VW Group and Mercedes Committed to MOST150

Both Use MOST Ethernet Channel for IP

Connected-car infotainment systems with their ever-increasing audio and video content require a reliable, scalable, high-speed data communications network that provides sufficient bandwidth and the ability to seamlessly integrate IP-based applications. For the Volkswagen Group and Mercedes the MOST150 high-speed networking standard is the solution. Audi was the world’s first carmaker to employ the MOST150 high-speed networking standard in production in October 2012, on the A3. The A3 has an Ethernet channel to all its infotainment system nodes.

Golf and Skoda vehicles are also launching with MOST150. Every vehicle in the Volkswagen Group that employs a standard or optional infotainment system based on the MIB (Modular Infotainment Baukasten, or platform) will make use of MOST150, which runs on a plastic optical fiber physical medium.

As announced in 2011, Mercedes is also fully committed to MOST150. Starting with the S class this year, all Mercedes vehicles will get the high-speed network with an Ethernet channel.

Why MOST150

MOST150 is a multipurpose network. The same physical layer can be used for many different applications. The first generation of the standard, MOST25, had three different kinds of communications channels, noted Stephan Esch, Audi’s head of vehicle networking technical development. “One is for the control of ECU’s and other things within the infotainment system. A second channel we could use for packet data, for example for transmitting navigation graphics to the instrument cluster. A third channel was

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Tough Driver Interface Challenges Remain

Carmakers are in a fix. The opportunity to bring numerous new features, services and sizzling graphics into the cockpit has never been greater. The OEMs are leaning heavily on user-interface engineering, but the state of that art hasn’t taken us nearly far enough. Mistakes made with the driver interface can be very costly: they can compromise safe driving, and they can confound and frustrate users if the controls are not intuitive.

Ford can surely attest to the danger of not getting the user interface right the first time. Not only was its MyFord Touch system glitch prone, but it was sharply criticized by car reviewers as being way too complicated to use.

Consumer Reports is finding similar usability problems with the Cadillac User Interface (CUE), which replaces buttons and knobs with a touch screen and flush, touch-sensitive switches. According to ConsumerReports.org, while “the system looks extremely impressive in the showroom with the center dashboard a swath of glossy black and chrome accents,” reviewers found the CUE’s controls “frustrating” and “overly complicated.”

Ford has addressed reliability problems with software updates and simplified MyFord Touch. GM is dispatching tech specialists into the field to teach dealers how they might train Cadillac customers to become more agile CUE users. It’s not clear, though, how many customers are going to want to spend more time at the dealer than they have to. “If the system isn’t intuitive, if you can’t learn it just from using it, you have a big problem,” asserted Linda Boyle, associate professor of industrial and systems engineering at the University of Washington. “Older people, especially, shouldn’t have to relearn how to use the air conditioner. These technologies are designed to make things more convenient, easier, safer to use, but are they really accomplishing that?”

Best HMI Practices According to Preh

◆ Interfaces must be intuitive and self-explanatory. Customers shouldn’t have to read manuals or require training.
◆ Driver distraction must be minimized. Touch screens aren’t adequate for data input in the car. Touch surfaces must be enhanced with haptic feedback and feeling aids so they can be operated while keeping eyes on the road. The best place for the display is near the windshield. The best place for manual input is near the center armrest. Manual input devices such as Audi’s MMI or BMW’s iDrive controller support this concept.
◆ Menus should be no more than two or three levels deep. First-level functions should be clearly defined. A back button is essential.
◆ Multimodality: Drivers should be given multiple paths to functions using a combination of steering-wheel switches, center console controls, voice recognition and touchpad interfaces.
◆ User interfaces should adapt to different driving situations and different users, from unsophisticated to expert.

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for synchronous transmissions of multiple audio streams, where you didn’t need any computing power to transmit the data.”

