Autonomous Braking for Pedestrians Coming to Europe

Passive safety systems for pedestrian protection—features such as automatic hood lifters that reduce the force of impact if a pedestrian is struck—have been in use for a number of years. Several carmakers have also introduced warning systems that highlight a pedestrian in the roadway and alert the driver visually. Volvo recently introduced an airbag that deploys from below the windshield to cushion the impact of a person struck by the vehicle.

Thanks to Euro NCAP (New Car Assessment Program)—which one year ago announced its decision to include autonomous emergency braking (AEB) technologies in its star rating system beginning in 2014—a broad selection of new vehicles will soon be equipped with active safety systems, which autonomously brake for pedestrians and cyclists.

Approximately 8,000 pedestrians and cyclists are killed each year on European roads. According to Euro NCAP, AEB systems can reduce accidents by up to 27%. A number of carmakers are targeting 2016 for introduction of an active pedestrian safety feature.

Euro NCAP is intended to help the European Union reach its target of cutting road deaths by 50% between 2010 and 2020. Thirty-one thousand lives were lost on Europe’s roads in 2010. Administered by a consortium of seven European governments, motorist organizations and consumer organizations, the Euro NCAP publishes safety reports on new cars, and awards star ratings based on the comparative safety of a vehicle's performance in crash tests and on how the vehicle is equipped. The top overall rating is five stars. The ratings strongly influence consumers' purchasing decisions.

As of last year’s Euro NCAP survey only two carmakers offered AEB pedestrian systems, Volvo and Toyota. At the 2013 Geneva Auto Show in March, Volvo announced it would begin offering an AEB system in mid-May 2013 that detects not only pedestrians but cyclists as well. The system, which relies on both radar and camera sensors, applies the brakes independently of the driver if a pedestrian or cyclist is likely to be struck by the car.

Pedestrian Death Toll

- Worldwide, 1.24 million people die each year from road traffic crashes.
- Pedestrians, cyclists and motorcyclists account for half of all traffic deaths.
- Pedestrian fatalities as a percent of total: Japan, 35%; Europe, 21%; U.S., 12%
- Because the focus on protecting vehicle occupants has been so successful, the percentage of pedestrian deaths relative to the total number of automotive accident fatalities has been growing.

The 2013 Lexus LS features Toyota’s Advanced Pre-Crash Safety (A-PCS) system. If the relative speed between the vehicle and a detected object or pedestrian exceeds 25 mph, the system will automatically brake.

Volvo and Lexus are only the beginning. By 2016 many more vehicle models will come with AEB for pedestrians. How hot is active pedestrian safety in Europe? “On a scale from zero to 100, it’s 100—because of Euro NCAP,” said Davide Santo, ADAS business manager for Freescale Semiconductor. “All of the carmakers want to do it, because the NCAP marketing tool is very important to them. Last year, between 60% and 70% of the cars offered for sale in Europe had the five-star rating. This year it’s going to be 70% to 80%. By 2016, [two years after AEB becomes essential for the five-star rating], 90% of...
Mobis...

Continued from page 1

nity worldwide.

This spring, Kwi-Han Chae, vice president of Hyundai Mobis R&D, consented to a written interview. Mr. Chae is responsible for the development of a wide range of automotive electronics products, from vision and radar sensors to batteries, advanced driver assistance systems (ADAS) and fuel cell vehicle systems.

Which electronics products from Mobis do outside carmakers find most appealing? What makes them special?

Two of our products come to mind, our integrated center stack (ICS) and intelligent battery sensor (IBS). ICS is the outer control assembly part of the infotainment and HVAC systems composed of display, control switches and knobs. It’s a key differentiating factor in the interior design with a high-quality look and feel. We have won many contracts for these with carmakers around the world, which has given us economies of scale so we can provide the best price to our customers.

The IBS monitors battery current, voltage and temperature and assists the engine management system to effectively control the alternator for optimal power generation. Mobis has top-level software algorithm development capability and a fully automated production line, resulting in stable quality and cost competitiveness.

Among all new products coming from Mobis, which are most promising in terms of sales?

We are expecting increased ADAS sales, especially of smart parking assist systems, autonomous emergency braking systems, smart cruise control and lane keeping assist systems. We have been developing our own sensors and sensor fusion technology. We offer radar, camera, and a long-range ultrasonic sensor that can detect at distances up to eight meters.

