Chassis Controls Update

While the ABS market has matured and while electronic stability-control applications are growing quickly, much is still left to accomplish within chassis controls. Continuing to make vehicles less susceptible to rollover crashes, carmakers are developing roll-control systems with electronically controlled actuation of suspension parts. As hydraulic brakes come under the control of computers, a revolution in brakes will occur with electromechanical brakes emerging eventually. Steering systems will undergo a similarly dramatic transformation, as they are made electromechanical. As the chassis system's suspension, braking and steering functions are increasingly placed under the control of computers, each system will become more connected to and dependent upon the others, until they are completely integrated under the control of a single computer.

One view of the promise of chassis control is that in time, the consumer will have a car that will not spin or roll over on any road surface, regardless of what demands the driver and weather impose on the vehicle. Aly Badawy, TRW vice president in charge of chassis engineering, told us that will happen when controls for suspension, braking and steering become totally integrated and operate independently at each corner of the vehicle. This ultimate integration of the chassis system with powertrain control at each corner will not come cheaply and is still decades away.

Other chassis engineers, however, are less optimistic and believe it is difficult to objectify the full potential of future chassis control systems. One top-ranking chassis engineer at Mercedes guessed that the industry has already taken advantage of

Turn to Chassis Control, page 8

AM1-C Joins OSGi

In keeping with its goal of leveraging existing standards, AM1-C (Automotive Multimedia Interface Collaboration) announced on February 27, 2001, that it became a member of OSGi (Open Services Gateway Initiative). Consistent with its overall goal of creating global standards for plug-and-play multimedia communications and information products in the vehicle, AM1-C’s focus will be to extend OSGi specifications to vehicles. In the vehicle OSGi will standardize the delivery of wireless automotive services, such as on-demand navigation, real-time traffic data, security/anti-theft systems, Web browsing, e-mail, e-commerce, remote diagnostics, vehicle personalization, and information and entertainment content.

The existing OSGi specification (Release 1.0) standardizes for the home or office, the means by which services are communicated to gateway devices like computers, set-top boxes, home appliances and game machines. Delivered from external wide-area networks, for instance, the Internet, to home and office internal networks, communications services include home security, information, energy management and e-commerce.

Most of the world’s carmakers belong to AM1-C, and for more than a year, IBM and Sun Microsystems have advocated that AM1-C become involved in OSGi; both companies sit on the OSGi board of directors. By adapting the existing Java-based OSGi specification, AM1-C will be able to quickly realize many of its multimedia plug-and-play goals for the vehicle:

- Since OSGi is an open standard, automotive service providers would be able to deliver OSGi-compatible content and services to any OSGi-compatible onboard multimedia platform.
- By using the same standards applied to homes and small offices, vendors will be able to integrate and link services wherever people are—at home, at

Turn to OSGi, page 2

OSGi

The Open Services Gateway Initiative was formed to provide a forum for the creation of open specifications for the delivery of multiple services from wide-area networks to local networks and devices. The non-profit corporation, founded by 15 companies in the United States in March 1999, currently has 81 members.

Definition: The OSGi specification defines the architecture and APIs (application programming interfaces) that allow delivery of wireless services to homes, small offices and soon vehicles. Based on the Java programming language, the OSGi specification provides for reception of multimedia services on a variety of platforms, from computers to set-top boxes to video-game terminals.

Automotive Extension: Perhaps as early as the end of 2001, automotive OSGi specifications will define the manner in which telematics software code and data are bundled, delivered to the gateway device in the vehicle, unbundled and installed. The standard will regulate wireless automotive digital products like route guidance navigation, diagnostics, Web browsing, information and entertainment content.

Gateway Device: The gateway device is an embedded server that manages incoming multimedia services while providing security; it is the interface between external wide-area networks (like the Internet) and internal networks in the home, office, and soon the vehicle.

Membership: Open to any interested corporation or enterprise, OSGi has an annual fee of $20,000. Deepak Kamlani is the executive director. Headquarters is Bishop Ranch 2, 2694 Bishop Drive, Suite 275, San Ramon, CA 94583, USA; phone 1-925-277-8110; fax 1-925-275-6691; www.osgi.org.
Continued from page 1

The following OSGi members have signed statements of work, which allow active participation at Vehicle Expert Group sessions: A drtranz, Prosysy, Ericsson, Toshiba, IBM, G atespace, Nokia and VDO. Other members who have sat in on sessions, but have not yet submitted statements of work, are A M I-C, Oracle and Sun. ◆

These O SG i members have interests in the automotive and telematics industries.