MOST150 has two additional channel types: One is an isochronous channel, which provides video streaming capability. “Now we can transfer video content from any source—TV tuner, DVD player, DVD changer or Blu-ray player—to the head unit or rear seat entertainment system over the optical ring. We save on cabling and silicon compared to the analog approach,” explained Mr. Esch.

The other new channel is an Ethernet channel for easy interfacing with IP (Internet Protocol) applications. “We have a lot of applications that are Internet based where we transfer Internet data, for example from a UMTS 3G modem and in the future from an LTE 4G modem,” said Mathias Halliger, who handles system architecture for Audi. MOST150 is the first automotive bus system to seamlessly integrate IP applications, according to Audi.

Henry Muyshondt, senior manager for Microchip Technology and technical liaison for the MOST Cooperation, is an expert on MOST technology and has long been involved with its development and deployment. SMSC acquired Oasis Silicon Systems, one of the founders of the MOST Cooperation, in 2005. Microchip Technology acquired SMSC in 2012. Microchip Technology provides MOST silicon, software and tools to the industry.

In his informative white paper, “High Speed Automotive Networking,” Mr. Muyshondt makes the case for MOST150 in the context of IP communications:

Most of the traffic in the IT world uses various protocols geared around IP packets, and many applications rely on this standard to process the information that can be flowing in and out of the car. ... MOST150 has a dedicated Ethernet channel. ... This channel can take a standard Ethernet packet without any special processing by the higher levels of the Ethernet management stacks and send it over the MOST network. MOST150 Intelligent Network Interface Controllers (INICs) even have Ethernet-style MAC (Media Access Control) addresses so the Ethernet packets can be extracted at the right location and passed on to other Ethernet devices.

Mr. Muyshondt is confident that the market for MOST150 nodes will blossom from tens of thousands of nodes in 2013 to tens of millions of nodes per year in the 2018 to 2020 time frame as MOST25 users transition to MOST150. Not only does MOST150 provide as much as seven times more bandwidth than MOST25 (about 140 Mbit/s for MOST150 vs. 20 to 23 Mbit/s for MOST25) but MOST150 leverages the knowledge, tools and processes already in use on production lines and at dealerships.

Audi first launched MOST25 in 2002 in the A8, and over the next ten years installed the network across the entire Audi product line. Simultaneously, the carmaker began working on a migration strategy to a network that would provide more capability and more bandwidth. Audi and Mercedes engineers believe that their transition to MOST150 will be less costly than what BMW is doing with its Broadcom BroadR-Reach automotive-qualified Ethernet solution.

Peter Häußermann, director of telecommunications for Mercedes-Benz, explained why he favors MOST150 over the BMW approach. “With MOST we get the full benefit of audio and video transmission, and we get an Ethernet channel on top of that. Plus, we don’t have to change the physical layer. Our optical fiber network is [electromagnetic] disturbance free. We get the [cost] benefit of industrialization within our large MOST community. The adopters of the automotive Ethernet approach do not have these benefits.”

Volkswagen Group carmakers will use MOST150 throughout their infotainment systems to connect head unit, audio amplifier, TV tuner and DVD player. Additionally they will attach the dashboard instrument cluster to the MOST ring to show such things as navigation maneuver and lane guidance graphics. But while camera applications for driver assistance require high bandwidth, those won’t be placed on the fiber optic bus. POF is not sufficiently robust nor is it sufficiently flexible to be run through the door to the side-view mirror where the camera is mounted. Audi presently favors LVDS (low voltage differential signaling) for camera applications, but is also considering using the next generation of MOST, known as MOSTnG or Ethernet over copper cable, possibly shielded or coaxial. Mercedes is also considering replacing its LVDS point-to-point camera connections with MOSTnG or Ethernet connectivity.

In addition to VW and Mercedes, MOST50 users General Motors and Toyota could also migrate to MOST150. According to Audi’s Mr. Esch, GM, Hyundai and some other Asian carmakers have shown a lot of interest in MOST150.