Due later this year, Mobis’ next-generation fully customizable infotainment platform based on Android will also provide a sales boost. The platform supports both closed and open app markets. Anyone who wants to make an IVI system can easily design a new solution using our software development kit (Android SDK with Mobis extension). The platform was developed with Wind River, a division of Intel.

Sales of our Active Intelligent Lighting System look promising. That system interacts with the navigation system to automatically adjust the lighting mode to general, downtown or highway. It can adjust the angle of light on curved roads and also lights an extra lamp on the left and right sides for crossroads. The system works with the LED adaptive front lighting system we introduced in 2012.

Finally, we are expecting increased sales for our green car technology. We are set up for high volume production of hybrid motor parts including motors, inverters and converters. Mobis and LG Chem have a joint venture, HL Green Power, which produces automotive lithium ion batteries.

Does Mobis do much business with Toyota and Honda?

While we don’t yet have business with Toyota or Honda, our business with other Japanese OEMs is expanding. We sell electronics and lighting products to Subaru and Mitsubishi Motors.

Why do your customers buy from you rather than from your competitors?

It differs from case to case, but the basic reason is a good combination of quality and price.

Among all the electrical and electronics standards being considered around the world, which are you most enthusiastic about?

In order to assure the efficient development of high-quality safety products, we achieved CMMI Level 3 capability in September 2011 and attained ISO 26262 certification for smart cruise control and lane keeping assistance systems.

To support our interest in multimedia and image transmission via Ethernet, we are members of the AVnu Alliance, and are interested in joining the OPEN Alliance special interest group.

We would like to participate in the development of international standards for high-voltage, high-current components used in electric and hybrid vehicles.

Strategy Analytics’ Report on Infotainment Market

According to a new report from Strategy Analytics, in the highly competitive infotainment domain, the top five suppliers together accounted for 37.5% of the total market in 2012.


For more information on the report or Strategy Analytics’ Automotive Multimedia and Communications Service, visit www.strategyanalytics.com.

Top Five Infotainment Suppliers by Market Share

<table>
<thead>
<tr>
<th>2012 Rank</th>
<th>2011 Rank</th>
<th>Supplier</th>
<th>YOY Growth</th>
<th>2012 Market Share</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>Harman</td>
<td>12.5%</td>
<td>8.5%</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Panasonic</td>
<td>-2.2%</td>
<td>7.6%</td>
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<tr>
<td>3</td>
<td>4</td>
<td>Pioneer</td>
<td>1.9%</td>
<td>7.5%</td>
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<tr>
<td>4</td>
<td>3</td>
<td>Hitachi*</td>
<td>-7.4%</td>
<td>7.0%</td>
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<tr>
<td>5</td>
<td>5</td>
<td>Alpine</td>
<td>-3.7%</td>
<td>6.9%</td>
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</tbody>
</table>

*Including Clarion

Source: Strategy Analytics

THE HANSEN REPORT
ON AUTOMOTIVE ELECTRONICS

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Circulation Manager Michelle Long

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Pedestrian...

cars on the market will probably be available with the five star rating.”

Freescale is providing radar and camera sensors and the microcontrollers used in forward-looking pedestrian detection systems. One microcontroller processes the camera images; a second micro processes the radar signals. Since vision processing is far more complicated and therefore microprocessor-intensive, sensor fusion, which makes a decision whether or not to apply the brakes, typically occurs in the radar’s processor. “Pedestrian protection is best achieved by using both radar and camera,” said Mr. Santo. “There can be no false positives.”

Information from the sensors needs to be processed almost instantly. “Pedestrians can react very quickly and jump back onto the curb when they see an oncoming car,” noted Thomas Classen, director of project management for driver assistance at Bosch, “so the radar and camera sensors need to quickly understand the situation to avoid misinterpretations of the scene that would cause unnecessary emergency braking.” There is somewhat less danger if the sensor fails to detect a pedestrian, because the driver is likely to see him or her and apply the brakes manually.

Bosch offers two different approaches to AEB for pedestrians, a stereo camera solution or its IR1V solution with a single camera and radar sensor. Both detect distances to obstacles. A single camera is not as effective at detecting distance.

“The advantage of the stereo camera, which is packaged as a single unit, is you have just one sensor installation to make,” suggested Dr. Classen. “The sensor is used for multiple applications, including adaptive cruise control. “But ACC based on cameras alone works only up to approximately 120 kph, compared with radar-based ACC, which works up to 150 kph.”

