New BMW 7 Series Loaded with New Electronics

By many measures, the 2009 BMW 7 Series sets a new high water mark for automotive electronics. Ready for delivery in November, this remarkable new vehicle boasts four world premieres: It’s the world’s first production application of a touch screen architecture. It’s the first time a carmaker has provided unrestricted access to the Internet. The 7 Series is the first vehicle to keep track of and display the current speed limit to the driver. And it’s the first time a night vision system has been offered that graphically highlights where the pedestrians are on the video monitor and warns the driver if he is at risk of hitting them.

More than ever, vehicles are made distinctive by means of software, and the new 7 Series has five-and-a-half times more software than the 7 Series that preceded it—one gigabyte compared with 180 megabytes. And despite the proliferation of software code, BMW expects that warranty expenses related to electronics and driver environment will be comparable to the old 7 Series.

“People have a right to expect one gigabyte of software code you have to control everything,” said Elmar Frickenstein, senior vice president of Mercedes-Benz and European director of supply chain at BMW Group. “You have to control the processes, you have to control the supply chain, you have to put in place new methods and tools. We use model-based software development. We deployed a new strategy for model-in-the-loop testing, software-in-the-loop testing and hardware-in-the-loop testing. So not only do we test components and subsystems, but we also test the whole car.”

With what BMW calls its Labcar (laboratory car) it can test all the software and the electronics systems and subsystems together. A year and a half before the start of production, Mr. Frickenstein

Telematics Makers Progress

After all these years, is telematics finally about to take off? “Well, nothing in the car industry takes off,” said Russ Shields, Chairman of Ygomi LLC and founder of Connexis, a telematics service provider with strong relationships with European carmakers. “Telematics is creeping up. You’ll see in 2010, 2011 and 2012 [telematics] features added to navigation systems. It’s happening in fits and starts with some companies doing better than others.”

OnStar, GM’s in-house telematics service provider with more than 4 million subscribers, was launched in 1995 and is still by far the world’s largest TSP. Over the years, other players such as AT&T, WirelessCar and Connexis have emerged, and Honda, Toyota and Nissan each have TSPs operating in Japan, but none have as many subscribers as OnStar.

Carmakers, especially luxury carmakers, make a great deal of money with embedded navigation systems and are worried about what the availability of inexpensive personal navigation devices and navigation-equipped smart phones and PDAs is doing to their market. The multimedia package for the Mercedes C Class is priced at $2,980. It includes a Harman Kardon audio system with 6-disc CD changer, but the most expensive part of the system is COMAND, a voice controlled, HDD navigation system. For comparison, the average price of PNDs is just over $300 according to iSuppli. And many cell phones have navigation capability. “PNDs are just beginning to take a bite out of the prices for embedded navigation systems,” said Phil Magney, who runs iSuppli’s automotive practice. iSuppli recently acquired Telematics Research Group, which Mr. Magney founded.

“The challenge for OEMs, if they want to keep these navigation profits, is to add features that both match what the existing handhelds do and do something more,” explained Mr. Shields. “Honda’s InterNavi Premium Club is the model. It has features like dangerous road conditions notification, which you only get if you buy the navigation system with your Honda.” A available in Japan, InterNavi subscribers also get automatic map updates, information about preferred parking, traffic predictions and much more.

According to the IT research and consulting firm Gartner Inc., global sales of telematics boxes, the devices installed in vehicles that enable data communications between the vehicle and the outside world, will grow very quickly: from 14 million units in 2008 to 57 million in 2012. “But most of those boxes will be very simple devices with very limited safety and security functionality,” said Gartner’s automotive practice leader, Thilo Koslowski. Included in the forecast are devices to implement Europe’s eCall initiative, which will probably mandate that all vehicles sold in Europe come with the ability to transmit location information to emergency services in the event of a crash.

Also included in Gartner’s forecast is the Ford SYNC solution. In November 2008 Ford will launch its safety application called 911 Assist, which uses the customer’s Bluetooth-equipped portable device to call a local 911 operator should an airbag-deploying accident occur. However, Sync will not supply location information; that will come from the phone’s

Worldwide Sales of Telematics Connectivity Modules (Units)

2008 to 2012 CAGR: 42%

2008 2012

14 million 57 million

Data: Gartner Inc.
Li-Ion Battery Maker A123 Registers for IPO

Lithium-ion (Li-ion) battery developer A 123 Systems of Watertown, Massachusetts, will soon go public. Its prospectus filed in August with the U.S. Securities and Exchange Commission provides insights into the company, its technology and its most significant target battery market—advanced batteries for hybrid electric vehicles (HEVs), plug-in hybrids (PHEVs) and electric vehicles (EVs). Hybrid electric vehicles use significantly more electrical and electronics parts than do nonhybrid vehicles and represent one of our industry's most promising growth segments.