Audi engineers are already thinking about their next transition, sometime in the next three or four years, to an even higher bandwidth network. “The IEEE is working on a Reduced Twisted Pair Gigabit Ethernet (RTPGE) standard,” wrote Mr. Muyshondt in an email. “I am involved with the IEEE. They are just starting to define the physical characteristics of the channel before deciding what other issues need to be tackled. From the time actual silicon products are available, it will take the car industry several more years to get that into a production vehicle. By then MOST will already offer a multi-gigabit solution (on the order of three to five gigabits per second). Late this year or early next year the first MOSTnG nodes running at these speeds will be available to carmakers.”
HMI...

According to the survey’s author, Mike VanNieuwkuyk, the problems users are having couldn’t be correlated with one particular interface—voice, touch screen, touch switches or knobs. “Users are having problems with all of these,” he says. “It’s not the best place to choose the functions or make menu selections. Manual inputs are best made from the center armrest, while the display is best situated near the windshield.” More multifunction controllers like the BMW iDrive and Audi MMI are coming to market, for example Mazda has a rotary controller on its 2013 CX-5 compact SUV and Kia has one in the new K9/Cadenza.

Touchpads integrated into the center console make a lot of sense. Since 2010 Audi’s MMI has included a touchpad that recognizes hand-drawn letters and numerals. Preh developed and has begun producing the latest generation iDrive controller that integrates a circular touchpad into the iDrive knob. The touchpad recognizes characters and 2D gestures. First introduced in the 7 Series in China at the end of 2012, the new iDrive controller is likely to be rolled out in more models later this year.

Manual Inputs

Ford has taken a lot of criticism over the capacitive touch switches on its MyFord Touch- and MyLincoln Touch-equipped vehicles, but these switches are here to stay, says Preh, the German company that builds the Lincoln MKZ center stack featuring capacitive touch slider functions for volume and HVAC blower functions. “Capacitive switches will always have a future in the automotive business,” said Jochen Ehrenberg, Preh’s executive vice president in charge of product development and purchasing. “When you design these switches you have to have in mind the potential for distraction; you shouldn’t have to look directly at them with a lot of concentration. You need to provide a surface for the switch that you can easily recognize with your fingers, so you know where to touch. It is also good to provide additional help with haptic or acoustic feedback.”

Mr. Ehrenberg recommends against using only a flat surface like the 17-inch touch screen employed by Tesla in the center stack on its Model S electric vehicle. When the vehicle is in motion it can be difficult to steady the hand to target what needs to be touched. He favors a multi-modal approach that includes touch and mechanical buttons or a rotary knob. “The best place to display information is not the best place to choose the functions

Continuing from page 1

Voice control will be an integral part of future multimodal driver interfaces. Albrecht Schmidt, professor of human-computer interaction at the University of Stuttgart, has conducted research on combining speech with 2D gesture inputs made on a touch-sensitive steering wheel. “The whole steering wheel is touch sensitive, allowing you to use gesture input wherever your hands are resting. You might say ‘driver window’ and then move your thumb up or down to adjust the window opening.” He presented a paper describing the research at the fourth International Conference on Automotive User Interfaces in Portsmouth, New Hampshire, in October 2012.

Convinced that the combination of speech and gesture improves the interaction, Professor Schmidt and his research partners plan to extend the approach with further modalities, in particular eye gaze and body posture. He does not see 3D gesture being widely used in automotive. “You could put your hand in front of the radio and raise or lower it to change the volume or use a flapping gesture to go to the next song, but 3D gesturing makes people tired very quickly. That is why the steering wheel will be there for a long time to come, because it supports the weight of your arms and hands,” he said.

Andrew Kun, associate professor of electrical and computer engineering at the University of New Hampshire, who chaired the October conference, has also done research on the speech interface.

“Speech provides opportunities because it lets you keep your eyes on the road. However, we know that speech can also be a problem. Talking on a cell phone actually makes me four times more likely to get into an accident. Just plopping speech interfaces into cars might not be good enough.” Professor Kun is interested in exploring the differences in the cognitive processes involved in conversations over the phone versus the far safer conversations between a driver and passenger. Those findings could be a starting point to create better speech interfaces, interfaces that behave more like interpersonal conversations.