TRW has been supplying sensors for hood-lifter systems as well as the lifting mechanisms for European customers for the past five years. It also partnered with camera-maker Mobileye on a pedestrian detection system which uses TRW’s 24-GHz radar. “But when Euro NCAP first announced their [new] requirements, we started development of our next generation radar, specifically designed to optimize performance for pedestrian detection,” said Andy Whydell, TRW senior manager of product planning. “By switching to 77 GHz we have a full one gigahertz of bandwidth available. That will give us four times better resolution to be able to detect pedestrians as quickly as possible.” TRW expects the product will launch in the next 18 months to two years. “We offer stand-alone radar and stand-alone camera systems capable of pedestrian detection, but our best performing system has both. The camera sends information to the radar, where the data fusion and braking decisions take place,” Mr. Whydell added.

See: CogniVue’s Image Processor, page 8
Background

Established in 1885 as Johnson Electric Service Co., a supplier of temperature control systems for buildings, the company name was changed to Johnson Controls Incorporated in 1974. JCI ventured into the automotive market in 1978 with the purchase of an automotive battery maker, Globe-Union Inc. Today, JCI is the world’s largest producer of lead-acid automotive batteries.

The company expanded its automotive product portfolio in 1985 when it acquired a manufacturer of automotive seating components called Hoover Universal. In the 1990s, headliners and other interior trim products were added, and the 1996 acquisition of Prince Automotive gave JCI the capability to integrate electronics with interiors.

JCI is organized in three primary business units: Building Efficiency, Automotive Experience and Power Solutions. Automotive Experience accounts for 50.8% of the company’s total sales. JCI has increased sales every year over the past 66 years, with the exception of 2009 when the global recession contributed to a 25% decline in sales and a net loss of $338 million for the company.

For fiscal year 2013, JCI is forecasting modest revenue growth, in the range of 3% to 4%. The company has been investing in Asia and expects to grow sales there from 14% of the total to 22% by 2014. JCI’s long-term growth target is 15% after-tax ROIC (return on invested capital).

JCI has a BBB+ long-term credit rating from Standard and Poor’s, an investment grade rating suggesting it has adequate capital to meet financial commitments and systems for driver information, infotainment and body electronics. Employees: more than 91,000
Sales per Employee: $220,495

Power Solutions

Headquarters: Milwaukee, Wisconsin
FY 2012 Sales: $5,906 million
Operating Margin: 14.5%**
Products: Automotive batteries
Employees: 14,715
Sales per Employee: $401,359

**Margin is based on segment income, which is calculated as operating income plus the portion of equity income associated with the business segment, that is, the income generated from joint ventures where JCI is the minority owner and doesn’t consolidate the sales.

JCI Electronics Business Unit Sales

FY 2004

$1.4 billion

FY 2012

$1.4 billion

In 2005 JCI sold the engine electronics business it acquired from Sagem. In 2007 it sold its diagnostics business.

JCI to Exit Electronics

Automotive Experience reports its sales and income in three segments: Seating, Interiors and Electronics. The biggest news about JCI’s Electronics business unit in the last few years is the company’s decision, announced in March 2013, to sell it. JCI’s Electronics sales totaled $1.4 billion in 2012, the same as in 2004, although the company has divested some small pieces of the business during that eight-year period. In 2005, the engine electronics business JCI acquired from Sagem was sold, and a diagnostics business went in 2007.

Valuations of auto electronics businesses have declined since 1996 when JCI acquired Prince Automotive for $1.35 billion, a multiple of 1.6 times sales. At the time, Prince had sales of $850 million. In 2001, Sagem’s $522 million automotive electronics business was acquired for $435 million, or 0.83 times sales. In 2003, JCI acquired Borg Instruments for $150 million, or 2.57 times sales.

