North American Suppliers Rocked by Economic Turmoil

Suppliers with exposure to the Detroit Three are being hit with a double whammy: exceptionally low sales at a time when money for borrowing has completely dried up. Bankruptcy or asset sales are a real possibility for some of them.

The economic situation in Detroit is obviously very difficult. I asked Kirk Ludtke, senior vice president and principal at CRT Capital Holdings, just how bad he thinks it is. "I've been covering autos since 1994. I grew up in Detroit; I went to school there. I don't think I've seen the industry as troubled as it is now," he said. Mr. Ludtke is a widely respected analyst who follows automotive stocks and bonds.

"We are coming to the end of a 20-year asset bubble. We just put more and more leverage into the system and that drove prices of everything up and created a lot of excess liquidity. Now that excess is coming out of the market and the leverage is coming out of the market. The root of the problem is consumer balance sheets—consumers are over-leveraged and becoming more so as the stock market falls and home prices fall," he noted.

As a result, consumers are pinched and unsure about the future. Many of them with poor credit are unable to get loans to purchase new cars. And with concerns about high gasoline prices, many who do purchase new vehicles opt for smaller ones with less electrical and electronics content.

The seasonally adjusted annual selling rate (SAAR) in October puts North American vehicle sales at 10.5 million units for the year, down from 12.5 million in September, according to the Detroit News, and down from 16 million units this time last year, a very steep decline. GM's 2008 U.S. unit sales through October were down 20.6%; Ford's were down 18.7%; Chrysler's year-to-date sales were down 26%.

Suppliers, especially those with a lot of business with the Detroit Three, have seen sales plummet and losses mount. The stocks of two suppliers with heavy exposure to the Detroit Three, Lear and Visteon, hit 52-week lows in early November. Visteon shares fell to $0.43 on November 5; shares of Lear stock dropped to $1.55 on November 6. TRW hit a 52-week low of $4.32 on October 28. Ford and GM together accounted for nearly 25% of TRW sales in 2007.

Cash flow for many suppliers has gone negative, and when cash and lines of credit run out, suppliers with low credit ratings will have nowhere to turn. "You talk to any analyst on Wall Street—nobody is recommending any automotive high-yield bonds. The advice we are getting is, 'sell everything in automotive,'" said Michael Long, lead portfolio manager for high-yield bonds at Pacific Life. "That goes for any of these high-yield bond issuers like TRW, Visteon and Lear. Even Ford and GM bonds are trading at distressed levels," he added.

"TRW's 7¾ bonds maturing in 2017 are trading at almost 50 cents to the dollar. The yield to maturity on that is 18¼ percent, which means if they need to raise money, they can't do it in the bond market," said Mr. Long. "It's a horrible situation."

Mr. Ludtke observed: "At these [vehicle sales] volumes, we will see some major suppliers file for bankruptcy. The market is telling you that. Lear's stock is under $2. Its bonds, which are probably more indicative, are trading at 35 to 40 cents on the dollar. TRW's unsecured debt is trading at 55 to 75 cents on the dollar. Visteon's unsecured debt is trading at 25 to 50 cents on the dollar."

Turn to Economy, page 3
Ethennet a Promising Alternative

One year ago SMSC announced that it had opened access to its MOST intellectual property, but industry players today believe that compared with CAN, LIN and FlexRay, MOST is still not nearly open enough. Without more openness and greater affordability, MOST could in several years give way to alternatives, for example, Ethernet, the widely applied network protocol used throughout the Internet.

Semiconductor supplier SMSC purchased MOST pioneer Oasis Silicon Systems in 2005. MOST, for Media Oriented Systems Transport, is a relatively high bandwidth network protocol used to transport digital audio, video and packet data, along with control information, among automotive infotainment system components.

The MOST Cooperation was founded in 1998 by BMW, Daimler, Harman/Becker and Oasis. Audi joined in 2000. The MOST protocol has been used to varying extent in vehicles made by BMW, Daimler, Audi, Land Rover, Porsche, Saab, Volvo and Hyundai, as well as four Toyota models. But even after ten years, MOST hasn’t spread to enough high-volume applications to make the technology more affordable.