Professor Kun is also very interested in doing research on eye gaze, in particular
The Company Profile... Flextronics Automotive

Flextronics International Ltd.
Address: 2 Changi South Lane, Singapore; telephone (65) 6890 7188; flextronics.com
FY 2012 Sales: $29,388 million
Interest and Other Expenses: 0.12% of sales
Operating Margin: 1.7%
Operating Cash Flow: $804.3 million
Employees: 159,000 as of March 31, 2012, including about 2,000 design engineers
Sales per Employee: $184,830
Market Capitalization: $3.90 billion as of January 29, 2013, 0.13 times sales
Shareholders’ Equity: $2,453 million
Working Capital: $2,017 million as of September 28, 2012
Total Debt: $2,200 million
Products: Electronics design and manufacturing services (EMS) account for 65% of sales.

Flextronics Automotive
FY 2012 Sales: $850 million
FY 2013 Sales Est.: $1.2 billion*
Top Customers Ranked by Sales: Ford, Nexteer Automotive, S1nn, Automotive Lighting, TRW
Employees: more than 6,000, including about 300 engineers
FY 2013 Sales per Employee: about $200,000
*All references to FY 2013 sales in this profile are estimated figures. Final results were not released at the time of publication.

Flextronics Automotive Background
Flextronics was founded in 1969 in Silicon Valley to assemble printed circuit boards for growing electronics companies that lacked sufficient in-house resources. The company began setting up Asian manufacturing facilities, in Singapore first, in 1981. After weathering major market downturns in the late 1980s and early 1990s, Flextronics went public first in 1987 and a second time in 1994.

The company's ordinary shares are traded on the NASDAQ Global Select Market under the symbol FLEX. From March 2007 to March 2012, Flextronics' stock price declined 66% while during the same period the S&P 500 grew by 10.5% and Flextronics' peers grew by 10.1%.
Sales have declined for five consecutive quarters and the company lost a key customer, RIM, as of the quarter ending December 31, 2012. In fiscal 2012, RIM accounted for more than 10% of Flextronics total sales. A major restructuring resulted in charges of $103 million in the last quarter and further charges, up to $125 million, are expected in the fourth quarter, which ends March 31, 2013.

The company’s growth strategy has included dozens of acquisitions, including a key rival, Solectron, in 2007 in a deal valued at $3.6 billion. At the time, Solectron’s sales were close to $11 billion, including 2.5% from automotive.

Flextronics today is the world’s second largest electronics manufacturing services supplier, a distant second behind Hon Hai (Foxconn), but the number-one supplier of electronics manufacturing services to the auto industry, according to the company. In 2007 they were number three in automotive EMS.

Flextronics Automotive Background
With decades of manufacturing experience in the communications and consumer electronics industries, Flextronics has developed considerable technological expertise and market knowledge that it can apply in the automotive industry.
Consumer electronics markets can be volatile, while contracts with automotive OEMs and tier-one products tend to have long life cycles. Flextronics Automotive operates 14 manufacturing facilities and six design centers in 11 countries, a footprint that is appealing to global vehicle makers.

Flextronics Automotive was created as a business segment in 2005, part of the High Reliability Solutions Group, which also includes medical, aerospace and defense products. It is estimated that 35% of Flextronics Automotive’s FY 2013 sales will come from the company’s own original design manufacture (ODM) products.

Automotive products are grouped in three major segments: Lighting Technologies (exterior, interior and LED), Smart Electronics (rear-view cameras, head units and connectivity modules, power door and lift modules) and Clean Tech (transmission and engine solenoids, DC/DC converters, recuperation modules, aluminum battery cables). The in-house business is managed by a product team with global responsibility for portfolio strategy and M&A activity.