In March 2013, the investment bank Barclays estimated the JCI Electronics
## Automotive Experience Segment Sales and Operating Margin by Year

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2012</th>
<th>2013E</th>
<th>2014E</th>
<th>2015E</th>
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<tr>
<td><strong>Revenue (in $ millions)</strong></td>
<td></td>
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<tr>
<td>Seating</td>
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<td>15,591</td>
<td>15,974</td>
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<td>Interiors</td>
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<td>4,265</td>
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<td>1,351</td>
<td>1,292</td>
<td>1,326</td>
<td>1,399</td>
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<tr>
<td><strong>Total Automotive Experience</strong></td>
<td>20,065</td>
<td>21,334</td>
<td>20,974</td>
<td>21,183</td>
<td>21,852</td>
<td>2.2%</td>
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<tr>
<td><strong>Operating Margin</strong></td>
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</tr>
<tr>
<td>Seating</td>
<td>4.4%</td>
<td>4.4%</td>
<td>3.0%</td>
<td>3.3%</td>
<td>3.6%</td>
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<tr>
<td>Interiors</td>
<td>(0.1%)</td>
<td>(0.5%)</td>
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<td>1.7%</td>
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<td>8.7%</td>
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<tr>
<td><strong>Total Automotive Experience</strong></td>
<td>3.9%</td>
<td>3.8%</td>
<td>2.7%</td>
<td>3.2%</td>
<td>3.9%</td>
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</tbody>
</table>

*Data: Barclays Equity Research*

## Automotive Experience Products

- **Electronics**: Displays, infotainment systems, body controllers, convenience features and clusters
- **Seating**: Automotive seat metal structures and mechanisms, foam, trim, fabric and complete seat systems
- **Interiors**: Instrument panels, floor consoles, door panels, headliners and overhead systems

## The Company Profile Continued

Business's value at $935 million, just 0.67 times sales. “JCI’s Electronics business is a niche player in the market (about 3% share) and small relative to JCI overall (about 3% of revenue),” according to a Barclays Equity Research report on the company. Barclays’ valuation assumes an EBITDA multiple of 7.5 times.

In the last couple of years, Electronics has been significantly more profitable than the other two Automotive Experience business units. In 2012, Electronics produced an operating margin of 9.5% vs. 4.4% and minus 0.5% for the Seating and Interiors units, respectively.

But JCI has recently entered the hyper-competitive market for complete infotainment systems, a market that requires large R&D investments. In a recent earnings conference call, JCI chairman, president and CEO Stephen Roell explained: “In order to participate in a bigger way and sustain in that business, we were going to have to make investments in navigation and other types of technologies. We just had to make a decision whether or not that was the business we wanted to allocate capital to. ... And so really the decision was to pursue that divestiture for purposes of being able to use that capital for other business growth opportunities and really a decision that we would not invest in electronics and maintain a niche position.” Before announcing its decision to sell the Electronics business, JCI had been telling investors that it wanted to establish a solid position in the infotainment market. JCI’s first full infotainment system will launch in a 2014 model-year program.

Without significant investment it’s hard to see how JCI could distinguish itself in the infotainment business. JCI claims to have the top position in automotive displays, with 25% of that market, but while the display is a key infotainment system component, infotainment market success is largely a matter of software—being able to deliver millions of lines of glitch-free software code on time.

According to the company, JCI is the world’s fourth-largest supplier of instrument clusters, with a 9% share of that market. But instrument clusters are also getting very competitive. The microprocessor at the heart of the infotainment system is now so capable that it can also handle what gets displayed on the instrument cluster. Because infotainment system suppliers can now reasonably apply their software and driver interface development capabilities to the cluster, it is likely they will take some business away from cluster suppliers.

For the whole company, JCI typically spends slightly more than 2% of sales on R&D, a significantly lower percentage than the automotive electronics industry tier-ones with whom the Electronics unit competes. In JCI’s other Automotive Experience businesses, Seating and Interiors, technology moves at a much slower pace. The same is true for lead-acid batteries, the Power Solutions segment’s major product.

JCI executives are indicating they have better uses for capital than investing in Electronics. In the April earnings call, JCI vice chairman Alex Molinaroli said the company will probably use the proceeds from the sale of the Electronics unit to pay down some debt and to augment some of the investments the company is going to be making in its other businesses. Elsewhere, JCI has said it wants to invest in...
AGM (absorbent glass mat) advanced lead-acid battery technology and in lithium-ion battery technology. The company also wants to fund expansion in China.

According to unconfirmed reports, Delphi, Harman International, Continental and Huayu Automotive Systems, a division of the Chinese carmaker SAIC, have made bids for the Electronics unit. The sale is being managed by JPMorgan Chase.