Carmakers around the world are quickly ramping up production of hybrid and electric vehicles. A123 estimates that the number of HEV, PH EV and EV models with an annual production run of at least 20,000 vehicles will grow from 10 models in 2008 to more than 100 models in 2012. As a result, the advanced battery market will grow to at least $5 billion by 2012 from $700 million in 2008, says the prospectus.

A123 aims to sell more than just batteries; it will also deliver fully integrated battery systems including thermal management, power electronics, control software and battery monitoring technology. Lithium metal hydride (NiMH) batteries are used in nearly all hybrid vehicles today, including the Toyota Prius, but according to A123, NiMH batteries "lack the energy density to make them practical for many PH EV and EV applications."

Lithium-ion batteries have been used commercially since the early 1990s in small portable electronics applications such as cell phones and laptop computers. They have higher energy densities than lead-acid or NiMH batteries and can be made smaller and lighter. Until recently, lithium-ion technology was not widely used beyond small portable devices due to limitations on the power, safety and life of Li-ion batteries.

The A123 prospectus states: "Battery systems such as those being developed for HEV, PH EV and EV powertrains require not only higher levels of power and/or energy, but also the ability to function over a wide range of temperatures and a longer calendar life. For example, portable electronic devices only require about 300 to 400 recharge cycles and a calendar life of about three years, whereas typical vehicle applications require several hundred thousand shallow recharge cycles for HEV applications and several thousand deep cycles for PH EV and EV applications, with a calendar life of approximately 10 years."

A123's newest Li-ion battery is based on proprietary nanophosphate chemistry originally developed at the Massachusetts Institute of Technology and exclusively licensed to A123. A123 was founded in 2001 by Yet-Ming Chiang, Gilbert Riley, Jr. and Ric Fulop to commercialize new battery technology developed at MIT.

The company has joint development and design agreements with several major carmakers and tier-one suppliers including General Motors for the E-Flex PHEV program and with Think Global for its city electric car. A123 is also working with General Electric to design battery system components for automotive programs.

The Wall Street Journal reported that Chrysler is considering using batteries from A123 in its recently announced EV and PH EV programs.

GM has said it will award a production contract for the Volt’s battery back to one of the two companies it has been working with on advanced development contracts—either Compact Power Inc. or Continental Automotive Systems—once the final evaluation is complete. Continental's battery pack uses battery cells co-developed by GM and A123; Compact Power uses cells from its parent company, LG Chem, of Korea. Continental will also supply the lithium-ion battery pack for M ercedes’ S400 BlueHybrid, but the cells for that program will come from Johnson Controls-Saft. In June 2008, Continental acquired 16% ownership in a Japanese developer of Li-ion cells, Enax. A123 currently offers six different lithium-ion batteries with attributes that vary according to the application. It is already in pilot production on a cylindrical 3.6 Ah battery that has a high power-to-energy ratio suitable for hybrid vehicles. And it is in prototype production on 7.7 Ah and 9.5 Ah cylindrical batteries, which could serve either in hybrid or plug-in hybrid vehicles by varying material formulations and coating techniques. The company is also producing prototypes of space-saving rectangular batteries suitable for extended range electric vehicles and PH EVs.
New MY 2009 Features

Carmakers are speeding up their efforts to bring more hybrids, plug-in hybrids and electric models to market in the next few years. J.D. Power and Associates predicts that hybrids will account for 7% of the U.S. market by 2015, compared with 2% in 2008. The Indian market research firm RNCOS predicts the global market for hybrids will increase annually at 12% from 2008 to 2015. Start-stop systems are being rolled out quickly in Europe; PSA/ Citroën and Fiat aim to have start stop standard on all their new models in the next few years.