Flextronics has been especially drawn to product segments shown to be growing faster than car production, and product areas where it can leverage its strengths. “From our Network Systems business, we have experience in computing, Wi-fi, Bluetooth, cellular technologies and more. We apply that expertise in automotive as well, in back-up cameras for example,” Mr. Vergin said.

Flextronics Automotive is also organized regionally with managers responsible for North America, Europe and South America. The company’s market development and engineering activities are well established in North America and Europe, so the focus is on Asia (China and India) and South America. Flextronics Automotive today has roughly 50 people doing market development and engineering in Asia, compared to zero a year ago.

**Fast Growth**

Chris Obey is president of Flextronics Automotive. When he joined the company from Lear in December 2011, he found a small automotive business headquartered in Germany with potential to grow. “When I got here we didn’t have a global automotive strategy,” Mr. Obey said. “We were very focused on German premium car makers and not on the rest of the industry. The products we were developing in Germany were not being picked up by the rest of the world. The same was true for North America. We had a design center in Toronto and those products weren’t being proliferated to the rest of the world. We had almost no sales in Asia, the largest car market in the world.

Having lived in Asia [Shanghai] for five years I was pretty comfortable that we could grow the business over there. And we had no business in South America. So the idea that we came up with, and what really was the springboard for a lot of new sales, is selling the whole product group globally.”

Mr. Obey was formerly president of Lear’s Asian operations in Shanghai and vice president of global purchasing. Since FY 2010, well before Mr. Obey joined the company, Flextronics Automotive has been quickly building its original design manufacturing (ODM) business through in-house development, acquisitions and by selling globally.

Since FY 2010, well before Mr. Obey joined the company, Flextronics Automotive has seen remarkable sales growth—58.7% per year through FY 2013. Some of that growth was fueled by acquisitions, the most recent being the December 2012 acquisition of Saturn Electronics and Engineering, a Michigan company with approximately $300 million in sales. Also the 2007 acquisition of Sidler Automotive led to significant new business in overhead console lighting with Mercedes, BMW, Audi and Porsche. That European business began to take off in 2011.

The bulk of the manufacturing services sales growth comes from some fast growing products. Two of its fastest growing EMS products are a connectivity module Flextronics is building for Ford, and an electric power steering module for the Delphi spinoff, Nexteer. Another growth area is drivers for exterior LED lighting.
Beyond EMS: Flextronics' In-House Automotive Business

The trend to outsource more automotive electronics manufacturing appears to have leveled off for now, so Flextronics Automotive's future growth won't come so much from the electronics manufacturing services side of its business; rather it will come from companies it acquires and from its own in-house developed products, the original design manufacturing (ODM) side of its business.

By 2015, Flextronics Automotive's ODM business will account for 50% sales, compared with 35% in FY 2013. "When we look at our backlog, the business we have already booked, it is going to get to 50% in two years," Mr. Obey said. "I think you need that presence to be a key player in the auto industry. And if you can get your products designed in by an OEM it is not as easy for the OEM to take you out as it is if you are a contract manufacturer." As a tier-one or tier-two supplier, contracts can last five to seven years, at least.

Intent on becoming one of the top electrical and electronics parts suppliers in the auto industry (though not nearly as big as Bosch or Continental), Flextronics Automotive expects its double-digit annual sales growth to continue, driven largely by new in-house products and expanding sales of its existing products to customers globally. "We look at two things especially," Mr. Obey said. "Emerging technology and emerging market trends, where additional content is being put into vehicles. That is where our focus is."

Flextronics International is focusing investments in its High Reliability Solutions business group (aerospace, defense, medical and automotive) because products associated with those markets have significantly longer life cycles than other markets served by Flextronics, and potentially higher margins. Product turnover is much faster in Flextronics' consumer electronics, smartphone and personal computer businesses. Flextronics exited its in-house PC business in 2012.