By selling its Electronics business, JCI loses one of its arguments for what makes the company an appealing interior supplier: that it is able to “seamlessly integrate electronics into its interior designs, a critical element of differentiation.” Displays and instruments, body controllers and connectivity products are some of the company’s top-selling electronics products. JCI’s BlueConnect Bluetooth connectivity solution, introduced in 2003, was one of the first on the market.

One of the company’s biggest electronics moneymakers over the years has been HomeLink RF garage door openers, which it brought to market in 1995.

JCI says it’s the world’s number-three head-up display (HUD) maker, with a 14% share of the market. The company supplies the HUD available in the Peugeot 3008 and Peugeot 5008. While the HUD market is growing at a double-digit rate, it would be hard for JCI to participate in the growth without large additional investments. The number-one HUD supplier, Nippon Seiki, owns half the market and has consistently been investing in new technology to make HUDs brighter and larger. Taking share from Nippon Seiki will be expensive.

One of the complications of the decision to sell the Electronics unit is finding a home for the Electronics employees, who currently share JCI’s 750,000-square-foot facility in Holland, Michigan, with the Interiors business unit. Holland is an attractive place to live and work; employees there will find it very difficult to be uprooted, unless another facility near Holland can be found or an arrangement is made with the new owners allowing employees to share the Holland facility.

JCI Electronics’ sales declined 13% in the second quarter of 2013, primarily due to lower auto production in Europe, where the company reports it has a higher level of electronics content than elsewhere. For the period from 2013 to 2015, the company has won electronics business for the BMW 7 Series (instrument clusters), for the Mazda Axela (HMI, connectivity) and Chrysler’s next-generation Jeep Liberty (instrument panel).

Power Solutions
JCI’s Power Solutions business unit produces batteries, almost exclusively. The vast majority of what it makes are conventional lead-acid automotive batteries for starting, lighting and ignition. The company also manufactures absorbent-glass-mat (AGM) batteries. Capable of frequent charges and discharges, they are the battery of choice for vehicles equipped with the start-stop feature, a fast growing application. The company has also been developing Lithium-ion batteries, which are becoming the battery of choice for hybrid- and electric-vehicle makers. JCI will also apply its Li-ion technology to 48-volt batteries in future dual-voltage (12V/48V) micro-hybrid applications. (In JCI’s lexicon, micro-hybrids are vehicles that will operate with dual-voltage architectures.)

The market for energy storage for all vehicle types—including conventional internal combustion-powered vehicles with and without start-stop, micro-hybrids, hybrids, plug-in hybrids and battery electric vehicles—will grow dramatically over the next eight years, according to JCI. In 2012, the global market totaled $26 billion; by 2020 JCI expects it will grow to $81 billion, a 15.3% annual rise.

JCI makes batteries for new vehicles as well as replacement batteries for vehicles already on the road. Approximately 70% of unit sales worldwide in fiscal 2012 were to the automotive replacement market. As such it is somewhat insulated from the cyclical nature of the auto parts industry. Despite the ups and downs of vehicle sales, batteries already in the fleet need to be replaced.

JCI Power Solutions was awarded $299.5 million in federal grants in 2009 to manufacture advanced batteries for hybrid and electric vehicles in Michigan.

Powertrain in Europe," said Mr. Cole. To meet the European standard carmakers would like to employ passive coasting start-stop systems that turn off the engine whenever the foot is lifted from the gas pedal. Passive coasting start-stop would improve fuel economy by as much as 15%, compared with a maximum improvement of 8% for conventional start-stop systems. The 48-volt battery is needed to maintain steering, engine cooling, air conditioning and lighting for the time the engine is shut down. Another advantage with 48 volts is an improvement in brake recuperation to roughly eight kilowatts, compared with two kilowatts at 12 volts. A 48-volt generator can supply up to 8 or 10 kilowatts; 12-volt generators supply up to three kilowatts.

In a December 2012 presentation to investors, JCI’s Mr. Molinaroli predicted that by 2020 another transition will be underway, taking carmakers from the dual 12/48-volt architecture to a single energy storage voltage of 48 volts. "Some customers have already decided they will take the dual-voltage path. Others are seriously exploring the idea."