Some high-volume carmakers say they simply don’t have a need for MOST. In my Car Makers Speak panel at Convergence 2008 in Detroit last month, top electrical engineers from GM, Ford, Chrysler and Honda wouldn’t commit to using MOST in high volume (at least 200,000 vehicles per year) within seven years. GM and Chrysler did not totally rule out adopting MOST somewhere down the road, but Honda is definitely leaning toward IEEE 1394, not MOST.

When talking about MOST, you need to differentiate between what the MOST Cooperation has done and what Harman and SMSC have done outside the MOST Cooperation,” explained Christian Thiel, in an email to The Hansen Report. Dr. Thiel has P&L responsibility for SMSC’s automotive product line. “The MOST Cooperation part has always been completely open to all members. But the Harman/SMSC part has been proprietary.

“So last fall we completely opened the specification of our proprietary part of MOST 25 (25 Mbps), and are offering a similar licensing model to the related patents and IP, as Bosch does with CAN. ... While we want openness, carmakers accept that someone has invested a lot of money to develop the technology and needs to see a return,” he wrote. SMSC paid about $119 million for Oasis.

Despite SMSC’s steps to open its MOST IP, a number of people in the industry believe that MOST is still relatively closed. That lack of access is motivating them to explore alternate network technologies.

Günter Reichart, a top electrical engineer at BMW, elaborated: “We have good relations with the company and with Christian Thiel. SMSC is now a little more open as they try and get better acceptance in the market, but they are [moving] a bit too slowly and that might deteriorate their market position. I have heard this also from many other automotive companies. Ethernet is an open technology that is widespread, with many experts, and it is not limited to just the ring topology. Ethernet could very likely compete with MOST in the future.”

BMW already uses Ethernet in the new 7 Series to send vehicle diagnostics data to service equipment and for quick software updates.

A nother issue contributing to the high cost of MOST is the fact that it requires plastic optical fiber. “MOST over copper was not a complete success,” noted Dr. Reichart. “It was a very expensive solution. That is what I heard from Toyota.”

Toyota, who has been using MOST on copper since September 2007, presently has at least two nodes installed on four different models. According to Dr. Thiel, optical MOST is only about $1 more expensive per node than electrical MOST, and it is nearly the same price when optical unit volumes are sufficiently high. The MOST cooperation has been working on a new design that should make the cost of an optical MOST node at least comparable to the cost of a copper node.

“If MOST wants to survive in competition with an automotive Ethernet,” Dr. Reichart advised, “I think it should be more open. That will reduce the cost for the MOST connectors and the MOST chips, both of which are very expensive.”

SMSC is currently the only source for the MOST network transceivers and the low-level networking software.

A nother critic of SMSC’s restrictive policies is Vector Information, whose customers are asking for MOST tools. But SMSC, which also makes tools, is not exactly cooperating. “When you compare the access we have to MOST today to the former Oasis times, it is really more open,” declared Thomas Beck, Vector CEO. “But if you compare it, for example, to CAN or FlexRay or LIN, then MOST is a completely closed shop.

“If you want to provide tools, you need special information about the protocol. That information for MOST 50 was not made available to us. And with their newest protocol, MOST 150, it’s the same story,” said Dr. Beck.

MOST is also pretty tough on small companies trying to participate in the market. John Maddox, who spent nearly seven years with Oasis and SMSC and now operates Simple Media Networks, a small engineering firm, elaborated: "I fundamentally like the MOST technology, I just don’t like the way the MOST Cooperation is run.”

Turn to MOST, page 3
Economy...

A ready in bankruptcy for nearly three years, Delphi has been unable to get the financing it needs to exit, but faces a more immediate problem. According to M r. Ludtke, Delphi has not been able to find buyers for new debtor in possession (DIP) financing to replace the current DIP financing, which expires at the end of 2008.

"On the first priority term loan, they are currently paying 7.5%. [In a new loan] that would go up to 9.5%. For the second priority term loan, they are paying 8.75% and that would go up to 10.75%, at least. And still, the deal is not getting done; there are just no buyers.

"Investors are very reluctant to put money into suppliers right now until there is some clarity as to how things are going to shake out with the Detroit Three, all of which are at risk. If the market doesn’t rebound, and if they don’t get some government support, I think you could see G M and Chrysler pursue a financial re-structuring in 2009 and Ford probably in 2010. If I were a DIP lender to Delphi, I would say this isn’t working," ventured M r. Ludtke.