Acunia (formerly SmartMove)
AMI-C
Ericsson
Hewlett-Packard
IBM
Lucent Technologies
Motorola
National Semiconductor Gmbh
Nokia
Panasonic
Philips
Sony
Sun Microsystems
Texas Instruments
Toshiba
VDO Car Communications
Wind River Systems

Volkswagen, longer part of AMI-C, or members of the organization set up the Vehicle Expert Group to work on extending the existing OSGi Specification to accommodate automotive and other transportation industries. "The Vehicle Expert Group will offer a bridge between A M I-C and OSGi," said the group’s chairman Johan Vos, O pen Telematics Framework architect at telematics specialist A cunia (Leuven, Belgium). "While the OSGi board has not yet approved a timetable for release of the automotive extension of the spec, we are optimistic that we will release something by the end of 2001." A cunia (formerly SmartM ove) is an A M I-C member, with U.S. offices in Cambridge, Massachusetts, and Detroit, Michigan.

The new automotive version of OSGi will accommodate the variability of wireless communications to the vehicle. For instance, disruptions in the communications signal will occur more often in a vehicle than in a home, so the spec must define how vehicle equipment downloads programs differently. The new version will also provide a means to locate vehicles geographically for location-dependent service providers such as local-area yellow pages.

Vehicle Expert Group

In January, when A M I-C joined OSGi, members of OSGi, which is based on Java, created by Sun Microsystems.

their office or in their vehicles.

◆ OSGi specs give vehicle manufacturers a means to update automotive systems over the life of the vehicle. OSGi specifications will govern the way carmakers send software to the vehicle, as well as the way the vehicle’s location information is made available to service providers.

◆ Since OSGi is an open standard, carmakers and suppliers will not be locked into any particular computer operating system or microcontroller family.

Saab’s Mats O verfjord, who handles outreach for A M I-C, represented A M I-C at the three-day OSGi conference held in Dallas, Texas, starting on February 27, 2001. Other A M I-C technical people who might have attended could not, as an A M I-C technical meeting was scheduled in Paris in the same time frame. While no longer part of A M I-C, or members of OSGi, B M W, DaimlerChrysler and Volkswagen have expressed a desire to adopt O SG i standards for the vehicle. However, no one from the German carmakers was at the February OSGi meeting. Neither Intel nor Microsoft are active participation at Vehicle Expert Group sessions: Adtranz, Prosyst, Ericsson, Toshiba, IBM, Gatespace, Nokia and VDO. Other members who have sat in on sessions, but have not yet submitted statements of work, are AMI-C, Oracle and Sun. ◆
Recently Retired Bosch CEO Shares Views on the Industry

After 41 years in the auto industry, Bob Oswald retired from Robert Bosch Corporation on December 31, 2000, at the age of 59. Since 1996, he has been chairman, president and CEO of Robert Bosch Corporation, based in Broadview, Illinois. Mr. Oswald, an electrical engineer with an MBA, also served on the board of management of parent company Robert Bosch GmbH (Stuttgart, Germany). Before joining Bosch in 1989, Bob Oswald worked for the Rochester Products Division of GM, then Ford and later Cummins Engine as vice president, general manager of electronics.

Kurt Liedtke, a German who has spent most of his career outside Germany, recently as head of Bosch’s Australian operation, will replace Mr. Oswald at Robert Bosch Corporation and also on the board of Robert Bosch, GmbH. Mr. Oswald will help his replacement ease into the job by consulting to Bosch until the end of June.

After that, Mr. Oswald, who lives in Bloomfield Hills, Michigan, will stay engaged in the auto industry in some fashion, perhaps by teaching, buying a small company or consulting. Always thoughtful and candid, Bob Oswald spoke with us recently about the auto industry.

More Competitive Pressure

The communications and entertainment segments of the automotive industry now have “a phenomenal number of new players,” Mr. Oswald declared, “and some of those companies will compete at the margins of where Bosch has competed.”

While Mr. Oswald sees continued consolidation among suppliers, he notices that some large suppliers are stepping back to reconsider the role they have taken on, to rethink their ability to satisfy everything the carmakers expect of them today. Carmakers expect suppliers to assume many more responsibilities.

“There are demands for lower prices, demands for taking over more work, demands for new technology. Demands, demands, demands. How the heck do you actually get an adequate return for your investors?” This has been getting consistently worse for five years, and it’s approaching the explosion point.”

While suppliers have gotten larger, and there are far fewer of them, there is overcapacity in the industry. Mr. Oswald believes suppliers have few options except to keep carmakers happy, since carmakers can go out and get new suppliers. Further, it is hard to say no to carmakers because consolidation has left fewer carmakers in the world.

