sense. But we have thought about making an AUTOSAR plug-in to Microsoft so the automotive world can link to the consumer world for basic functionality, like energy management.”

Here’s the latest on some of the leading carmakers’ plans to introduce AUTOSAR into production vehicles:

BMW

In a small first step toward AUTOSAR adoption, BMW will apply the standard runtime environment (RTE) as well as AUTOSAR, page 8
A Wireless Network Engineered Especially for Cars—No Dropped Calls

A utonet M obile Service provides wireless Internet connectivity designed especially for moving vehicles. A ny Wi-Fi device can maintain a broadband-level seamless connection on more than 95% of the roads in the United States. A $39 monthly subscription and a $595 in-car router turn the car into a Wi-Fi hotspot capable of access speeds from 600 Kbps to 800 Kbps and uploads at 200 Kbps.

Maintaining an uninterrupted link to the Internet while the car is moving is no small feat. Simple cellular data-card connections don't work because there is no easy way to overcome the problem of dropped calls. The connection is easily broken when the car moves between cell phone towers or between high- and low-speed networks. Once the dropped call syndrome was addressed, a utonet developers discovered they had another problem. When there are multiple users online inside multiple cars, for example when traffic collects at stop lights, it created collisions in the network.

A utonet M obile, a San Francisco, California start-up, developed a network management solution it calls TRU Technology, which solves these network failure problems. That essential technology is embodied in software algorithms that reside at the router inside the vehicle and at the A utonet call centers. A utonet's technology anticipates network failures before they occur and automatically fixes the problem before it is experienced by the customer. "What we do differently, what no one has ever done before, is manage every vehicle from a user's quality perspective," noted A utonet co-founder and C EO, Sterling Pratz. "The algorithm in the car analyzes what you are experiencing, and if it goes outside an acceptable threshold it notifies us. A ll of this monitoring is 100% automated; our router unit has a mini network operating center inside it."

It takes 15 minutes to install the router in the vehicle; it requires only four screws and a connection to 12-volt power. The routers are usually mounted in the trunk, on the side or under the trunk lid or under a seat. The two antennas, externally attached to the router housing, are sufficient in roughly 99% of the cases; if they're not, an external 2 dB gain antenna is added. A ny Wi-Fi-enabled device will connect to the router.

M r. Pratz elaborated on why a managed network is essential to the A utonet M obile business model. "W hen we built this network we wanted to create an easy to use, seamless experience for the customer. Secondly, we wanted to be sure that a customer is never going to bring his car to a service center because he thinks the Internet is down. T he number-one complaint customers make to their Internet service provider is that they can't access the Internet—even if the problem is with their own computer, they think the Internet went down."

A utonet M obile will soon announce which carrier's nationwide communications network will serve as its single backhaul carrier. "W e use our partner's tower network, but we are the ones who actually manage the entire process of connecting to the car. O ur network operating centers work with our customers, giving them very personalized service. You have just one 800 number to call, A utonet M obile's. W ith other networks, customers don't know who to call—the carrier, the router maker or the car manufacturer," M r. Pratz noted.

Presently there are just 22 A utonet M obile employees, although more will be hired as more subscribers are brought in. T he company expects it will need only one call-center employee per 7,000 subscribers. "M uch is done automatically. T he router does the authentication, it handles the network approach; if there is a disconnect, the router reconnects automatically in milliseconds. O ur idea was we wanted our customers removed from the technology," said M r. Pratz.

Building the Subscriber Base

C alling itself "the world's first in-car Internet service provider," A utonet M obile launched its in-car Internet service in January 2007, and has thus far put 1,000 mobile subscribers online. A n additional 5,000 subscriptions are on back order awaiting the next build of routers. B y the end of 2009, A utonet M obile expects 100,000 subscribers and one million by the end of 2011.
ZF Friedrichshafen
2007 Consolidated Sales: 12,649 million euros
Change from 2006: up 8%
Outlook for 2008: Sales will increase approximately 4%, with increased vehicle production in Eastern Europe, China and India offsetting sluggish Western markets and high materials costs.

With the exception of Car Chassis Technology, where sales decreased 2% compared with 2006, all ZF business divisions reported sales growth. Both the Steering Technology (ZF Lenksysteme, a 50/50 joint venture with Bosch) and Powertrain and Suspension Components divisions grew 12%. Sales of electronic steering systems increased, as did sales of electronic CDC (continuous damping control) systems.

