Automotive Semiconductors: Slower in the Near Term

Interested in their views on new auto electronics applications, market trends and pricing, we recently interviewed some automotive semiconductor managers responsible for business in the U.S. and Europe. The managers we spoke to were from the four companies with the largest automotive sales worldwide: Motorola, ST Microelectronics, NEC and Infineon.

We also interviewed Peter Thoma, president of Elmos Semiconductor. A spin-off from BMW, Elmos works with BMW, Mercedes and Volkswagen on some of the world's most advanced auto electronics. In looking to the future, Dr. Thoma predicted that despite the softness in the automotive electronics market today, overall penetration of automotive electronics would approach the level of today's BMW and Mercedes vehicles. "The value of electronics in the BMW 7-series or 5-series is approaching 40% of the car's total value, and in 10 to 12 years, you will find those features on most cars."

Sales Growth
The worldwide automotive semiconductor market has grown between 15% and 17% per year for the last several years but will slow to 10% to 12% per year for the next five years or so, according to the Motorola Transportation System Group, the world's leading maker of automotive semiconductors. Reasons for the slowdown in growth include: (1) Car sales are expected to be down somewhat from recent all-time highs; (2) A few near-term automotive applications have been moved out a year or so; and (3) Products like ABS and airbags have matured, but new applications, like telematics, are not yet significant enough to make up for lost semiconductor sales.

Aotomotive Bluetooth—Later

Despite the clear wishes of carmakers to install Bluetooth hands-free portable phones in vehicles as soon as possible, they will have to wait until the second or third quarter of 2002. The competitive hype from would-be vendors suggests Bluetooth is worth waiting for: "unmanaged and dynamic network connectivity anytime, anywhere, with any Bluetooth-equipped device—devices that can spontaneously and unpredictably join or leave the network."

The original idea behind Bluetooth was that one phone could function in a number of ways: at home with fixed-line charges, on the move as a mobile phone with cellular-usage charges and, when in range of another mobile phone with built-in Bluetooth wireless technology, as a walkie-talkie with no telephony charge. Indeed, making ad hoc networks between devices such as phones and PDAs and the vehicle is still a big part of the Bluetooth promise, a promise carmakers expect Bluetooth to live up to. Using short-range, low-power wireless communication technology for voice and data, Bluetooth devices do not have physical connectors: any phone or component with a Bluetooth chip can connect to the embedded Bluetooth node in the vehicle.

Since at least nineteen countries have now banned cell-phone use while driving, as has the U.S. state of New York (36 states have legislation pending), there will be increasing pressure to make phones hands free in vehicles, where, by some accounts, approximately 70% of all cell phone calls are made. While hands-free phones can be hardwired into the vehicle, avoiding any need of Bluetooth, the consumer would be locked into that particular phone. According to some estimates, nearly 80% of consumers trade in their phones, on average, every 18 months, yet consumers trade cars, on average, every seven years. Bluetooth's portability between vehicles is a definite plus for the auto industry.

Sadly, however, the first automotive Bluetooth application, hands-free phones, will not appear until the second or third quarter of 2002, and hands-free phones in high-volume vehicles will not happen until at least MY 2005. Further, wireless point-to-point connections such as a phone in the vehicle are significantly less complicated than multipoint networks of three or more nodes, for instance, one Bluetooth device at home with car systems; for instance, information could be transferred from the home computer to the garaged vehicle for work or pleasure trips.

Bluetooth Applications

Hands-Free Phones, First
- Allowing the driver to keep his hands on the wheel, Bluetooth links a portable phone to an embedded vehicle node that connects to the driver's microphone and an amplified speaker. A Bluetooth node in the vehicle will allow interoperability between any manufacturer's phone and the vehicle. Since the connections are wireless, matching connectors are not needed.
- In time, the vehicle's audio system will connect wirelessly to the Bluetooth phone.