More Global Business

Not only between Europe and the rest of the world, but especially between Germany and the rest of the world, there are language, cultural and fairly important business differences, reflected Mr. Oswald, who often found himself almost alone on the board of Robert Bosch defending the different ways other cultures do business.

Mr. Oswald was the only non-German on the eleven-member management board; Mr. Oswald can speak German socially but does business in English.

We asked Mr. Oswald what about Bosch Automotive he would change. “If I could change one thing, I would emphasize faster and more complete globalization of the senior management structure of Bosch, with the target of better utilizing the worldwide capacity that’s already there.”

Bosch’s strengths include not only advanced technologies, but also excellent development and production capabilities worldwide. Mr. Oswald believes that over the next decade, Robert Bosch GmbH should reorganize to better represent the global nature of the business, for instance, including on the board up to four members from various regions worldwide.

“When you are trying to operate in a global environment, what you find consistently is that the customers have higher expectations of you [as a global player] than of their own national suppliers. Then you get into the whole question of cultural differences.” If people from different cultures cannot accept each other, there will not be trust, and Mr. Oswald concludes, trust is crucial to global business. “A lot of good things can happen where there is trust, without having all the details worked out. Where there is trust, that isn’t always possible—especially getting into standards.”

More Diesel Engines

Mr. Oswald would like the United States to look at the overall impact of its environmental policy. Europeans are more sensitive to environmental issues than Americans are—witness their acceptance of the Kyoto Accords—and yet the European response to environmental problems is more pragmatic. He believes that Americans would be better off if they balanced health and environmental risks against costs as Europeans do.

While diesel engines are common in Europe, strict American emission mandates limiting NOX and particulate matter, as well as the low price of fuel in the U.S., have severely limited the use of diesel engines in the States.

Improving fuel economy and reducing emissions, even CO₂ emissions, which contribute to global warming, will become increasingly important in the United States. Since fuel cells will not be ready this decade, the solution will have to come from the internal combustion engine, and, suggested Mr. Oswald, diesel is the best IC engine to do that.

Diesels are considerably more efficient than gasoline engines, but they are not as clean, a drawback to increased use in the U.S., given current emission mandates. In the near future, diesel engines will be made cleaner, predicted Mr. Oswald. “We [at Bosch] are optimistic that the combination of technologies we already know today, combined with some additional after-treatment concepts, together with some further modifications in the fuel itself, will put diesel engines in the picture in the U.S. That’s why Bosch has been investing big in diesel [parts] manufacturing capacity here.”

HID Market 2001 to 2010

The market for HID (high intensity discharge) headlamps is strongest in Europe and will remain so through 2010, according to a study by Just-auto.com. While the HID market in Japan will also expand, North American vehicle buyers will be slow to adopt the costly option, according to the report. In the U.K. the price for HID lighting in 2001 ranges from £666 to £975 ($1,008 to $1,433).

Penetration of HID in New Passenger Cars, by Region

<table>
<thead>
<tr>
<th>Region</th>
<th>2001</th>
<th>2005</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Europe</td>
<td>11%</td>
<td>23%</td>
<td>42%</td>
</tr>
<tr>
<td>Japan</td>
<td>8%</td>
<td>20%</td>
<td>35%</td>
</tr>
<tr>
<td>North America</td>
<td>2%</td>
<td>8%</td>
<td>17%</td>
</tr>
</tbody>
</table>

The Company Profile...  Huntsville Electronics

Headquarters: 100 Electronics Blvd., Huntsville, Alabama 35824, USA
Core Products: Electronic control units, especially engine and transmission controls, radio head units and instrument clusters
Key Strengths: High quality, low-cost, high-volume manufacturing, well-practiced delivery to Chrysler plants
Top Customer: Chrysler accounts for 95% of shipments.
2000 Shipments: $995 million; the company accounts for what it ships as standard costs, not as sales; profits are not included.
Capital Spending in 2000: $72 million
Employees: 2,929 (as of 12/31/00) of whom 2,274 are hourly workers and 655 are salaried, including about 300 product engineers
Owner: DaimlerChrysler

Background
Founded in 1952, the forerunner of Huntsville Electronics Division was set up by Chrysler Motors to work on the Redstone missile program, and the company continued to work on space projects throughout the 1960s. In 1972, the company first began making automotive electronics. In May 1987, Chrysler reorganized its in-house parts suppliers as an independent parts subsidiary called A custom, with 31 manufacturing locations in the U.S., Canada and Mexico. A custom’s Electronics Division was headquartered in H untsville, Alabama, with 3,200 employees, about 270 more than today.