Car Driveline Technology increased 5% due to increased exports by ZF’s European OEM customers and strong demand for the second generation of ZF’s six-speed automatic transmission.

Regionally, Western Europe accounted for 67% of ZF Group sales; Asia-Pacific, 13%; and North America, 10%. Sales in Western Europe increased 8% in 2007; Asia-Pacific sales grew 46%; sales in North America declined 19%.

ZF has products in its pipeline to help carmakers meet fuel consumption and emissions regulations. The company claims that its eight-speed automatic transmission for passenger cars, introduced at the Frankfurt Auto Show, improves fuel efficiency by 6% compared with its second generation six-speed automatic transmission, and by 14% compared with conventional five-speed automatics. The eight-speed transmission is also fully compatible with hybrid drives. Production is scheduled to begin by 2010.

ZF’s electric power steering for midsize and luxury cars, torque vectoring rear axle drives, power on demand electromechanical active roll stabilizer and wider.

A utonet...

When the network was launched, the monthly subscription fee was $49; today the fee is down to $39 per month. “We are less than half the cost of a cell card, which serves only one user. And we connect the entire family in the car. That is one of our major, major advantages,” declared M. Pratz.

While individuals can purchase a router directly from Autonet Mobile, most of the existing business has come from car dealers. A Autonet has sales agreements with ten of the top 100 dealer groups in the United States. Some Toyota dealerships were first, followed by Mercedes, Chrysler and Ford dealers.

A year ago Avis Rent A Car began offering its Avis Connect service in San Francisco, where for $10.95 per day customers can include an A Autonet router with their car rental. “Just plug it into a cigarette lighter or wall outlet, log on, and you are ready to go,” says Avis on its website. According to M. Pratz, the service is currently available at 14 Avis locations throughout the United States. Within the next two quarters, the number of Avis Connect outlets will be expanded to 60 locations. In the first year, 8,000 customers rented the service from Avis.

M. Pratz said that A Autonet is currently talking to a number of carmakers about a possible agreement to market A Autonet...

Autonet Subscriber Forecast

Autonet Mobile expects one million Internet-connected subscribers by 2011.

Autonet Mobile as a dealer-installed option: “We would like to lock down one or two deals with carmakers, which hopefully we can get done this summer.

“One-hundred eighty million homes already have broadband, and there are 275 million Wi-Fi devices in the U.S., a number that grows by 10% every year. iPhone works great with A Autonet,” noted M. Pratz. “The car companies realize their customers have a Yahoo or a YouTube experience in their homes, but when they get inside their vehicles they are totally disconnected. Carmakers like us because we are a new form of in-car entertainment; now they can give their customers what they are already using today in their homes.” M. Pratz also said that in a high-volume OEM application, subscription rates might drop below $20 per month.

If and when A Autonet lands an OEM deal, it will get development and manufacturing help from Delphi, which M. Pratz describes as A Autonet’s tier-one manufacturing partner. “They have come up with some innovations to do an automotive grade version of the A Autonet router for the OEM space,” he said.

A Autonet’s radio partner, Novatel Wireless, a provider of broadband access solutions, makes the data radio inside the A Autonet Mobile router. A Autonet, which built its first routers used in the aftermarket in conjunction with Novatel, says it is still looking for one more strategic manufacturing partner.

Co-founder Sterling Pratz is a former professional race car driver who has held executive positions with Xerox. He co-founded INW, which was eventually bought by a telecommunications company. A Autonet’s other co-founder, Doug Moeller, is chief technical officer. M. Pratz Moeller has more than 20 years of experience in networking and emerging wireless technologies. A Autonet Mobile is privately held with funding from Morganthaler Ventures and Easton Capital. “If we do an IPO, it wouldn’t happen for another two or three years,” said M. Pratz. ◆

Background and Acquisitions

Melexis’ main products are Hall-effect ICs (magnetic sensors), pressure and acceleration sensors, sensor interface ICs, automotive systems-on-a-chip, embedded microcontrollers, wireless communications ICs, bus system chips, and optical and infrared sensors. While the automotive industry represents Melexis’ core market, accounting for 70% of sales, the company also serves consumer electronics, wireless, industrial and medical markets.