Multinode Networking
- Bluetooth Networks could eventually connect various stand-alone or portable devices to a vehicle.
Eliasson of Side their vehicles, suggested Anders products people are choosing to use will be determined by which Bluetooth next product introduced in the vehicle is a member of the Bluetooth Special Interest Group. The manufacturers of Bluetooth phones do not control the number of phones on the streets, rather, the carriers determine when and to what extent they will offer customers Bluetooth phones. Cellport, which recently formed a joint venture with the Japanese firm Omron to cooperate on telematics, announced a new hard-wired cell phone docking-station for the vehicle. A next-generation version with Bluetooth may be ready in 2003.

Many of the necessary automotive specs for Bluetooth have not yet been established. Mr. Parikh wants to be sure that Bluetooth nodes embedded in the vehicle fit automotive requirements for temperature, vibration and electromagnetic compatibility. Bluetooth will operate in the ISM (Industrial, Scientific and Medical) radio-frequency band at 2.4 gigahertz worldwide. No license is required to operate in the ISM band, so interference will be an issue. A utomotive experts are concerned about the potential for interference from things like GPS, satellite radio broadcasts and IEEE 802.11, which operate at or near Bluetooth’s 2.4 GHz. While not yet deployed, RF street lighting or fusion lighting, which receives energy to

Continued from page 1

Obstacles to Bluetooth

◆ Some Bluetooth hardware components, including chips, are not yet available and will be very expensive, initially.
◆ Still to be determined are automotive hardware specs for Bluetooth nodes and specifications for interoperability between various manufacturers’ Bluetooth devices.
◆ Demand for Bluetooth nodes in the vehicle will depend on sales of Bluetooth wireless phones, expected to grow slowly.
◆ Interference is a likely problem. Interference can come from Bluetooth applications both aboard the vehicle and aboard nearby vehicles, as well as from systems such as GPS, that operate in the same 2.4 GHz bandwidth as Bluetooth.
◆ Environmental specs covering temperature, vibration and electromagnetic compatibility in automotive applications have not been established.

Some Bluetooth hardware components, including chips, are not yet available and will be very expensive, initially. Still to be determined are automotive hardware specs for Bluetooth nodes and specifications for interoperability between various manufacturers’ Bluetooth devices. Demand for Bluetooth nodes in the vehicle will depend on sales of Bluetooth wireless phones, expected to grow slowly. Interference is a likely problem. Interference can come from Bluetooth applications both aboard the vehicle and aboard nearby vehicles, as well as from systems such as GPS, that operate in the same 2.4 GHz bandwidth as Bluetooth. Environmental specs covering temperature, vibration and electromagnetic compatibility in automotive applications have not been established.

Bluetooth...
Bluetooth...

power lights from nearby RF transmitters, could also interfere with Bluetooth.

Alternatives

Problems with Bluetooth have led some to call for alternative wireless high-speed networks, such as IEEE 802.11, a LAN that also uses the 2.4 GHz band. Mr. Parikh believes that Bluetooth is better for portable applications like phones and PDAs, because it demands less power than 802.11. Because it has more range than Bluetooth, IEEE 802.11 might be better for communications between the car and an outdoor kiosk at a fuel station or at home to download data to the vehicle.

Others in the industry have considered other alternative radio bands. For example, ITS America has been pushing the FCC to set aside frequencies in the 5.8 GHz band, but that band may not be available worldwide as is 2.4 GHz. If Bluetooth devices experience too much interference at 2.4 GHz, then an alternative frequency spectrum will certainly be looked at more closely.

Bluetooth SIG (Special Interest Group)

The technology takes its name from the Danish king Harald Bluetooth (Bluetooth), who united Denmark and Norway in the tenth century. Formed in May 1998, Bluetooth SIG oversees standards-making and commercialization. The five founding members include two of the world's top makers of portable phones, Nokia and Ericsson, as well as IBM, Intel and Toshiba. Believing that open standards generally achieve greater consumer acceptance and broader market adoption, as well as foster development of more innovative products, Bluetooth SIG membership is open to any company interested in making Bluetooth products. Members receive a royalty-free license to use the wireless technology and get access to technical specifications and training seminars. Bluetooth SIG members currently include more than 2000 Adopter/Associate member companies and the following companies that have Promoter status:

3Com, Ericsson, IBM, Intel, Lucent, Microsoft, Motorola, Nokia and Toshiba.