The Electronics Division is now basically an electronics assembly operation for Chrysler, run from two plants in Huntsville, Alabama. The custom name was dropped in the mid-1990s and the division is no longer independent or seeking outside business. H untsville again serves one carmaker, DaimlerChrysler, following the merger in 1998.

Chrysler buys some electronics from Temic, a slightly larger division of DaimlerChrysler with more technology depth than H untsville, according to Chrysler engineers. Temic, however, is at a disadvantage in that it cannot sell to Chrysler at cost, as H untsville can. Not long after the Daimler-Benz and Chrysler merger in 1998, the companies explored the possibility of aligning H untsville with Temic, but that alliance was ruled out because the companies’ basic economic structures are so different. Temic, a profit-making entity, is focused on Mercedes and also on the merchant market, while H untsville Electronics is solely an in-house component division; H untsville does not count its shipments as sales, but rather as the total of standard costs.

Over the last decade, H untsville has sharpened its focus on three core product groups: electronic control units—especially engine and powertrain controllers—radios and instrument clusters. Over the decade, the company has also moved from making low-volume parts—such as 40 units per day for some products—to a focus on high-volume manufacturing. “We like to build 250,000 units per year and up,” noted Peter Voetsch, who became H untsville’s plant manager in 1998. He was business manager from 1987 to 1995. From 1995 to 1998, M. Voetsch was plant manager first for Chrysler’s...

The Company Profile Continued

Huntsville Products Shipped* (in units)

<table>
<thead>
<tr>
<th>Products</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radios</td>
<td>1,807,266</td>
<td>1,594,310</td>
</tr>
<tr>
<td>Engine controllers</td>
<td>2,362,812</td>
<td>2,577,062</td>
</tr>
<tr>
<td>Transmission controllers</td>
<td>2,581,378</td>
<td>2,288,739</td>
</tr>
<tr>
<td>Body controllers</td>
<td>1,313,025</td>
<td>1,447,655</td>
</tr>
<tr>
<td>Instrument clusters</td>
<td>1,135,486</td>
<td>1,344,689</td>
</tr>
<tr>
<td>PC boards</td>
<td>488,412</td>
<td>605,954</td>
</tr>
<tr>
<td>Airbag controllers</td>
<td>300,000</td>
<td>210,437</td>
</tr>
<tr>
<td>Total</td>
<td>9,988,379</td>
<td>10,068,846</td>
</tr>
</tbody>
</table>

*Includes service volumes

Shipment by Product

<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Powertrain controllers</td>
<td>50%</td>
</tr>
<tr>
<td>Body controllers</td>
<td>10%</td>
</tr>
<tr>
<td>Transfer case controllers</td>
<td>2%</td>
</tr>
<tr>
<td>Instrument clusters</td>
<td>16%</td>
</tr>
<tr>
<td>Amplifiers (4-channel analog audio)</td>
<td>1%</td>
</tr>
<tr>
<td>Radios</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>44%</td>
</tr>
<tr>
<td></td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>3%</td>
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<td></td>
<td>11%</td>
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<td></td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>29%</td>
</tr>
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</table>

Increased Productivity

Given its United Auto Workers union agreements, Chrysler cannot downsize the number of employees at Huntsville, and given that Chrysler does not want to increase the amount of electronics made in house, the number of employees has remained roughly constant over the years. However, because of improvements in productivity, Huntsville has increased the total value of the electronics it manufactures without increasing the number of employees. One result of Huntsville’s productivity gains over the last few years is that the company has been taking over Chrysler business that other outside suppliers have had. Integration has also been a factor in Huntsville picking up share from its competitors, freeing up Huntsville manufacturing capacity to take on work that came from outside suppliers.

The greatest single reason for Huntsville’s productivity improvements is the implementation led by Dennis Pawley of Chrysler’s version of Toyota’s lean production methodology in the early 1990s. Mr. Pawley was head of manufacturing at Chrysler until 1998. Before the Daimler-Chrysler merger, Mercedes had adopted similar manufacturing methods. Mr. Voetsch described production methodology as “essentially going after costs and productivity improvements in every facet of our operation.” Because Huntsville is highly automated, the improvement process often focuses on supervisors and area-manager efficiency improvements.

Training is a big part of the process, and workshops are held that break down every small piece of every operation. Bottle-necks and throughput are improved using the Theory of Constraints, noted Mr. Voetsch.

In 1989 Chrysler initiated SCORE (Supplier Cost Reduction Effort), a cost-and waste-reduction program, which benefited both the carmaker and suppliers. Chrysler asked suppliers for ideas on how to cut costs and eliminate waste and then shared the savings with the suppliers. SCORE touched the whole supply chain, and according to one source, the savings reported by DaimlerChrysler was $2.3 billion in fiscal 1999.