Saturn Electronics

Acquired in December 2012, Saturn Electronics and Engineering, with annual sales of roughly $300 million, makes solenoids for automatic transmissions. "Each transmission has one on/off solenoid and one for every speed; a six-speed transmission has seven solenoids," said Mr. Obey. As carmakers improve fuel economy by adopting transmissions with more speeds, the market for solenoids will grow faster than vehicle unit production.

One of the things that appealed to Flextronics about Saturn Electronics is its location near Detroit. "One of our goals has been to transfer our headquarters from Germany to the U.S. I didn't add a lot of infrastructure to the Detroit area in the

last 12 months because I knew the deal was going to take place,” Mr. Obey noted.

“Saturn was primarily a North American company. With the global Flextronics footprint, our goal now is to expand that solenoid product line to the rest of the world. We are also looking at acquisitions that would complement the Saturn business,” he added.

Saturn also produces specialty wiring harnesses. While Flextronics Automotive is not at all keen to compete with major suppliers such as Sumitomo, Yazaki, Delphi and Lear for the vehicle’s main wiring harness costing $500 to $800 each, it does see opportunities to produce $6 to $12 jumper cables, business the big players might find unappealing.

Since Flextronics took over, Saturn is no longer a certified Minority Business Enterprise. That status provided tax incentives to Saturn’s customers to do business with them.

Infotainment and Connectivity

With a 40% stake, Flextronics is the number-two shareholder in the German audio component and connectivity supplier, S1nn. (See the company profile of S1nn in the November 2011 Hansen Report.) Flextronics manufactures 100% of the electronics developed and sold by S1nn, under the S1nn brand.

Flextronics is working to develop an infotainment partner in Asia while it looks at other potential partners in other parts of the world. In China, for example, Flextronics might seek joint venture partners rather than acquisition candidates.

According to Mr. Obey, Flextronics is bringing a new integrated head unit to market. “These are pretty hefty modules,” he said. “They would include voice control, GPS and wireless technology—everything but the display.”

Flextronics Automotive Strengths:

- Flextronics International’s 220,000 engineers, 100 factories, 2,000 design engineers, rich experience building everything from smartphones and tablet computers, to equipment for cloud computing and high-reliability products for aerospace and medical markets.
- More experience with consumer electronics than most of its automotive competitors, says the company.
- Manufacturing scale: For example, Flextronics International operates more than 1,500 SMP (surface mount package) machines vs. a typical automotive electronics company that might operate only 20 or fewer.
- Flexibility and “a willingness to do anything an auto company wants us to do,” says Mr. Obey, “from design concept through logistics, services, refurbishing, to after sale”.
- Global processes: all plants run with the same lean Flextronics manufacturing processes.
- Flextronics offers unmatched purchasing scale and local supply network:

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<th>Flextronics Automotive Footprint</th>
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<td>Suzhou, China</td>
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Flextronics Competitive Market Position

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Source: Flextronics and IDC

Ashok Tiwari, Flextronics director of operations observed: “Customers see a lot of value coming from us because they don’t see us as just an automotive company. They see the value of our scale and the footprint we have. When I buy some electronic component—most of them are commodities—I leverage our global buying power. Our scale allows us to develop local supply bases, as we have in Asia.” Flextronics’ scale also gives it the ability to ramp up manufacturing quickly and at multiple sites.

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<th>Major Automotive Customers</th>
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Major End Customers

- Audi
- BMW
- Chrysler
- Ford
- Mercedes
- Porsche
- Volkswagen
Roundup of 2012 Auto Electronics Supplier Sales

Autoliv
2012 Net Sales: $8,266.7 million
Change from 2011: up 0.4%. Sales of airbag products were flat and seatbelt product sales decreased slightly. Active safety product sales grew by 36.2%, but those products comprise less than 3% of total sales.
Operating Margin: 8.5%, compared with 10.8% the prior year
Outlook for 2013: Consolidated sales growth in the range of 2% to 4% is forecast, but due to further vehicle production cuts expected in Western Europe especially, first quarter 2013 sales are forecast to come in 4% lower than in Q1 2012.