The company that today is Melexis Microelectronic Integrated Systems was founded in 1988 by Fred Bulcke, a German electronics engineer. Private shareholders took over in 1994 and named the company Elex Sensors to promote the core product, sensor ICs. That same year, Elex developed its first Hall sensors. The private shareholders sold out to Elex NV, the majority owner of M elexis NV, in

1996. Following an IPO in 1997, Melexis acquired a Massachusetts-based maker of Hall ICs, U S M ikroChips Inc., which had sales of more than $5 million when it was acquired. That business is now a Melexis NV subsidiary called Melexis Inc. With locations in New Hampshire, Michigan and California, Melexis Inc. today serves as the marketing, sales and field technical support for all Melexis products in the North American market.

In 1999, Melexis’ parent company acquired Thesys Mikroelektronik Produkte GmbH (Erfurt, Germany) a producer of ASICs and application specific standard products (ASSPs) specializing in RF and automotive bus systems. Thesys, now renamed M elexis G mbH, had been an East German state-owned facility. With 442 employees, Thesys produced sales of 33.6 million euros in 1998. Since M elexis NV operates as a fabless semiconductor company, it sold Thesys’ wafer foundry to X-FAB, another M elexis-affiliated company.

In 2004 M elexis acquired Sentron AG, a 1.4-million-euro Swiss company that invented the flux-concentrator technology now used in M elexis’ Triaxis Hall sensors.

Melexis is controlled by the Belgian holding company, Xtrion NV, which owns 50.5% of the company. Xtrion’s main shareholders are M elexis’ co-CEO s Rudi De Winter and Françoise Chombar, and M elexis’ co-founder and chairman of the board, Roland Duchâtelet. M r. De Winter, an electronics engineer, also serves as M elexis NV vice chairman of the board and managing director. He is responsible for marketing, technology support, intellectual property, software and the business divisions of the company. M r. De Winter, who is married to Ms. Chombar, is responsible for operations, quality and human resources. M r. De Winter and M s. Chombar both worked for BMW’s semiconductor spin-off, Elmos G mbH, from 1986 to 1989, M r. De Winter as development manager and M s. Chombar as planning manager.
Strategy for Sustained Growth

Melexis’ sales have grown every year for the last ten years, generating net margins between 16% and 20% and return on equity of more than 45% each year. Mr. De Winter explained how Melexis manages to be so consistently profitable despite generating 70% of sales in the automotive industry, an industry notoriously skimpy on profits.

“Terror started as a small company, and we’ve always been economical in our spending, focusing investments toward products that yield profitable results. We are fabless, so we did not have to make those large investments. The company invests in the development of the intellectual property of the product itself.”

Melexis designs its own products and the chips that comprise those products. According to Mr. De Winter, 95% of Melexis’ technology was developed in house, not through the company’s acquisitions.

Most of the wafers used in Melexis’ products are purchased from outside foundries, primarily from X-FAB. Melexis buys about 25% of X-FAB’s annual output. X-FAB is 58% owned by Xtrion, the same holding company that controls Melexis.

The wafers are sent out to assembly houses where they are cut into chips and assembled into their packages. Before the devices are shipped to customers, they are returned to Melexis for final testing and calibration.

“We developed the dedicated equipment for testing our chips in house. Our test strategy and test and calibration equipment are proprietary. We believe that is strategic to our ability to guarantee the quality of the products. It is also a large added value to our sensor products, because standard equipment to test sensors is not available anywhere,” said Mr. De Winter. Melexis’ integrated management system complies with ISO/TS 16949:2002, the automotive system quality standard.

The company invests in the development of the intellectual property of the product itself.”

In 2007, Melexis’ three largest customers accounted for 34% of sales. Sensor maker Sensata is Melexis’ largest customer, purchasing 70 million Melexis chips per year. Sensata’s biggest Melexis purchase is signal-conditioning ICs used in pressure transducers. “Sensata appreciates our focus on the auto industry,” noted Mr. De Winter.

Melexis’ second-largest customer is TRW. A automotive, which buys custom ICs for power steering systems, acceleration sensors for airbag side-impact crash sensors and stepper-motor controllers for HVAC flaps. The third-largest Melexis customer, a German power supply and charger company, Friwo, is not in the auto industry. The third largest automotive customer is the former Siemens VDO, now part of Continental.