Mercedes and Volkswagen are launching 2009 model year diesels in the U.S., and other carmakers will soon follow. Mercedes BlueTEC vehicles and Volkswagen’s Jetta TDI now qualify for sizeable federal income tax credits. Ford is counting on its new small cars like the Fiesta and K to revitalize declining sales. Those vehicles will be available in Europe this fall; the Fiesta is due in the U.S. in 2010.

While the main focus is on fuel efficiency, new electronics features geared toward safety, comfort and convenience are still making their way to the market, and features once reserved for luxury cars are moving down market. For example, the KA mini-car will offer heated seats and windshield, and Toyota has what it claims is the world’s first rear window curtain airbag on the subcompact iQ in Japan.

Camera Applications

Applications for camera technology are expanding beyond parking aids, blind spot detection and lane keeping assist. Two carmakers, Opel and BMW, have announced MY 2009 releases of camera systems that recognize traffic signs and display the results on the instrument panel. The Opel system, provided by HELLA, will debut on the new Insignia. The new BMW 7 Series will be fitted with a single-camera system from Continental and Mobileye that not only reads speed limit signs, but also scans for headlamps and taillights and adjusts the headlamps to high or low beams as needed.

Toyota, together with Aisin AW, Zenrin and Toyota Mapmaster, developed a brake assist system that combines stop sign information from the navigation system and a rearward looking, rear mounted camera, which identifies the road markings that precede stop signs in Japan. It crosses references the road marking against turn to Features, page 8

Telematics...

own GPS location feature or through voice signal triangulation done by the cell-phone carrier.

But simple systems like these don’t deliver the full promise of telematics, which goes beyond keeping people safe and well-connected in their vehicles. Telematics can also add value to the car ownership experience.

The Internet

Basic safety and security telematics devices fail to take full advantage of the Internet, which is quickly becoming essential in the vehicle as the backbone for both multimedia and telematics systems. There is no better way to give consumers access to information, to entertainment, to services and features once reserved for luxury cars.

Drivers can already access the Internet in their vehicles from smart phones, PDAs and other portable devices, but the human machine interface in those devices is neither safe nor convenient to use while driving. In November 2008, BMW will be the world’s first carmaker to provide unrestricted Internet access in the new 7 Series and also in the 2009 3 Series. Other BMW models will follow.

“We have to start to get the Internet in the car,” declared Elmar Frickenstein, BMW’s top electrical engineer. “In the next generation we will get more and more functions from the Internet. It’s BMW’s strategy to open onboard functions to off board functions.” BMW drivers will have access to the Internet only when the car is at a standstill. In models equipped with rear-seat infotainment systems, passengers can use it anytime.

“In the future the Internet will definitely be a big factor in telematics but it will be different from how consumers use the Internet today,” said Mr. K. Odowski. “It won’t be about searching and browsing like we do at home. Rather it will be about connectivity. You will see a lot of innovation and new thinking in the ways you can connect the vehicle to the outside world.”

One of the telematics service providers’ most important services will be the creation and maintenance of Internet portals with access to websites especially designed for drivers and passengers. Carmakers will want portals that enhance the ownership experience and the brand as well as bring in revenues. ◆
The Company Profile... Panasonic Automotive Systems

Thumbnail Sketch

Panasonic Corporation*
Headquarters: 1006, Kadoma, Kadoma City, Osaka 571-8501, Japan
Telephone: 81-6-6908-1121
FY 2007 Sales: ¥9,068,928 million ($83.81 billion)
R&D Expenditures: 6.1% of sales
Capital Investment: 5.0% of sales
Net Margin: 3.1%
Net Cash from Operations: ¥466 billion ($4.31 billion)
Stockholders’ Equity: ¥3,742,329 million ($34.6 billion) as of September 30, 2008
Market Capitalization: ¥5,175,942 million ($47.8 billion) as of September 30, 2008
Employees: 305,828
Sales per Employee: ¥29.7 million ($275,000)

Panasonic Automotive Systems Co.
Headquarters: 4261 Ikonobe-cho, Tsuzuki-ku, Yokohama-shi, Kanagawa 224-8520, Japan; Telephone: 81-045-939-6111
FY 2007 Sales: ¥714.3 billion ($6.60 billion)
Products: Audio, navigation, rear seat entertainment, premium sound systems, hybrid batteries, other automotive electronics, electrical systems and components
Employees: 9,900

Introduction
This profile is somewhat different from typical Hansen Report profiles. When it comes to communicating with the press, Panasonic is more conservative than any other company we deal with. The company would not make executives from Panasonic Automotive Systems available to us either for live interviews or for an e-mail exchange. Four executives from Panasonic Automotive Systems were kind enough to talk to us on the record, but they could not talk definitively about new products, nor could they say much about Panasonic’s global automotive business and strategy.