For more information, see the website www.bluetooth.com.

Within the Bluetooth SIG is the Car Profile Working Group, the group responsible for developing Bluetooth automotive application profiles; it is chaired by Bjorn Bunte (Bjorn.Bunte@nokia.com) of Nokia. That group receives guidance from the Bluetooth Automotive Expert Group, which includes most of the world's carmakers, and is about to release technical recommendations that cover the automobile's unique requirements; the group will continue to update those recommendations. The Automotive Expert Group is chaired by Jay Parikh of General Motors (jayendra.s.parikh@gm.com), who is also an active participant in AMIC (A multimode IC with media interface). AMIC is a member of the Bluetooth SIG, and Mr. Parikh represents AMIC interests in the Bluetooth SIG. AMIC is comprised of all of the world's major carmakers, except DaimlerChrysler, VW and BMW, which are members of the Bluetooth SIG.

Semiconductors...

Unprecedented Price Pressure

Fred DiVincenzo, vice president and director of global sales and marketing, Motorola Transportation Systems Group, suggested that even though the number of auto chips sold each year is rising, total revenue has trended down, as chip prices have declined.

OEMs and tier-one suppliers are responsible for the downward price pressure as the companies struggle to cut costs and demonstrate an upward trend in profits.

Two of the world's largest tier-one suppliers, Delphi and Visteon, spun off from parents GM and Ford, must now show more profit. Mr. DiVincenzo elaborated: "To do that, they must become less reliant on business from their former parents and go after carmakers, where they are forced to take share away from existing suppliers. More tier-one suppliers are showing up to bid for business, and that has made competition even more intense and helped to drive prices down."

Price pressure from OEMs has been unprecedented, continued Mr. DiVincenzo.

"It's worse with DaimlerChrysler than it was with Lopez." In the early 1990s, GM's notorious purchasing czar J. Ignacio Lopez de Arriortua established GM's global sourcing strategy and aggressively sought lower prices from suppliers. Mr. DiVincenzo told us: "Lopez asked suppliers to work with GM ... whereas DaimlerChrysler is unilaterally mandating large price cuts." Under Lopez, GM sent a manufacturing team into the supplier and suggested numerous cost-cutting methods, savings from which were shared 50-50, according to Mr. DiVincenzo.

Other Market Trends

In the near term, carmakers seem most focused on cost reduction, so projects involving integration of chips or modules are going forward. NEC's Kevin Tanaka told us that customers are pushing ahead with integration as fast as they can because that saves money, but other projects, like a new audio system or body feature, are being pushed out in time.

In North America, long-term development programs are staying on track, reported Todd McaIlister of NEC Electronics (NEC Corporation's U.S. sales and manufacturing subsidiary, with headquarters in Santa Clara, California). "The longer-term, new, whiz-bang applications, like multimedia information computing platforms, still seem to be progressing along at the anticipated pace."

'Warm' Applications

A electronics prices go down and electronics integration continues, new applications will be the driver for auto electronics growth. Our experts weighed in on which applications are 'warm' and which are 'not so warm'.