While today Melexis relies on organic growth of its business, it would not be opposed to making another acquisition. “We are already a strong engineering company, but we don’t see ourselves necessarily as a strong sales and marketing company,” said Mr. De Winter. “So a company with a strong sales and marketing background would be a good candidate.” The CEO believes that the consolidation of the semiconductor industry will continue. “In my view there are too many companies around the world developing the same things,” he observed.

continued on following page
**Why Melexis**

What distinguishes Melexis from the companies with whom it competes? “First of all we are very focused on technology for the automotive market. Seventy percent of sales go to automotive customers, a percentage that is likely to remain stable for some time to come,” said Mr. De Winter. “Second, we are much more flexible than many of our competitors. If an automotive customer asks us for a special product, we are willing to try to answer that need.” Melexis, which has been growing faster than the $20 billion market for automotive semiconductors, expects the market to grow at 7% per year. Melexis automotive sales have increased by 8.6% annually in the last five years.

“We continue to follow the wave of further increases in electronics in cars, which will continue at least for the next ten years,” said Mr. De Winter. “It is the only way to reduce emissions and make cars safer. As electronics costs gradually decrease and more applications become feasible, we see many opportunities for more automotive electronics.”

For the next several years Melexis expects its shipments to Asia to grow at a faster rate than its shipments to Europe or to the United States, as customers continue to locate production in lower-cost countries. Japan, however, is a special case; like most Western suppliers, Melexis has not found a great deal of success there. “Japan is a tough market, and customers there are very demanding,” said Mr. De Winter. “The only products we are successful with in Japan are those like Hall sensors where we have a strong market position and where there is no Japanese competition. Our Triaxis sensor does well in Japan. It can be used to sense position and also to sense current, for example to measure the charging and discharging of batteries or current flow in a three-phase hybrid motor,” he noted.

**Melexis’ Major Competitors**

- Allegro Microsystems
- Austria Microsystems (AMS)
- Diodes Inc.
- Infineon
- Micronas
- NXP
- Rohm

**Hall Effect Devices**

- EG&G Heimann
- Elmos
- Freescale
- Hamamatsu
- Honeywell Solid State Electronics
- Maxim
- NEC Semiconductors
- Optek
- RF Micro Devices
- STMicroelectronics
- TAOS
- Texas Instruments
- ZMD

**Melexis’ Five Core Values**

**Customer Orientation:** Finding innovative ways to excel in the quality of our products and services, our relationships and our results. In so doing, our customers will be successful with their customers.

**Enjoyment:** We are committed to making working at Melexis enjoyable. And while our goals are very challenging, we believe in a sustainable balance of our work environment and the private sphere.

**Leadership:** We are leaders in our markets. ... We will ensure that our people are provided with the opportunities to be heard and with the skills, information and empowerment to make a difference.

**Profitability:** Superior products generate superior profits, which attract superior investors and shareholders.

**Respect:** Our work environment is built on mutual trust and respect, founded on honesty, openness and fairness, where employees have equal opportunity regardless of gender, race or ethnic background.

**Technology**

In 2007 Melexis invested 14.6% of sales in research and development. That research is driven by specific customer requests, but also by Melexis’ market research that identifies long-term needs. Of late, Melexis R&D has concentrated on the development of Hall sensors, integrated pressure and acceleration sensors and gyroscopes, 16-bit microcontrollers, infrared and opto sensors, bus ICs and RF components. In all its served markets, Melexis booked 70 design wins in 2007 totaling more than 65 million euros in new business annually by 2011.

Aaccording to Melexis it has a history of bringing “inflection point technology” to the automotive market. For example, in the early 1990s it began supplying magnetic and pressure sensors that could be programmed in the field through the existing connectors on the component, rather than with laser trimming or through extra contacts that are then epoxy filled after calibration is complete.

**Hall Effect Devices**

A more recent example of inflection point technology is the company’s Triaxis Hall devices, which can be applied in non-contact rotary, linear and 3D-joystick position sensors. The sensor employs ferromagnetic tape applied to the chip as an additional back-end step. The process concentrates the lines of magnetic flux—bends the magnetic field—so they can more easily be read by the Hall device. Conventional planar Hall technology is only sensitive to the flux density applied orthogonally to the IC surface. The Triaxis Hall sensor is also sensitive to the flux applied parallel to the IC surface.