Still, the executives from Panasonic Automotive Systems provided interesting insights into multimedia and talked to us at length about some of their concepts for what’s next in infotainment. And while concepts are not quite as real as specific new products, PASA assured us that Panasonic doesn’t talk about concepts unless there is a link to eventual product plans.

A narrative Background
Panasonic Corporation was founded in 1918 and incorporated in 1935. The company began producing car radios for OEMs and the aftermarket in 1957. Automotive introductions in the 1980s included a synthesized voice warning device, knock sensors and engine control electronics.

In 1992 Panasonic began producing car navigation equipment and CD mechanisms for OEMs; DVD navigation systems followed in 1999. Panasonic entered the market for rear seat entertainment systems in 2001, and the following year introduced hard disk drive navigation.

Panasonic Automotive Systems (PAS) was established January 1, 2003, when all the separate automotive portfolios within Matsushita Electric Industrial, Matsushita Communications Industrial and Kyushu Matsushita Electric were combined into one internal business.

Kazuhiro Tsuga, president of PAS, is responsible for global product development, production and sales. Fifteen percent of

The Company Profile Continued

Panasonic Automotive Sales
FY 2003 to 2007 CAGR: 11.6%

Panasonic Automotive Sales by Region
FY 2007 Total Sales: ¥714.3 billion

Panasonic Automotive Sales by Product
FY 2007 Total Sales: ¥714.3 billion

PA S’s sales come from the aftermarket, the rest from OEM’s.

Panasonic Automotive Systems Europe GmbH (PA SE) was established in April 2004. PA SE develops car audio, CD changers and multifunction displays for automotive customers in Europe and employs more than 200 people.

One of only four strategic businesses within the entire Panasonic Corporation that is slated for significant expansion, automotive electronics is expected to reach one trillion yen ($9.2 billion) in sales by 2010. That 11.9% annual growth rate is significantly faster than the market. PA S’s profitability was not made available, although the business segment in which PA S resides, AV C Networks, produced profits of ¥252,239 million, a 5.8% margin on sales of ¥4,319,594 million.

The company outlined its automotive growth strategy in a press release earlier this year: “In particular, it will emphasize [the] three areas of in-car comfort, safety and security and environmental protection. To be more specific, Matsushita will respond to demands for car-mounted, high-definition AV systems and simple car navigation systems, while aiming to launch products that provide vision assistance and power management.”

M uch of PA S’s sales growth will come from batteries for electric vehicles. Panasonic’s joint venture with Toyota, Panasonic EV Energy, leads the industry in the manufacture of nickel metal hydride (NiMH) batteries and battery management systems for hybrid vehicles. The joint venture, which supplies batteries for Toyota, Lexus, Hino and Daihatsu hybrid vehicles, is part of the Panasonic Automotive Systems business. Toyota owns 60% of the JV; Panasonic owns 40%.

Panasonic EV Energy is expanding NiMH production capacity at its Omomori plant and according to Toyota will supply lithium-ion batteries for a Toyota plug-in hybrid vehicle due in 2010.

A lso among PA S’s fastest growing products in North America and Japan are CCD cameras. “They are exploding in the market now, because so many vehicles are being produced with one or more displays in the front,” said Tom Dunn, manager of marketing and new business development, Panasonic Automotive Systems America.

Panasonic is investing ¥94 billion ($869 million) in a new image sensor production facility in Toyama, Japan, which will support not only its consumer electronics devices but in-vehicle camera applications as well. Honda uses a Panasonic CCD camera system in the 2009 Odyssey van in Japan. The system uses multiple cameras to provide a 360-degree view of the area surrounding the vehicle, and Panasonic’s image processing A IC combines the view from four CCD cameras into one image displayed on the navigation monitor. Last December, Panasonic launched a rear view camera and monitor product for the aftermarket as a low cost alternative to traditional rear view safety systems that require an in-dash navigation system display.