Electronic Stability Control: ESC systems have penetrated into Europe, where in 2000, 13% of vehicles had such systems, according to Bosch, with ESC penetration in Germany at 39% and estimated to grow to 63% by 2004. Afta penetration was only 2% in 2000, and Bosch expects that to increase to 3% by continued on page 8
**The Company Profile...**

**Autoliv**

**Headquarters:** Autoliv Inc., Box 70381, SE-107 24 Stockholm 70, Sweden; phone: 46 8 587 206 00; fax: 46 8 411 70 25; www.autoliv.com

**Major Products:** Airbags, airbag systems, seat belts and seat-belt systems

**2000 Sales:** $4,116 million

**2000 R&D:** 4.8% of sales, compared with 5.2% of sales in 1999

**2000 Capital Expenditures:** $217 million

**Sales by Region:** Europe, 50%; North America, 38%; Japan, 10%; ROW, 2%

**Top Six Customers:** Listed in order of sales, these companies account for roughly two-thirds of sales: Ford/Volvo (20% of sales), GM, DC, PSA, VW and Renault.

**Employees (year-end 2000):** 28,000, of whom 1,400 or 5% are in sales and administration; 2,520 or 9% in R&D; and 24,080 or 86% in manufacturing

**Largest Shareholder:** Robur Funds with 10.0% of share capital

**Background**

A utoliv's mission is “to develop, produce and sell systems worldwide for the mitigation of injuries to automobile passengers and pedestrians, and for the avoidance of traffic accidents.” A utoliv stock is traded on the New York Stock Exchange and the Swedish Stock Exchange; one-half of shares are held in Sweden, and one-third are held in the United States.

In 2000, A utoliv had nearly 30% of the global market for safety restraint products. Besides its major products—airbags, seat belts and seat-belt systems—the company also makes safety electronics, steering wheels, anti-whiplash systems, seat components and child seats.


**Vertically Integrated Systems Supplier**

M orton, at the time of merger, was a more vertically integrated company than A utoliv, and that resulted in lower sales per employee than A utoliv had previously enjoyed. Sales per employee has also declined as A utoliv has moved much of its production into countries with lower-wage employees, resulting in lower productivity, according to the company. Sales per employee was $215,000 in 1995, compared with $147,000 per employee in 2000.

“W hile we don’t necessarily need to manufacture everything ourselves, we want at least to have the capability to
manufacture all of the key components, so we have the know-how,” explained Mats Ödman, director of corporate communications at Autoliv. The company produces in-house these key components used in its airbag systems: airbags, inflators and electronic control units. For seat-belt systems, it makes seat belts, pretensioners and load limiters.

In addition to the Morton merger, Autoliv acquired companies throughout the 1990s that made it more vertically integrated, including steering-wheel producers like Isodelta (Poitiers, France), inflator makers like Livbag SA (France), formerly an Autoliv joint venture, seat-belt webbing producers like Marling Industries (United Kingdom) and most of sensor-maker Sensor Technologies (Japan). Two joint ventures, one between Autoliv and Sagem, and the other between Autoliv and Nokia, were set up to develop and manufacture the Volvo emergency call system. In yet another example of vertical integration, Autoliv bought out its JV partners Sagem and Nokia in 1998.

In 2000, Autoliv acquired the world’s second-largest initiator company, OEA, and Japan’s second-largest steering-wheel company, Izumi.

While some companies are marketing pre-assembled modules—even complete interiors—Autoliv definitely sees itself as a safety systems supplier, not a module supplier. The company takes responsibility to make sure the whole safety system and each of the subsystems work together. For instance, the weight sensing system is shipped directly to the seat manufacturer but is engineered to work with the entire airbag system. In the new Renault Laguna, the seat belt and frontal airbag are tuned to work with each other via the same electronics control unit. The new Laguna is the first vehicle ever to win five stars in the EuroNCAP (Euro New Car Assessment Program). In partnership with Renault, Autoliv was the exclusive safety system supplier for the Laguna.

## Profitability, Market and Sales Growth

Given competitive pressures and the expectations of carmakers, Autoliv believes that the unit prices of airbag and seat-belt systems will decline in the future. Per-share earnings declined by 14% in 2000, and operating margin declined to 4.9% in the fourth-quarter of 2000, from a high of 10.7% in the fourth-quarter, 1998.