In his view, "G M needs to take back Delphi’s North American business. By doing that, Delphi will be more profitable, its exposure to G M will be greatly reduced, and it will be easier to finance when the markets normalize. That could set Delphi up to emerge. Otherwise, the uncertainty about a G M bankruptcy, about Delphi emerging, eventually that is going to catch up with Delphi and they will start losing share to companies that don’t have any of these issues."

If one or more of the Detroit Three fail, a number of their suppliers will also fail. A s the automotive market recovers, Toyota and H onda will eventually pick up much of the lost ground. But because Toyota and H onda strongly favor Japanese parts suppliers, many Western suppliers will not be able to recover lost share.

A ccording to the New York Times, the U.S. Treasury Department turned down a request by G M to help finance the automaker’s possible merger with Chrysler. The government deal to release $25 billion in low interest loans to G M, Chrysler and Ford to develop fuel efficient vehicles was still in the works as of the beginning of November. That loan could let them redirect money already spent for cleaner cars to other capital needs. The Detroit carmakers are seeking an additional $25 billion from the government for general use, not tied to fuel-efficient technology. 

MOST...

ooperati on is run. For me, as a contractor trying to develop small projects, it’s difficult. I’ve got a customer right now that wants to make 100 MOST devices. But if we have to pay $10,000 to the MOST cooperation to get information and then another $11,000 to SMSC to get licenses for software, it’s way too expensive.”

A nother factor limiting MOS T adoption is its history. "The first roll-outs of MOST devices were fraught with errors," noted M ark G ill, who looks after infotainment technology in Analog Devices’ DSP organization. "There were many revisions, and the devices were not interoperable. That caused delays in product releases from tier ones, which held up the OEM s. The repercussion of that, I think, has been some fear for those not yet invested in MOST technology that they have a very large hurdle to overcome. ... In contrast to MOST, you have numerous vendors who are able to provide Ethernet technology. It is used widely [outside of the auto industry] because it is a low risk, low cost solution. Ethernet is an open standard, whereas MOST is proprietary."

The Ethernet Alternative

Having done research on the applicability of Ethernet to automotive networks and with some pre-serial development activities involving Ethernet technology underway, B M W’s Dr. Reichart told us that Ethernet could potentially be used in B M W vehicles. T he first applications would be in infotainment systems, possibly followed by driver assistance systems, but neither would be released until after 2015, at the earliest.

We asked Brad Starks, platform architect for in-vehicle infotainment, Intel Corporation, whether Ethernet would be a good alternative to MOST. M ore than 20 years ago Intel was part of the alliance that developed Ethernet networking technology, which became the basis for the IEEE 802.3 standard. M r. Starks responded by email as follows:

"Ethernet is appealing because it has high bandwidth, low cost, broad adoption, an extensive ecosystem and is easy to implement. But it has not been widely adopted for automotive multimedia transport because it relies on packet switching and has historically lacked the quality of service mechanisms inherent in the circuit-switched MOST architecture."

"However, new techniques proposed by the recently formed 802.1 Audio Video Bridging Task Group promise to provide time-synchronized, low latency streaming services over Ethernet. [O nce these] mechanisms are implemented Ethernet will certainly get the attention of the automotive industry."

Xilinx, a leading supplier of programmable logic devices, also noted the current limitations of Ethernet as a replacement for MOST for transporting real-time audio and video without the improvement of the Audio Video Bridging extension. T he company confirmed there is significant interest in Ethernet among automotive OEM s and tier ones. O ne possible application is a temporary wired connection between a vehicle and service bay equipment. A nother is for point to point connections, for example between a telematics unit receiving wireless data and an infotainment head unit that needs to store and display the data.

Even though Ethernet is an open standard, the auto industry will need a special version in order to make it work in the car. “Carmakers will have to pay for that development, one way or another,” suggested D r. Thiel. “A s a leading provider of embedded Ethernet and automotive networking solutions, we are happy to provide our customers also with Ethernet solutions.”