Active noise cancellation (ANC) from Panasonic is also fairly hot and likely to move beyond Panasonic’s initial two customers, Honda and Toyota, according to the company. The main application for ANC is in vehicles with cylinder deactivation, which shuts down cylinders when full power is not required, for example on level highways as the vehicle cruises. But when engines are running in the deactivated mode they often make too much noise, noise that’s apparent in the cabin. The noise canceling signal is played on the vehicle audio system. “It’s difficult for carmakers to tune engine damping for both activated and deactivated modes. ANC makes it easy for them,” said Cary Wilson, senior vice president, Panasonic Automotive Systems America.

WH y Panasonic?
A ccording to our contacts at PA SA, there are a number of good reasons why automotive customers choose to do business with Panasonic. One is because Panasonic has experience in a lot of different markets including computers, avionics and consumer electronics, and it successfully leverages that experience in the auto industry. A lso, customers appreciate Panasonic’s experience serving two of the continued on following page
world’s most demanding carmakers, Toyota and Honda. In fiscal 2007, Toyota was PA S’s largest customer accounting for 34.5% of total sales; Honda was number two, accounting for 15.4% of sales. And the company is vertically integrated, often developing its own semiconductors. “For example, silicon developed for televisions and for airline passenger video monitors can be applied to automotive applications,” noted Mr. Wilson.

Even though Panasonic is vertically integrated, he continued, “We have tremendous relationships with almost all the other big guys. We supply a lot of components to Apple, we work with Microsoft through our Toughbooks [laptop computers] and with Intel.”

Hakan Kostepen, director of planning and innovation at PA SA, added, “Panasonic has an R&D lab in Hollywood, California, that is working on next-generation content for the home, content which is moving into this Internet cloud that soon will be made available to people in their cars.”


### Displays Are Hot; Decks Are Not
A sk Panasonic what’s new in audio and the answer you’ll get is displays. According to Mr. Wilson, “The hottest thing right now is displays. Because of the success of the iPod touch and the iPhone everybody is expecting bigger, more glamorous displays in the car. It’s the H M I that’s really getting to be a big deal.”

“Typical audio system displays are getting to be seven to eight inches with high quality, 18-bit R G B video and wide V GA resolution,” said Mike Burk, chief engineer, PA SA. “But use of big displays will be to make it easier for drivers to select titles by presenting images rather than text. “Every one of our customers is implementing some sort of strategy for displaying album art,” said Mr. Burk.

At the 2008 Detroit A uto Show, Panasonic demonstrated a rear seat entertainment system with a 16-inch video screen that could display a variety of aspect ratios including two separate half-screen video images side by side. According to Panasonic, because portable audio/video devices (e.g. iPods, smartphones) are so pervasive, DVD and CD changers will probably not be part of infotainment systems by 2010 or 2011. PA S’s sales of deck mechanisms declined by an average of 5% annually over the past five years and accounted for less than 3% of sales in FY 2007.

### Navigation: Platform for Content
“Navigation is shifting. It used to be about maps, getting from point A to point B. But we at Panasonic want navigation to be about location-based content. We want to make content number-one in the car,” declared Mr. Kostepen. “First you need information [content] to decide where you are going. The next step is, ‘How do I get there?’”

Panasonic has been developing and presenting to customers concepts for infotainment systems that would wirelessly link to a variety of content and service providers via the Internet. “Our target is by the first quarter to be ready to sign a contract. We need another six months or so,” said Mr. Kostepen.

Panasonic has a number of W iMa X activities already underway in Japan. An Internet-connected infotainment concept could feasibly be implemented in the U.S. as soon as 2012 once mobile WiMa X, which will handle two-way transmissions to a moving vehicle at mobile broadband data rates, is widely available. “WiMa X could be the game changer, which is why Intel and G oogle are investing in that area,” said Mr. Kostepen. LT E (Long Term Evolution) 4G wireless technology might also play a significant role, according to Mr. Kostepen.

“Much of what we are doing at Panasonic will be content related,” said Mr. Kostepen. “It will be similar to the iPod, which comes with iTunes, where you go for content.” One approach Mr. Kostepen envisions is Panasonic forming a relationship with a strong luxury brand carmaker, like Lexus or Cadillac, to create an Internet portal for the car brand with other partners such as Google, Yahoo, YouTube or M icrosoft. “There are 1.5 million Lexus owners. So, let’s say, on behalf of Lexus we go out and negotiate for some content that Lexus owners might want. For example, we might get a discount for Lexus owners to attend a golf event. We send them an e-mail about the discount and include a list of hotels where they can stay. Lexus might get one percent of what
the owners spend at those hotels," he suggested. "The driver gets relevant content that fits the brand lifestyle, and if the driver acts on this content information, new business models are created based on the car brand and content synergies."