The company expects little sales growth in 2001, but expects “significant growth over the next five years due to consumer demand, technology innovations and government regulations.” In the past decade, U.S. National Highway Traffic Safety Administration regulations mandated in FMVSS (Federal Motor Vehicle Safety Standard) 208 have supported a large part of the demand for airbags, required for drivers and front-seat passengers on all new light vehicles since September 1, 1998. FMVSS 208 mandates a wide range of vehicle safety measures, including three-point belts in back seats, airbags in cars and light trucks, and, with the most recent amendments, occupant weight sensors for new airbag systems.

The world market for seat belts will continue to grow, according to Autoliv, because seat belts are becoming increasingly sophisticated with new features like pretensioners, automatic height adjusters and load limiters. Also, in the United States carmakers are required to install three-point (lap-shoulder) retractor belts for rear-seat passengers, since NHTSA tests in the early 1990s found that three-point belts would be 10% more effective than lap belts in the back seat.

## New Products

Autoliv holds about 3,000 patents, mostly for seat-belt systems or airbag systems. While the majority of Autoliv products today are restraint systems that operate during a crash—airbags and seat belts—the company intends to offer more pre-crash products and more post-crash products. Pre-crash systems such as night vision help prevent collisions, while post-crash systems improve the chances for survival once a crash has occurred. For example, the Volvo On Call emergency mobile phone service automatically calls and provides a rescue team with the vehicle’s exact location.

Side airbags for chest protection are currently the company’s fastest-growing product segment, accounting for 15% of Autoliv’s total sales in 2000. In the next few years, growth will come mainly from head side airbags, such as Autoliv’s inflatable curtain, introduced in 1998 on Volvo, Mercedes, Toyota and Audi vehicles, and the I T S (Inflatable Tubular Structure), introduced in 1997 in the United Kingdom.
cooperation with BMW and Simula (Phoenix, Arizona).

**Competitive Strategy:**
**Technology and Global Presence**

The company believes that two key A utoliv strengths make it successful: global presence and technology leadership. The company operates facilities throughout the world, which is fitting, given the global presence of carmakers. Mr. Ödman summed up the company’s two competitive advantages: “We have a proven technology track record. With Volvo, we were the first to introduce side airbags; with BMW, we introduced the first head-protection product and with Mercedes, the first curtain. ... If a customer wants to have the same product all over the world, there is a good chance that we can do that.”

Business units are organized globally by carmaker: DaimlerChrysler, Ford (Jaguar, Mazda, Volvo), GM (Holden, Isuzu, Opel, Saab, Suzuki) and Renault (Nissan). Other business units are organized locally by carmaker: BMW, Daewoo/Hundai, Fiat, Honda, PSA (Peugeot/Citroën), Toyota/Daihatsu and VW Group (VW, Audi, Seat, Skoda).

A utoliv spent 4.8% of sales on R&D in 2000. Although only a very small percentage of that goes to fundamental R&D, such research has yielded whiplash-injury protection products and improved test dummies, particularly for analyzing injuries caused to pedestrians from vehicles. Sales from products invented in the five-year period from 1990 to 1995, such as thorax airbags, grew to account for 8% of total sales by 2000. An nd sales within “new products,” a category A utoliv defines as those invented within the most recent five-year period, have grown from 2% of total sales in the five-year period from 1990 to 1995, to 4% in the five-year period from 1995 to 2000.

The 1997 merger with Morton gave A utoliv inflator and airbag module technology and extended A utoliv’s market from Europe to North America. In 1996, the company had 89% of its sales in Europe, and just 5% of sales in North America. Today 50% of sales is in Europe, 38% in North America, and 10% in Japan. Globally, A utoliv intends to strengthen its position in its key markets, Europe and the United States, but also make an extra effort in Japan. The company started local airbag production in Japan in 1998, and opened a crash facility in 1999. In 2000, A utoliv acquired the second-largest Japanese steering-wheel company, Izumi, and the North American seat-belt operation of NSK. It also acquired 40% of NSK’s Australian seat-belt business, with the option to increase its interest to 100% in two steps, in 2002 and 2003. With the NSK Japanese business, A utoliv accounts for approximately a quarter of the Japanese seat-belt market. A utoliv elected Tetsuo Sekiya, president and CEO of NSK, to the board of directors.