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The Hansen Report on Automotive Electronics, Portsmouth, NH USA www.hansenreport.com

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The Company Profile...  Lear Electrical/Electronics

**Background**

Lear Corporation's history in the seating business dates to 1917 with the founding of American Metal Products, a seat frame supplier to the automotive and aircraft industries. By 1941 the company was serving seven automotive OEMs including GM, Ford and Chrysler, and five auto parts suppliers. American Metal Products was taken over by Lear Siegler in 1964. In the next decade Lear Siegler grew into a global conglomerate serving varied markets, with sales topping $1 billion. Lear Siegler was bought by an investment group in 1987, and the following year a management buyout of the General Seating Division separated the automotive business, which eventually became Lear Seating Corporation. Lear Seating went public in 1994 and changed the company name to simply Lear Corporation. Lear is traded on the New York Stock Exchange under the symbol LEA.

Aided by several major acquisitions, including United Technologies Automotive and Grote & Hartmann, Lear expanded its product line to encompass electrical distribution systems and electronics. In 2007, while retaining a minority stake, Lear sold its Interiors business segment, which included instrument panels and cockpit systems, headliners and overhead systems, door panels, flooring and acoustic systems, to International Automotive Components Group. The company today operates two primary businesses: Seating and the Electrical and Electronics Division (EED).

Half of Lear Corporation's sales in 2007 went to General Motors, Ford and their affiliates. Lear says it supplies every major carmaker in the world and holds the number-two share of the global market for automotive seating systems.

With a total of 91,000 employees, Lear operates 215 facilities in 34 countries. Lear has been moving its manufacturing to low cost regions such as Mexico, Central America, Eastern Europe, Africa and Asia. Forty percent of Lear's components currently come from low cost countries, a percentage Lear expects to increase to 60% by 2010. The company has also established low cost engineering centers in China, India and the Philippines.

In this year of shrinking automotive sales volumes and the recent global economic collapse, Lear has been forced to take aggressive measures to cut costs as well as tap into its existing lines of credit. The company lowered its 2008 sales target from $15 billion to $14 billion and saw its...
growth was driven by multiple customers, market. According to the company that sales grew at 9.1% per year, significantly faster than the electrical and electronics industry. Ray Scott, the new president of Global E/E Systems, explained why: “Before, we ran more regionally in scope. We had capabilities and core competencies that were not being shared, not being taken across our global customers. After we divested interiors, we did a lot of work to understand how we wanted to position ourselves. We found that Electrical and Electronics, without question, is going to be the core growth and major focus of our company moving forward.”

Lear’s target market, $65 billion

“In February 2008, Lear established a global operating structure for the two remaining divisions: Global Seating Systems and Global Electrical and Electronics Systems. Ray Scott, the new president of Global E/E Systems, explained why: “Before, we ran more regionally in scope. We had capabilities and core competencies that were not being shared, not being taken across our global customers. After we divested interiors, we did a lot of work to understand how we wanted to position ourselves. We found that Electrical and Electronics, without question, is going to be the core growth and major focus of our company moving forward.”

Mr. Scott, who was president of Lear North American Seating Systems prior to taking global responsibility for EED, said Lear plans to achieve future growth organically and through acquisitions, though any acquisitions will probably have to wait until the automotive market recovers. He wants to grow E/E sales from about $3.0 billion in 2008 to between $10.5 billion and $14 billion by 2012. That kind of annual growth, between 31.6% and 41.4%, is a very, very aggressive target, but despite the current economic black cloud, the top management at Lear EED is confident that by focusing investments and efforts on a very select group of products and specific customers, Lear can achieve organic sales growth of 13.6% per year, reaching $5 billion in sales by 2012. The company plans to increase EED’s share of its served market from about 5% today to 7.7% in 2012. Some product lines will likely be sold or discontinued.

“We now are taking a very selective approach,” said Mr. Scott, “to grow with specific customers, globally, with an alignment to our product divisions.” In Asia, Lear has had success with Chinese carmakers Chery and Geely, as well as with Volkswagen’s and General Motors’ operations in the region. In Europe, where it is already one of BMW’s largest electronics suppliers, Lear is aggressively working with PSA, Renault/Nissan, Fiat, Daimler and Volkswagen/Audi. “We have been very successful with our diversification. The backlog we have won has been very diversified, not only with products but in the customer balance as well,” Mr. Scott said.

Lear EED recently reported that it has won $400 million in new business since January 2008. Included is a new battery charger and high-voltage electrical distribution systems.