Carmakers are very concerned about the success of portable navigation devices sold in the aftermarket, as well as navigation-enabled mobile phones, both of which have taken a bite out of the embedded navigation market. In response, said Mr. Kostepen, "OEM's are now defending their turf. And one of the best ways they can do that is by emphasizing their brands. So, if you can bring in content that especially benefits BMW, Cadillac or Lexus owners, and it is tailored specifically for the individual, you've created a very powerful business model."

Panasonic's concept is different from OnStar's business model, where subscribers must pay a monthly fee. "The telematics most consumers know is airbag [deployment] notification, which is something you never want to use," explained Mr. Kostepen.

"What the traditional telematics business model provides is insurance. I'd rather have a telematics system tell me what is happening in my town on Friday or Saturday night. Send me a review of that restaurant nearby, or trailers for the movies playing nearby, or a short video about a band playing in the area. Or, if the system knows that I buy at Target and it knows I'm near a Target location, it could send me the store's e-promotion, showing only the products I am interested in."

Mr. Kostepen believes Panasonic's approach to navigation will distinguish it from its major competitor, Denso. "Denso is about engine control and safety. They can take safety, the active Driver Assistance System functions, and we'll take location-based content applications. Content-related functions will change every year or year and a half. Safety related functions change every five years or so. Panasonic's goal is to be on the fast content cycle, the faster product cycle."

In Mr. Kostepen's view, the Internet will be at the heart of future infotainment systems. "Whether it's Internet radio with 15,000 radio stations available, or video snacks from YouTube, or information sharing, the Internet will definitely be part of the in-car infotainment system. It's already in the home on the PC or laptop and in the business environment, and it's moving into mobile devices. By 2011 you will readily see it in the car."

"We had Internet radio in a demo at the Detroit Auto Show, which allowed people to interact with that feature real time," noted Tom Dunn. "The feedback we received was really eye opening. We've done some subsequent clinics and Internet radio is one of the hot features people point to and see as having value. Those features, however, will have to wait for high-speed mobile broadband wireless connectivity with coverage that goes everywhere cars go."

**Partnership with Garmin**

In January 2008, Panasonic Automotive Systems America announced its intention to partner with personal navigation device maker Garmin to jointly develop navigation systems and collaborate on OEM automotive projects targeting various carmakers. Panasonic very much believes in partnerships as a way to more quickly take advantage of market opportunities and share the risks.

"What Garmin brings to the partnership is its navigation brand, its appealing user interface and its experience with connected services. Panasonic brings its infotainment brand and its tier-one experience."

As a first step, the partners will turn the Garmin PND into a circuit board that can be inserted into Panasonic car audio-video systems. Step two will integrate Garmin software into Panasonic head units. The third step will be integrating content, including location-based services, into Panasonic infotainment systems. "Any consumer already knows the Garmin user interface and find it very intuitive to use," said Mr. Kostepen.

While Garmin is the number-one U.S. supplier of PNDs, the joint development will focus on embedded OEM navigation systems. OEMs who are interested in offering PNDs to their customers will work directly with Garmin. Both companies can also pursue independent initiatives with carmakers.

"Part of our reason for the Garmin relationship is we think there is a huge opportunity for some significant impact if you can make navigation more cost effective," noted Mr. Wilson. "This trend to have everything onboard in a hard drive doesn't make sense if everybody already has their music library in their Apple [device]. Ford Sync was a huge wake up call." Ford Sync makes it easy to connect portable devices to the vehicle and operate them safely.

Panasonic says it has already booked a development contract with a carmaker based on its collaboration with Garmin.
BMW...

explained, BMW had 30 test cars on the street. “This allowed us more than five million kilometers of street travel to test all the different use cases relative to software quality.”

BMW’s commitment to quality is also evident at the factory. “Before the old 7 Series left the manufacturing area we had 1,800 electrical and electronics check points. In the new 7 Series, we have 3,500 check points,” said Mr. Frickenstein.