**New Electronics**

A mong new electronics products recently brought to market, A utoliv believes these three show the greatest promise: occupant weight sensors for airbags, occupant spatial sensors for airbags and rollover detection systems, which trigger the window curtains and seat-belt pretensioners. Below are descriptions of these and two other important new electronics products: night vision and the **Volvo On Call** emergency mobile phone service.

◆ **Occupant Weight Sensor:** Weight sensors determine whether the seat is occupied and if so, the weight of the passenger, so that the airbag is deployed with the correct amount of force. The demand for front-seat passenger weight sensors comes from NHTSA FMVSS 208, which mandates advanced airbag systems starting with MY 2004, when 35% of all new vehicles must have such smart restraint systems. The percentage rises to 65% by MY 2005, and 100% for MY 2006.

In terms of sales, weight sensors show the greatest promise to A utoliv among all new electronics products in the pipeline. Already two major carmakers have ordered weight sensors for production vehicles sold in the U.S., and other orders are expected soon. With delivery starting in 2002, the first customer has ordered a small quantity, but the second order, from a U.S. customer, is for nearly one million sensor systems (each with 4 load cells) per year, beginning in the fall of 2003.

Price distinguishes the A utoliv weight sensor from the competition, according to Jan Carlson, president of A utoliv Electronics, who added that performance is also superior to the competition. The company’s know-how in packaging the sensors and integrating them into the seat is distinctive. Each seat requires four thick-film load cells that are placed between the seat runner and the seat structure to precisely measure the seat occupant’s weight. Each load cell has a number of thick-film resistors inked onto each load-cell’s metal substrate and positioned to bear the full weight of the passenger, so that like stiff springs, they deform as weight is applied. The substrate deflection proportionally changes the load-cell’s resistance readings, correlating to the occupant’s weight. Also part of each seat’s sensor system is an ASIC and a microcontroller.

◆ **Occupant Spatial Sensor:** Not only must the weight of the passenger be known in order to determine if the airbag should be deployed and with what force, but the position of the occupant must also be determined. A utoliv’s spatial sensor system uses four ultrasonic transceivers...
Autoliv Electronics Manufacturing Facilities and Employees (mid-year 2001)

<table>
<thead>
<tr>
<th>Location</th>
<th>Engineers</th>
<th>Production Workers</th>
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<tbody>
<tr>
<td>Ponteise and Rouen, France</td>
<td>130</td>
<td>680</td>
</tr>
<tr>
<td>Molala &amp; Linköping, Sweden</td>
<td>90</td>
<td>320</td>
</tr>
<tr>
<td>Tsukuba, Japan</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Dachau, Germany</td>
<td>10</td>
<td>—</td>
</tr>
<tr>
<td>Auburn Hills, Michigan</td>
<td>40</td>
<td>—</td>
</tr>
<tr>
<td>Total</td>
<td>280</td>
<td>1,050</td>
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A utoliv benchmarked. The autoliv system will use a smaller infrared video camera mounted, not behind the grill where it can get dirty, but up on the windshield, close to the wipers. As in the Cadillac, the image will be projected on a head-up display, but instead of projecting directly onto the windshield, a utoliv will use a separate display that pops-up from the top of the instrument panel. Since other night vision systems must use various projectors depending on the curvature of the particular windshield, a utoliv's approach should be less costly.