EED is emphasizing these five product lines, which it believes have the greatest promise of sales growth and profits:

- Hybrid components (plug-in charging systems, battery charging modules, DC-DC converters, high voltage wire and connection systems)
- Smart junction boxes
- Wireless (remote keyless entry and tire pressure monitors)
- Sound systems (digital amplifiers)
- Body electronics (including network gateway capability)

Hybrids: Major Growth Opportunity

Lear has been investing, and finding some success, in one of the fastest growing segments of the automotive electronics industry: electrical and electronics components for hybrid vehicles. “We have a strong wiring division and a strong body electronics division,” noted Bill Mattingly, Global Electrical and Electronics...
Lear Electrical/Electronics

Global Market Potential for Hybrid Electric Vehicle Components

<table>
<thead>
<tr>
<th>Year</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>2008</td>
<td>$760 million</td>
</tr>
<tr>
<td>2012</td>
<td>$4,000 million</td>
</tr>
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2008 to 2012 CAGR: 51.5%

Data: Lear

ics' new vice president of engineering, and formerly the top electrical engineer at Chrysler. “For those divisions growth has been stable, but not that fast. Now with this hybrid group we see huge opportunities.”

Lear is focusing on those hybrid vehicle components for which carmakers are most likely to depend on their suppliers. “The carmakers will want to control the traction motor, the batteries, because they cost so much, and the hybrid control unit,” said Mr. Mattingly. “That leaves an opportunity for us in the high-voltage wiring, battery chargers, DC-DC converters and possibly high-power battery monitoring systems and inverters. It plays to our strength, because we are already well positioned in body controllers and power distribution,” he said.

According to Lear estimates, the electrical distribution system in a full hybrid vehicle costs approximately 100% more than the distribution system in a conventional vehicle. The total electrical/electronics content in today’s hybrid vehicles can cost from $3,500 to $7,500 more than the E/E content in a conventional powertrain vehicle. Lear’s product line serves approximately $1,500 to $2,500 worth of that additional content.

Lear makes the entire wiring harness, including high-voltage wiring, terminals and connectors, for the Dodge Durango and Chrysler Aspen hybrid SUVs, which started production in August 2008. Last month, however, Chrysler announced it is stopping production of the hybrid SUVs as of December 31, 2008, when it closes its Newark, Delaware, assembly plant.

Lear has also booked a production order for wiring on a North American produced plug-in hybrid that will begin shipping in 2010. And the company has a development contract for high-voltage wiring with a European carmaker, for which production could start in 2012.

A ready in production is a battery monitor for a Volkswagen micro-hybrid vehicle. The monitor ensures there is sufficient charge in the battery to restart the engine before initiating the start-stop function. Lear has verbal commitments with two other customers for reduced-cost battery monitors that will go into production in 2012.

Lear is also already producing a low-power DC-A C inverter that works in the 100- to 400-watt range; it has booked an order for a DC-A C inverter capable of kilowatts of power. Used to power the traction motor, the higher-power inverter will be ready for production in 2012.

Lear has won a production order for 2011 or 2012 from a European carmaker for a DC-DC converter that will be used to regulate supply voltage in a vehicle with the start-stop feature.

And finally, Lear has won two production orders and a development contract for an in-vehicle battery charging module that will convert 110 volts A C from the power grid to DC power for recharging the battery on a plug-in hybrid vehicle. Shipments are set to begin in 2010.

Lear is developing the battery charger (and the DC-DC converter) with Delta-Q Technologies, which makes power conversion and power management products used in recreational, industrial and specialty electric drive vehicles.

According to Jason Forcier, vice president and general manager of the Global Electronics business, the biggest challenge in developing the battery charger involved its power electronics and getting the project costs down. Lear and Delta-Q have been working to adapt charger designs from industrial applications to the automotive environment.

Smart Junction Boxes

Carmakers seeking to take weight and cost out of their electrical distribution systems increasingly design in smart junction boxes, which integrate power distribution with body electronics functionality. A more electronics content is
added to vehicles, smart junction boxes allow for greater flexibility in packaging. Smart junction boxes are Lear's top selling electronics products. The company is among the top three market players, especially with Ford, where its business continues growing as new Ford global vehicle architectures come out.