Among all the innovations in the new car, Mr. Frickenstein is most proud of the vehicle’s electrical and electronics underpinnings. “We had the assistance of FlexRay and MOST communications networks and of the Autosar software architecture. That makes me proud because we are in front of the whole industry in bringing all these together in a new electrical/electronics architecture in the new 7 Series,” he said. A long with its German partners and others, most notably Daimler AG, BMW has led in the development of the MOST, FlexRay and Autosar standards.

In the new 7 Series, the high-speed, safety-critical network FlexRay connects as many as 16 ECUs involved with the drivetrain, suspension, damping, steering and braking systems. As a result, “no other car is able to control longitudinal, lateral and vertical movements with such outstanding precision,” according to a BMW press release. FlexRay is 20 times faster and can handle more nodes in a single network than CAN, the network protocol that preceded it.

FlexRay is also connected to the 7 Series’ central gateway, which links all the vehicle’s buses together, including an Ethernet link used for service bay diagnostics and to download software updates to the vehicle.

The new vehicle is also the world’s first implementation of Autosar, although because the latest Autosar version was not available in time, BMW could only use the new standard in six ECUs. In each of those ECUs, only some of the basic software is Autosar compliant.

The new 7 Series employs as many as 60 to 65 electronic control units, depending on options, about the same number as in the last 7 Series. There are many more functions in the new vehicle and some of those functions were combined into single ECUs.

Our contacts at BMW roughly estimated the total number of microcontrollers at 150, including 8-, 16- and 32-bit devices. Eight of the 32-bit devices are PowerPCs.

Of all the remarkable new features that are part of the new 7 Series, Mr. Frickenstein couldn’t say which would be most popular with consumers. He did, however, tell us which features he personally likes best: the speed limit indicator and adaptive cruise control with stop and go.

The current speed limit is determined from a forward looking camera mounted on the rearview mirror that recognizes road signs. That data is compared to data from the car’s navigation system, which knows, for example, when the vehicle enters city limits, where speed limits are reduced. The system, from Continental, with pattern recognition from the Israeli firm Mobileye, is accurate 95% of the time.

“I also really love A CC with stop and go,” said Mr. Frickenstein. “I drive 35 kilometers each way to work through Munich, which can be tedious. But I can switch the system on and that means I don’t have to use the brakes or put my foot on the accelerator. I just follow the car in front of me.”

World’s Firsts in the 2009 BMW 7 Series

- Night vision with pedestrian detection
- Speed limit information
- Autosar (6 ECUs with some Autosar basic software)
- Unrestricted Internet access

Other New E/E Features on the 7 Series

Updated iDrive
80 GB hard drive
Black panel instrument cluster display
New navigation features
BMW Routes, trip guidance direct from the Internet to the vehicle
Integral Active Steering
Side-view cameras for monitoring crosswise traffic
Back-up camera
Lane departure warning
Lane change warning
Integrated owner’s manual (available via iDrive)
Integrated Chassis Management linking drivetrain, suspension, damping, steering and braking systems
Up to sixteen ECUs communicate via FlexRay
Remote telematics services (e.g. locking and unlocking of the vehicle)

Features...

the map data to calculate the vehicle’s proximity to the stop sign. The system issues visual and audible alerts, and if the driver hits the brakes suddenly after the warning, the system automatically applies the optimum braking force. Toyota first launched the system in Japan on the 2008 Crown and plans to expand the offering on other models “in the near future.”

Mercedes’ new adaptive high beam assistance system uses a camera mounted in the front windshield to monitor traffic ahead of the vehicle and adjusts the headlamp range to provide the optimum lighting for the traffic situation. As the system recognizes oncoming traffic or vehicles ahead, it continually adjusts the headlamp range so the light falls in front of the other vehicles. New data is transmitted to the headlamps every 40 milliseconds. Low beam range can be increased from about 65 meters to 300 meters. The system, due in the spring of 2009, comprehends steering angle so the lights are dipped when the vehicle corners, and on open empty roads they automatically switch to high beam.

The new Honda Odyssey due on the market in Japan this month features a multi-view camera system that gives the driver a 360-degree view of the area around the vehicle. Four CCD cameras, supplied by Panasonic (Matsushita Industrial Electric), are mounted around the vehicle: one in the front grille, one at the rear and one on each side mirror. The images from the four cameras are processed by an ECU in the dashboard and displayed on the navigation monitor as an overhead view.

Nissan introduced a similar system last year, but it uses CMOS cameras.