Part of the appeal of using the Triaxis Hall sensor for angular position sensing is its precision. Resolution is in the range of 1/100 of a degree and absolute accuracy is one degree. “We use a different magnetic concept that allows us to achieve more accurate position sensing with a less expensive magnetic construction, so the end result is better performance at lower overall system cost,” said Mr. De Winter.

Introduced in mid-2005, the Triaxis Hall sensor is just now beginning to generate significant increases in automotive sales, and more new applications are on the way. For example, the popularity of the stop-start feature in Europe, which shuts down the engine when the vehicle is stopped in traffic and restarts when the brake pedal is released, has led to an increase in the demand for angular position Hall sensors on both the clutch pedal and the manual gear box. The Triaxis Hall is also used as a throttle position sensor and brake position sensor.

**Hall Innovations**

Hall semiconductors have been used in cars for nearly 20 years to sense the
position or speed of moving parts. Over the years, improvements in Hall devices have kept the technology in the vehicle. One of the biggest innovations was the move from bipolar to CMOS devices, which Melexis now uses exclusively. The current generation of Hall sensors uses a scheme that switches the direction of the current through the Hall elements at roughly 100,000 times per second, which eliminates offset errors caused by temperature and strain.

To meet a growing demand for Halls in safety applications where redundancy is required, Melexis has developed a sensor with two Hall chips, each with isolated ground and voltage supply. If one chip fails the redundant chip can sustain critical function until the module can be replaced.

Melexis considers Hall effect its most important technology. Sales of Melexis’ automotive Hall sensors increased by 24% in 2007, accounting for roughly 25% of total revenue.

Halls have typically been used in on-off applications, for example to count gear teeth in wheel-speed sensors, or to keep track of engine position as with cam- and crank-angle sensors. But a faster growing application these days for Hall devices is analog sensing, where the device is used to precisely measure the variation of the magnetic field, which can then be correlated with position.

“More and more you are seeing analog applications, and that is an area where Melexis excels,” noted Peter Riendeau, in charge of global marketing communications for the company. “Linear applications include ride height, lightchild angle position, steering torque, steering-wheel position, and throttle- and pedal-position sensing, some of which used to be done using potentiometers. One compelling reason to use Halls is their ability to self test—providing feedback that the sensor is functioning properly.”

◆ Brushless Motor Drivers
A nother promising new product Melexis is developing with a number of automotive customers is a highly integrated DC motor driver for brushless DC (BLDC) motors. Brushless DC motors have been considered for automotive applications for a long time, but the cost of the electronics has rendered them uneconomical.

“Excluding stepper motors, today there is maybe only one brushless motor per car on average. They are used for power steering or the water pump,” noted Mr. De Winter. “Over the next five or ten years, that number can grow to ten per car. BLDC motors give more torque for the same volume, or they can make the same torque with a smaller motor. So they save on copper and steel, the costs of which are going up. But you need to add electronics; each BLDC motor requires about $4 to $5 worth of electronics. In five years or so the electronics cost could get down to $2 or $3 per motor.”

Vehicle applications for brushless motors are increasing. “Today’s belt-driven water pumps, fuel pumps and oil pumps will be replaced by electric motor-powered pumps, which can then be intelligently controlled,” explained Mr. De Winter. “There is no way to turn a belt-driven pump on and off, so it is robbing horsepower all the time. And with the increasing popularity of stop-start systems, when the engine shuts down you still need cooling, the fans and blowers need to run. These too will be driven by electric motors,” he predicted.

◆ Infrared Thermometers
Another product expected to do well in automotive applications is Melexis’ infrared thermometer with integrated signal conditioning. Sales of Melexis’ IR temperature sensors were up 51% in 2007. Capable of measuring the surface temperature of objects in front of it, typically the vehicle’s occupants or the seats, the Melexis IR thermometer has been widely adopted on Chrysler vehicles as an alternative to conventional HVAC temperature sensing.

The conventional method combines a thermistor with a small fan to sample air from the cabin. Melexis’ IR sensor is comparable in price to the thermistor and fan approach, but has no mechanical parts to wear out, no noise from the fan, and the IR sensor reacts much faster than a thermistor.

Melexis recently developed an IR sensor that uses two sensing elements in the same package, one aimed at the driver and the other at the front seat passenger.
standard functionality in six or seven body-control ECUs on the new 7 Series due in the fall of 2008. However, since version 2.1 of the AUTOSAR standard was not ready in time, the carmaker will still use its own BMW basic software in those ECUs, not the AUTOSAR basic software.