**Wireless**

Remote keyless entry and tire pressure monitoring systems are both targeted growth products for Lear. Beginning with GM in 1990, Lear today has remote keyless entry systems installed in roughly five million vehicles globally and expects to double that figure by 2012. Lear’s RF technology provides an operating range of 1,640 feet with an external antenna and up to 787 feet with an internal antenna.

While tire pressure monitor systems are required in all new vehicles in the U.S., they are also being more widely installed in Europe and Asia, both as a safety feature and because properly inflated tires can reduce fuel consumption and CO2 emissions.

**Sound Systems**

Lear is focusing on mid- to high-end amplifiers and sound system engineering, including acoustical, electrical and network systems integration, primarily for BMW. The company is targeting Ford for increased business in amplifiers, which will likely be marketed under the THX brand. Lear currently supplies amps for Lincoln THX audio systems.

**Why Lear? Body Electronics Plus EDS**

One of Lear’s competitive strengths is that it is one of only a few companies that can supply both the wiring harness, including terminals and connectors, and body electronics modules, the two main cost components of an E/E architecture. That capability makes Lear well equipped to work with OEMs in optimizing new vehicle architectures. “More and more, as automakers try to adjust their engineering staff to optimized levels, we are seeing there are tasks they have to delegate to the supply base. We’ve recently been asked by a couple of carmakers to take a look at designing both the wiring harness system and the power distribution electronics for the whole vehicle,” Mr. Mattingly noted.

Drawing on his experience at Chrysler, Mr. Mattingly brings to Lear a good perspective of what a carmaker’s expectations are, and the importance of Lear having a clear understanding of the vehicle application. “A supplier needs to have that dialog with the OEM early in the design phase, so the specification that ultimately is delivered is one that meets the application in that vehicle,” he said.

Jason Forcier, who was North American regional president of automotive electronics for Robert Bosch before joining Lear in August 2008, commented on how different carmakers deal with outsourcing application software for body control modules, one of Lear’s most promising growth products. GM, for example, does a considerable amount of software development in house; Ford and BMW do far less. “There is a fair amount of software activity going on here at Lear,” he said. “We have partnerships with customers like Ford and BMW where Lear is developing the code for the BCMs used in their vehicles.” Ford and BMW are Lear’s biggest customers for electronics. Lear believes another advantage it holds over its larger competitors is its reputation for developing solid, mutually beneficial relationships with its customers. Lear’s ability to control the engineering of the wiring harnesses, terminals, connectors and body electronics helps OEMs to reduce their development, production and material costs. Frank Orsini, vice president and general manager of global electronics for the whole vehicle,” Mr. Orsini elaborated: “We talk [to the OEMs] about the cost benefits of working with Lear as opposed to just sourcing to three different suppliers. We have some great systems and tools we use at Lear—it can be a combination of technology driving optimization, it can be sound engineering in terms of execution. But honestly, this boils down to working hand in hand with the OEMs to develop the system.”

Lear cites its low R&D overhead as a further edge over the competition. In 2007 Lear Corporation’s R&D expense was less than one percent of sales. By outsourcing pure research to local university partners, spending very selectively on development and predevelopment, and keeping engineering tightly controlled, Lear EED has kept its R&D costs approximately 25% lower than its competitors, according to the company.

EED’s spending on R&D is higher as a percentage of sales than the corporation’s. It is focused on core body electronics, especially smart junction boxes, wireless systems and lighting control, as well as on high power components for hybrid and electric vehicles.