JCI expects the market for Li-ion batteries used in micro-hybrid vehicles to grow quickly: By 2020, micro-hybrids could account for between 15% and 25% of the expected $81 billion global battery market. Two forces are driving the move to 12/48-volt networks: the demand for more power-hungry features like active damping and PTC cabin heaters, and government-mandated CO2 emissions and fuel-economy standards. The toughest market mandate is the European target to cap CO2 emissions at 95 grams/km by 2020. That equates to fuel economy rates of 58 miles per gallon for Europe vs. 43 mpg for the U.S. and 39 mpg for China.

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Starter Batteries
JCI is number one in starter batteries. Why? “We have best-in-class engineering, very robust manufacturing processes and a long history of making lead-acid batteries around the world in multiple manufacturing locations,” suggested Garth Cole, Power Solutions’ executive director of product development, in charge of product management for the original equipment battery market. JCI batteries also have PowerFrame positive grids, which, the company claims, deliver up to 70% better electrical flow than other grids. The stamping process produces a consistent, optimized pattern to improve the structural integrity of the grid, making it less susceptible to metal fractures and therefore more resistant to corrosion.

“All of the power to start the car comes from the positive grid,” noted Mr. Cole. The PowerFrame manufacturing process uses 20% less energy and releases 20% lower greenhouse gas emissions than other manufacturing methods, according to JCI.

More than 97% of all automotive lead-acid batteries in the United States are recycled, making them the most recycled post-consumer product, according to the company. Johnson Controls, along with its customers, helped develop a closed loop recycling system, which moves a battery from a manufacturing facility to the retailer, where they pick up used batteries, recycle them, and use them again in their manufacturing. Batteries produced in the U.S. use 60% to 80% recycled materials, including lead and plastic.

Start-Stop Absorbent Glass Mat (AGM) and Enhanced Flooded Batteries
Vehicles with the start-stop feature are 5% to 8% more fuel efficient than vehicles without it, making start-stop especially popular in Europe where fuel prices are relatively high. According to JCI, start-stop penetration will reach 70% of new vehicles in Europe by 2017. In that time frame the global market for start-stop batteries could reach 35 million new vehicles. “The start-stop market has very quickly gone from being a new idea, to mainstream, to almost becoming the powertrain in Europe,” said Mr. Cole.

JCI already supplies more than 4.5 million start-stop batteries per year to carmakers in Europe. The vast majority of those JCI batteries are AGM types, which provide three times the cycling durability and significantly more energy throughput compared with conventional batteries. AGM batteries are well suited to the start-stop feature, which automatically switches off the engine every time the car is at a standstill.

In response to the anticipated demand, JCI is investing $520 million globally to build its AGM manufacturing capacity. Since JCI began producing AGM lead-acid batteries in 2001, it has made more than 18 million of them. The battery’s key feature is the absorbent glass fleece separators which are wrapped around each positive grid, keeping the grid in contact with the battery acid. The components are made to fit tightly, which reduces vibration while exerting uniform pressure on the plates. “By being under compression and having the electrolyte wrapped tightly around the positive grid, paste shedding, a typical cause of battery failure, is minimized,” explained Mr. Cole.

For simple, entry-level start-stop systems, JCI offers enhanced flooded batteries (EFB) as an alternative to AGM. More robust than standard SLI (starting, lighting and ignition) batteries, EFBs can handle the more frequent cycling required by start-stop, but they don’t perform as well as AGM under heavy loads. Less than 10% of the batteries JCI supplies for start-stop are EFB.

48-Volt Li-Ion Battery Applications
As soon as 2016, carmakers in Germany will begin the transition to 12/48-volt power networks, and that has created a demand for 48-volt Lithium-ion batteries. JCI, who is working with a European carmaker to develop 48-volt lithium-ion batteries, thinks the dual-voltage architecture will start with the Europeans but expand globally. “We are seeing a broad-based interest in 48 volts,” said Mr. Cole. “Some customers have already decided they will take the dual-voltage path. Others are seriously exploring the idea.”

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Distinctions Claimed by JCI
◆ World’s number-one supplier of lead-acid batteries
◆ First to market with Li-ion batteries for hybrid vehicles, in 2008 in France
◆ Leader in lead-acid battery recycling: 500 metric tons annually
◆ World’s number-one supplier of batteries for start-stop vehicles
◆ World’s number-one supplier of absorbent glass mat batteries (used in start-stop applications)
◆ World’s number-one display supplier with a 25% market share
Automotive Electromagnetic Compatibility Engineering—Continuing Education Recommended

If you think, as I have, that electromagnetic compatibility (EMC) engineering is something the automotive electronics industry has already figured out, a field where not much new needs to happen, think again.