◆ Volvo On Call: Since 1998, a utoliv has manufactured all the mobile phones installed in Volvos in Europe. A new system called Volvo On Call will be available later in the fall of 2001, according to Volvo. A utoliv will provide the system, which includes an integrated GSM board, modem, keypad, hands-free capability and handset, plus software. The system provides subscribers with an automatic accident-alert feature and manual emergency SOS button, similar to OnStar. In the event of an airbag deployment, a connection is automatically established with the call center. Other features include help if the car keys are lost, a car-tracking function in case of theft, roadside assistance in the event of a mechanical breakdown and operator-assisted route guidance. ◆

Autoliv Manufacturing Facilities in Countries with Over 1,000 Employees

<table>
<thead>
<tr>
<th>Employees</th>
<th>Capabilities</th>
<th>Customers</th>
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<tbody>
<tr>
<td>Estonia</td>
<td>1,050</td>
<td>AutoVaz, GAZ, GM, Autoliv Sweden</td>
</tr>
<tr>
<td>France</td>
<td>4,200</td>
<td>Peugeot/Citroen, Renault, Autoliv</td>
</tr>
<tr>
<td>Germany</td>
<td>2,820</td>
<td>Audi, BMW, DC, Ford, MAN, Mazda, Opel, Porsche, VW, Autoliv</td>
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<td>Great Britain</td>
<td>1,650</td>
<td>Aston Martin, Ford, Jaguar, Mazda, Mitsubishi, Nissan, Peugeot/Citroen, Rolls Royce, Rover, Toyota, Vauxhall</td>
</tr>
<tr>
<td>Mexico</td>
<td>2,000</td>
<td>DC, Ford, GM, VW, Volvo</td>
</tr>
<tr>
<td>Spain</td>
<td>1,050</td>
<td>DC, Ford, Nissan, Opel, Peugeot/Citroen, Renault, Seat, VW, Autoliv</td>
</tr>
<tr>
<td>Sweden</td>
<td>2,600</td>
<td>Saab, Scania, Volvo, Autoliv</td>
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<tr>
<td>USA</td>
<td>8,200</td>
<td>BMW, DC, Daihatsu, Ford, GM, Honda, Isuzu, Mazda, Mitsubishi, Nissan, Subaru, Suzuki, Toyota, Autoliv</td>
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Autoliv Electronics Sales by Year in $ Millions

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales in $ Millions</th>
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<tbody>
<tr>
<td>1996</td>
<td>104</td>
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<tr>
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<td>154</td>
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<td>173</td>
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<tr>
<td>1999</td>
<td>190</td>
</tr>
<tr>
<td>2000</td>
<td>200</td>
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Autoliv Electronics Thumb Sketch

2000 Sales: $200 million
Top Customer: All electronics are sold in-house to Autoliv companies.
Products: Airbag electronic control units and components
Employees at year-end 2000: About 1,300, of whom 260 are in R&D

Semiconductors...

2004. Infineon’s Bob Lefort, however, sees ESC picking up in the United States. ESC was an optional or standard feature on MY 2001 vehicles from Acura, Audi, BMW, Ford, GM, and Mercedes, Subaru, Toyota, Volkswagen and Volvo, according to Automotive News. Ford announced it will equip all its SUVs with the Ford AdvanceTrac system by 2005. ESC is already moving beyond luxury cars and SUVs to less expensive vehicles like the Oldsmobile Intrigue and Ford Focus.

◆ Tire Pressure Monitoring: Signed into U.S. law in November 2000, the TREAD (Transportation Recall Enhancement Accountability and Documentation) act mandates that NHTSA (National Highway Traffic Safety Administration) complete rulemaking to require a warning system in new motor vehicles to indicate when a tire is significantly under-inflated. This requirement will become effective for OEMs no later than two years after completion of NHTSA’s rulemaking. On July 25, 2001, NHTSA further defined the proposed new federal motor vehicle safety standard to include: “the installation of tire pressure monitoring systems in new passenger cars, light trucks, buses and multipurpose passenger vehicles with gross vehicle weight ratings of 10,000 pounds or less to warn the driver when the vehicle has a significantly under-inflated tire.”