**Lear Products**

<table>
<thead>
<tr>
<th>Electrical Distribution</th>
<th>Body Electronics</th>
<th>Lighting</th>
<th>Infotainment</th>
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<tr>
<td>Complete vehicle wiring systems</td>
<td>Horn controls</td>
<td>Adaptive front lighting systems</td>
<td>Sound solutions</td>
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<tr>
<td>Terminals and connectors</td>
<td>Memory seats</td>
<td>Exterior lighting electronics</td>
<td>Amplifiers</td>
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<tr>
<td>Passive smart and solid state junction boxes</td>
<td>Heated/ventilated seats</td>
<td>Interior lighting electronics</td>
<td>TV tuners</td>
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<tr>
<td>Power distribution centers</td>
<td>Trunk locks</td>
<td>Ambient lighting electronics</td>
<td>Rear seat entertainment</td>
</tr>
<tr>
<td>High Power</td>
<td>Gateways</td>
<td>Infrared sensors</td>
<td>Wireless</td>
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<tr>
<td>High-voltage wire systems</td>
<td>Shift interlocks</td>
<td>Keyless entry</td>
<td>Keyless entry</td>
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<tr>
<td>High-voltage terminals and connectors</td>
<td>Door interlocks</td>
<td>Garage door openers</td>
<td>Garage door openers</td>
</tr>
<tr>
<td>DC-DC converters*</td>
<td>Trailer taws</td>
<td>*Not yet in volume production</td>
<td>DC-AC inverters*</td>
</tr>
<tr>
<td>DC-AC inverters*</td>
<td>Front wipers</td>
<td></td>
<td>Battery charging modules*</td>
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<tr>
<td>High power printed circuit boards</td>
<td>Rear wipers</td>
<td></td>
<td>Battery monitors</td>
</tr>
<tr>
<td>Battery monitors</td>
<td>Door locks</td>
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volume production. BMW has already begun to use some AUTOSAR software in its new 7 Series, and sees AUTOSAR as an essential software ingredient of all future platforms.

GM is also committed to AUTOSAR but won’t begin to roll it out until after 2014. Ford and Honda are considering the standard but are not ready to make a commitment. Chrysler is not a member of the AUTOSAR consortium.

AUTOSAR

The only certain advocate on our panel for the AUTOSAR multimedia bus protocol in high volume was BMW, who uses it now. Ford also uses it on some Volvo models, but not in high volume. MOST on twisted-pair copper is being considered by BMW and Chrysler because it might eventually cost significantly less than fiber-optic transport. Some years from now Ethernet could replace MOST, a possibility being considered by BMW, Chrysler and GM.

Honda is committed to IEEE 1394, another alternative to MOST.

Linux Infotainment Platform

BMW was the only carmaker on the panel committed to the open source Linux infotainment platform. GM will decide in six to 12 months if it will help develop the standard platform initiated by BMW, Wind River and Intel.

CE4A and NGTP

BMW was also the only carmaker on the panel saying yes to the CE4A and the Next Generation Telematics Protocol (NGTP). CE4A is an initiative promoted by four German carmakers to create standard interfaces between portable devices and the vehicle. NGTP is a standard created by BMW, Connexis and WirelessCar that would make it easier for carmakers to choose from a variety of services and providers.

Japan’s Telematics Services

Japanese telematics service providers are making more safety-related content available to subscribers.

In December 2008 Nissan will expand a test program for its slip hazard warning service, which alerts drivers to slippery road conditions, to all vehicles with factory installed HDD Carwings navigation systems. Warnings are developed using data from the Intelligent Transport System (a government/industry data communications consortium) and ABS activation in the probe vehicles. Drivers receive voice warnings when they approach areas identified as potentially hazardous.

Honda’s InterNavi Premium service continually collects data from InterNavi-equipped cars to provide not only real-time traffic information, but additional services such as the most fuel-efficient route to a destination, road conditions in the event of an earthquake or severe weather, and crime statistics in a destination area.

Toyota’s G-Book mX Pro uses probe data from other mX Pro-equipped vehicles to supplement traffic information supplied by VICS (Vehicle Information and Communications System).

<table>
<thead>
<tr>
<th>Subscribers to Major Japanese Telematics Services</th>
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<tbody>
<tr>
<td>Service</td>
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<tr>
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</tr>
<tr>
<td>Toyota G-Book</td>
</tr>
<tr>
<td>Nissan Carwings</td>
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<tr>
<td>Honda InterNavi Premium Club</td>
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¹As of March 2008
²Carwings navigation systems sold through September 2008. The first three years of basic service are free.
³As of November 2008

NHTSA Monitors Safety Standards

As part of its mandate to periodically evaluate the effectiveness of the Federal Motor Vehicle Safety Standards, in August 2008 NHTSA released its Evaluation Program Plan 2008-2012. Some upcoming evaluations of interest to the automotive electronics industry include:

2009: Effectiveness of advanced air bags
TPMS effect on tire pressure
Roll stability control and electronic stability control for heavy trucks, tractors and trailers
Effectiveness of ESC, follow up

2010: Side air bags and head protection air bags, follow up

2011: New crash-avoidance technologies (forward collision warning, ACC, lane departure warning)

2012: Knee air bags
Effect of TPMS on crashes