In the new 3 Series, due to hit production in 2011, up to 50% of the vehicle's ECUs will employ the AUTOSAR standard for the RTE, basic software and application software. After 2011, AUTOSAR compatible software will be applied throughout the BMW product line as a running change with each new ECU or microcontroller replacement.

**Mercedes**

Mercedes' first AUTOSAR application will be in a single body control ECU on the M Class in 2010. In that application, the RTE and application layer will be AUTOSAR compatible as well about half the basic software.

Next up for standard AUTOSAR software is the S Class coupe, due in 2011. “There we will use it to replace a couple of the existing chassis ECUs, to learn the tools and the development process so we will be well prepared when the 100% switchover comes with the new S Class in 2012,” said Stephan Wolsfriex, head of Mercedes car development and director of electrical and electronic systems and chassis for Daimler AG. That switchover will involve the powertrain, chassis and body domains, though not all of the application software will conform to AUTOSAR.

**Volvo**

Taking a step-by-step approach to implementation, Volvo’s first application of AUTOSAR basic software will come in 2009 or 2010, for network management in the body control module. The network management software handles the medium speed CAN network in the body controller and the gateway to the high-speed CAN network in the engine. Opting for a flexible approach initially, Volvo wants to accommodate both AUTOSAR nodes and non-AUTOSAR nodes, depending on what suppliers offer.

The first ECU that is fully AUTOSAR compliant will come in 2010 or 2011, according to Bengt Banck, vice president of E/E systems engineering for Volvo Cars. Volvo’s adoption of AUTOSAR will be somewhat dependent on how quickly its suppliers implement the standard. Mr. Banck noted that because of the flexibility Volvo is building into its systems, “We can take it ECU by ECU because we don’t really need to match the specific date to the launch of a new platform.”

**Ford**

Ford had been relying on Volvo to pioneer its AUTOSAR effort, but with the April 2008 launch of Ford's new global product development and purchasing teams, and the decision to have Volvo remain independent from those, Ford’s global electrical team must now engage with AUTOSAR on its own. While Ford supports AUTOSAR in principle, as of mid-April it was still deciding what its AUTOSAR role would be and the degree to which it would make AUTOSAR part of its product development plans.

**General Motors**

“AUTOSAR won’t have a pervasive application at GM while Global A is our electrical architecture, but that doesn’t mean we won’t use it,” said Scott Kirchner, GM director of global controls and software engineering. “We may well use an AUTOSAR application software component that we get from a supplier. But as a pervasive concept in the electrical architecture, we won’t use it until around 2015 at the earliest.”

**Chrysler**

Chrysler isn’t a member of AUTOSAR and is undecided about if and when it will become a member, and if it will employ the standard in production vehicles.

**Nissan**

Nissan has not yet decided if it will apply AUTOSAR in a production vehicle. That decision won’t be made until after Nissan has had an opportunity to validate the AUTOSAR software being developed by a Japanese government-funded JaspAR working group. While AUTOSAR won’t be adopted by Nissan before 2012 or 2013, the carmaker could use AUTOSAR-compliant software from Bosch or Continental before then.

**Honda**

According to Toyohei Nakajima, a top R&D executive at Honda, Japanese carmakers have not yet decided if they will adopt AUTOSAR because the spec itself “is a work in progress,” and they haven’t yet finished their evaluation. “The Japanese auto industry is in accordance with AUTOSAR since we can not find any merit to creating a competing standard,” he said.

**Brose**

2007 Sales: 2,481 million euros
Change from 2006: up 6.1%
Outlook for 2008: 3,100 million euros; the 25% growth will come largely from Brose’s 2007 acquisition of Continental’s electric motors business in April 2008.

Brose’s seat adjuster product segment grew 13% compared with the prior year; closure systems sales grew 7%, followed by door systems, which increased just 3%.

At the Frankfurt IAA in September 2007, Brose displayed some new door and seat products including power motors for side doors that can stop the motion of the door at any position, and power folding rear seats with adjustable length, backrest and headrest.

According to Brose, the purchase of Continental’s electric motors operations will allow Brose to begin producing motors for a BS/ESP, HVA C, engine cooling, electric steering, sunroofs, double clutches and parking brakes. The company sees strong future growth in electric steering and automated manual transmissions.