Tire pressure can be monitored with one low-cost 8-bit microcontroller mounted within each wheel, although some carmakers, like GM, would like to use the existing ABS wheel-speed sensors to deduce which tire has low pressure. A warning system in new motor vehicles will follow. According to a press release from Koyo Seiko, who will initially be the supplier for Saturn, demand for EPS is rising in Japan, where it is a popular feature on minicars. Koyo Seiko estimates 30% worldwide penetration of EPS by 2005.

Not-So-Warm Applications

◆ Telematics: While telematics holds the potential of all applications for long-term profits at carmakers and suppliers, it will not be a moneymaker for several years. Elmos president Dr. Thoma explained that telematics content—the service product presented in or delivered to the vehicle—is not yet convincing to the consumer, and “the one-time cost is still too high.” Neil Krohn, vice president technical engineering at Motorola, agrees that content is the main failing of telematics: “We have not yet found the killer application. That is why at Motorola we are focused on delivering an onboard computing platform [the mobileGT] that allows new product content to quickly be realized and brought to market. One of these may well be the killer application that everyone needs.” A couple of our experts, however, believe that satellite radio will deliver more appealing content than telematics providers. Two satellite radio businesses will each broadcast about 100 channels of digital music and talk programming to U.S. listeners: XM Satellite Radio will commence service in September in two lead markets, Dallas/Fort Worth and San Diego, and expand to national coverage in November; Sirius Satellite Radio expects to broadcast by the end of the year.

◆ 42-Volt Applications: Moving more slowly than was expected just a year ago, carmakers are taking stock of the added costs of such systems. For the majority of vehicles, new features enabled by 42 volts are not appealing enough to consumers to justify the extra cost of 42 volts.

◆ Electromechanical Valves: AIso developing slowly is one of the drivers of 42 volts, electromechanically-powered valves. With only some small-volume applications appearing in Europe around 2005, high-volume applications will not happen for another six to seven years until they can be made less expensive, ventured Dr. Thoma.

◆ ACC: Given that ACC (adaptive cruise control) currently does little more than make the car more convenient to drive in moderate traffic, it is just too expensive and has not lived up to earlier forecasts. A warning to our experts, ACC needs to work not only in stop-and-go traffic but be a real safety system that reliably warns or intercedes to bring the vehicle to a full stop when it detects a stopped or slow obstacle ahead.

World OEM Automotive Electronics Demand by Product

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<td>World Light Vehicle Production (000)</td>
<td>49,495</td>
<td>49,700</td>
<td>55,915</td>
<td>61,110</td>
<td>1.8%</td>
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<tr>
<td>$/Vehicle</td>
<td>661</td>
<td>1020</td>
<td>1255</td>
<td>1595</td>
<td>4.9%</td>
<td></td>
</tr>
<tr>
<td>World OEM Auto Electronics Demand</td>
<td>16,631</td>
<td>25,368</td>
<td>33,581</td>
<td>43,745</td>
<td>5.4%</td>
<td></td>
</tr>
<tr>
<td>Engine &amp; Drivetrain</td>
<td>7,437</td>
<td>12,830</td>
<td>17,719</td>
<td>24,555</td>
<td>6.7%</td>
<td></td>
</tr>
<tr>
<td>Safety &amp; Security</td>
<td>5,322</td>
<td>7,484</td>
<td>10,801</td>
<td>15,955</td>
<td>8.1%</td>
<td></td>
</tr>
<tr>
<td>Comfort, Convenience &amp; Entertainment</td>
<td>3,322</td>
<td>4,992</td>
<td>8,083</td>
<td>13,245</td>
<td>10.4%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>32,712</td>
<td>50,674</td>
<td>70,184</td>
<td>97,500</td>
<td>6.8%</td>
<td></td>
</tr>
</tbody>
</table>

Data: World OEM Automotive Electronics, a new report published in June 2001 by The Freedonia Group. The 355-page study is available for $4,500. For more information or to order call 440-684-9600 or visit www.freedoniagroup.com.