I spoke recently with Todd Hubing, Michelin Professor of Vehicle Electronic Systems Integration at Clemson University and director of the Clemson Vehicular Electronics Laboratory (CVEL), who brought me up to date on the progress being made in designing for EMC. Dr. Hubing has been doing research on electromagnetic compatibility for his entire career. His company, LearnEMC, provides EMC instruction and design assistance to practicing engineers. He divides his time between the CVEL and CU-ICAR (Clemson University International Center for Automotive Research), teaching graduate students and working with automotive OEMs and suppliers on multiple research and compliance projects.

“Top automotive electrical engineers probably think that EMC is something they know how to deal with already, that it is no longer an issue in automotive electronics,” Dr. Hubing suggested. “I think they may be surprised to learn that designing EMC into their product is every bit as important as designing in mechanical reliability or thermal reliability. It has to be done early on or you are not going to have a good product. Every company talks about how important EMC is, but in my experience they often don’t know they have a problem until they fail the first test.

“The people responsible for electromagnetic compatibility, whether it’s a product engineer or an EMC specialist, need constant training, because this is a rapidly changing field. Not only is our knowledge changing but automotive electronics are changing, and as a result the sources and coupling paths for emissions are also changing.”

Performance Based EMC Design

Dr. Hubing and his researchers have been working for years to develop the theoretical underpinnings of good automotive EMC design. Early on Dr. Hubing concluded that pursuing the path of electromagnetic modeling was futile.

“EMC is all about things you didn’t intend to happen. You are working with so many unknowns.” he said. “You might do two different tests on a wiring harness, for example, and get two very different emissions profiles. You can’t predict something that can’t even be tested with consistent, repeatable results. Using electromagnetic modeling to solve a problem that is not well defined is not going to work.”

The Clemson group has developed a number of algorithms to make maximum radiated emissions calculations based on circuit board and ECU parameters. That work has culminated in a performance-based approach to EMC design. “This is the first process ever where we start with the requirement and work backward to what we have to do on the board to meet that requirement,” Dr. Hubing noted.

Dr. Hubing writes about this in an article published this month at www.incompliancemag.com.

The traditional design, build and test approach to automotive EMC compliance will not be sufficient to ensure the safety or reliability of tomorrow’s automobiles. A Design for Guaranteed Compliance approach promises to ensure that automotive components will meet all EMC requirements at the time they are tested. … More work needs to be done before this concept reaches its full potential, but electronic system designers can already derive significant benefit by applying this approach to products currently under development.

Designing for guaranteed compliance saves money compared with an approach that finds EMC problems only after a product has been prototyped. By then, according to Dr. Hubing:

Routing and placement options that would have been easy to implement early, may no longer be available. Fixing problems that are discovered when testing a prototype is much more likely to involve relatively expensive filters or shields and can cause delays to the product development schedule.

For more information, visit www.cvel.clemson.edu, or contact Dr. Hubing: Hubing@cemson.edu.

CogniVue’s Image Processor Ready for Automotive Applications

Processors, which in mobile applications are packaged together with cameras, must be extremely small. And they must have very high performance while generating very little power. CogniVue, a Canadian startup, has an answer: Its image cognition processor (ICP) offers ten times more performance per area per power than graphical processing units.

After spending only a couple of years promoting its technology to the automotive industry, early last year CogniVue won a major award from a German OEM for its processor, which will be used in a smart backup camera. “Ours was the only high-performance processor that could fit into a camera that small, less than one inch on a side, so the thermal design is very important,” said Thomas Wilson, vice president of business development at CogniVue. “In that application we are in the range of 200 milliwatts.”

In June of last year, CogniVue licensed its current and next-generation vision processing IP to Freescale, who will be handling production. CogniVue also licenses vision algorithms and application software.

CogniVue's Image Cognition Processor capabilities include:

◆ Lens distortion correction
◆ Perspective correction
◆ Object detection, recognition and classification
◆ Feature tracking
◆ Single-camera distance estimation
◆ Display overlay with alphas blending
◆ Multi-view for smart backup camera (split, top-down, panoramic views)
◆ Surround view with image stitching
◆ Video encode and decode
◆ Vector graphics acceleration (OpenVG)