Autoliv attributes $79 million of the $184 million decrease in operating income in 2012 to “higher costs for capacity alignments and antitrust investigations.” In June, the company pledged to U.S. Department of Justice charges of conspiring to fix prices on airbags, steering wheels and seatbelts and agreed to pay a $14.5 million criminal fine. Autoliv projects an additional $25 million to $50 million in further capacity alignment costs in 2013.

In January 2013, Autoliv announced that its sensors and cameras underpin BMW’s new Dynamic Light Spot night vision system which senses and illuminates pedestrians near the road giving the driver time to avoid them. BMW’s earlier night vision systems also use Autoliv technology.

Bosch Automotive Technology
Preliminary Results—Detailed Report due April 18, 2013.
2012 Sales: €30.9 billion
Change from 2011: up 1.7%
Automotive Technology accounted for 59% of total Bosch sales in 2012. Bosch reported particularly good growth, 50%, in sales of gasoline direct injection systems, while sales of diesel systems contracted due to lower production volumes by its European OEM customers and commercial vehicle makers in China.

In January 2013, Bosch outlined its plans to expand its range of driver assistance products, progressing eventually to fully autonomous systems. The first step, the “traffic jam assistant,” which brakes and accelerates in stop and go traffic at speeds between 0 and 50 kilometers per hour, is expected to go into series production in 2014.

Delphi Automotive
2012 Sales: $15,519 million
Change from 2011: down 3.3%
2012 Net Margin: 8.0%, well ahead of 2011’s 7.3% net margin
Outlook for 2013: Delphi’s 2013 guidance puts sales in the range of $16.2 billion to $16.6 billion
Sales in the Electrical/Electronic Architecture segment grew 5.3% in 2012. The other three reporting segments saw sales decline: Powertrain sales lost 2.5%; Electronics and Safety sales declined 3.3%; Thermal sales were down 5.2%.
Overall, sales grew 11% in Asia and 6% in North America while declining 6% in both Europe and South America.

In October 2012, Delphi completed the acquisition of FCI Group’s Motorized Vehicles Division, which added to Delphi’s automotive connector product portfolio.

Lear Corp.
2012 Sales: $14,567 million
Change from 2011: up 2.9%
2012 Operating Margin: 5.2%
Outlook for 2013: Lear expects sales to reach $15.0 to $15.5 billion, with operating income in the range of $725 million to $775 million.
Sales in the Seating division grew by a modest 1% last year, to $11,029.6 million. Adjusted segment earnings for the business were $697 million, or 6.2% of segment sales, slightly lower than the prior year.

The Electrical Power Management Systems segment saw healthy growth in sales of 10%, to $3.5 billion, driven primarily by new business including incremental new programs for the Ford Ranger, BMW 3 and 6 series, Daimler’s C class coupe, the Volvo V30 and Range Rover. Earnings for the EPMS business increased 40% from the prior year to $259 million, or 7.3% of segment sales.
North America and Europe accounted for 39% and 35% of sales respectively in 2012. GM and Ford are Lear’s largest customers.

HMI...

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pupil diameter, which he feels is a good measure of cognitive load. “Pupil diameter responds very quickly. It could be used in the design phase to learn what driver interfaces people find more or less difficult to use.”

As cars become increasingly autonomous, Professor Schmidt is also thinking about the potential problem of the driver who is disengaged from the tasks of driving. Today’s high-end vehicles already control speed and maintain a specified distance from the car ahead. They brake in an emergency, and they nudge the vehicle back into its own lane.

“It is getting so boring to sit behind the wheel of a car that is doing everything right,” Professor Schmidt told us. “It will become increasingly unlikely that you will keep both hands on the wheel and have a fixed gaze on the street. Without more challenge, humans will occupy their minds with other things besides driving. One question we are interested in is how can we keep the driver in the loop? Can we monitor him? And how much advanced notice do we need to give that he needs to take more control of the car? Three-hundred milliseconds is not enough time. We probably need more advance warning, more like 10 seconds,” he said.