Huntsville does not participate directly in SCORE. While lower costs to DaimlerChrysler are the actual result, hypothetical SCORE awards to Huntsville would be as follows:

- 1996: $15.997 million
- 1997: $19.129 million
- 1998: $16.602 million
- 1999: $16.490 million
- 2000: $ 9.289 million

In its restructuring plan, DaimlerChrysler set aside the price-cut schedule previously mandated by SCORE—10% by 2003—and now requires a 5% price reduction from all suppliers in 2001. That 5% will apply to Huntsville’s material and component suppliers as well. Daimler-Chrysler purchasing is currently negotiating 5% cost reductions for Huntsville’s boards, chips, connectors and other components.

continued on following page
Chrysler will collaborate with suppliers to find another 10% in savings by 2003.

Quality

In J.D. Power and Associates' 2000 Initial Quality Study, all of Chrysler's vehicle nameplates scored considerably better than the average of 9.7 problems per 100 vehicles for sound system quality. Of all nameplates sold in the United States, Plymouth had the second highest ranking with just 5.6 problems per 100 vehicles. Jeep followed in fifth place with 6.6 problems per hundred; Dodge was at 8.1 problems and Chrysler at 9.3. Infinities in 1998, nearly the level that it remains at 9.6 problems per thousand parts.

Chrysler's View of Huntsville

We spoke with one of Huntsville's most influential Chrysler customers, Bob George, electrical platform director for Jeep and chairman of Chrysler's Cross-Platform Tech Club. We asked him to tell us about Huntsville's strengths and weaknesses. "They do projects on time [and] deliver quality parts, on time. They are unmatched because they know our systems very well. ... Chrysler's platform engineers prefer working with Huntsville over the competition, because most of the working-level managers, including Huntsville's automotive electric systems engineering manager, Gary M Archenia, have all been employed up here at Chrysler's Auburn Hills. They are us. They've worked here on platforms, they understand the problem.

Chrysler has agreements with the United Auto Workers union that maintain the number of employees at Huntsville and limit the amount of outsourcing Chrysler can do. UAW employees make considerably more per hour than most electronics-manufacturing workers elsewhere in the world. In the late 1980s, Chrysler explored the possibility of selling Huntsville, but the UAW blocked any action. Some at Chrysler feel that unions sometimes force Chrysler to use Huntsville even if it is not totally competitive. One reason is that as modules are integrated, there is less work to go around, and the result is Huntsville taking other suppliers work in order to keep the unions happy.

Despite expensive manpower, Huntsville usually does quite well on price compared with its competitors, sometimes even coming in below what would have been the competitors' cost, speculates Mr George. "I would say manufacturing technology is excellent. ... Design is competitive, but not necessarily state of the art. ... You can't ask Hunteville for some of the things a broad systems supplier like a Bosch, Denso or Siemens can deliver, but Huntsville can design a damn good box."

Huntsville uses the latest automation technology, minimizing the number of workers needed on each line and consistently comes out with a low-cost, high-quality product.

While Huntsville is not a systems house, the company's high-volume, high-quality, low-cost manufacturing will continue to serve it well, predicted Mr George. That is, as long as Chrysler has its own internal competencies in important areas like powertrain engineering. "If [Chrysler's] internal competencies get strained and we need some real system expertise, that could put Huntsville at risk. ... It's hard to differentiate yourself on just pure mechanical design and manufacture. It will be system knowledge, system efficiencies and software that I think are going to be the future differentiators. It's not, 'Can you pound out a cheap box?'"

Staying Competitive

Chrysler works hard to be sure that Huntsville has plenty of competition to keep it honest. Mr George elaborated, "Chrysler engineering and purchasing have been very good at making sure that there is a M otorola around to compete with Huntsville. That has pushed them. Our battle is to make sure that [Huntsville] doesn't just gobble up everything with no competition. ... If they're not good in a commodity, they can lose the business."

Even though Chrysler is obliged, given its agreement with the UAW to maintain Huntsville's employment level, Huntsville says that it has not grown complacent and still works hard to satisfy its customer. Each year it surveys 50 to 60 key engineering and purchasing contacts at Chrysler for feedback. On a scale from one to five, those surveyed anonymously respond, rating Huntsville's performance in cost, quality and technology. Huntsville's combined score for all three attributes has risen from 3 out of 5 in 1995 to 4 out of 5 in 1998, nearly the level that it remains at today.

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Good Results With Packaging

Huntsville believes its component design capabilities are a strength. A product-engineering group of about 300 at Huntsville does most of its product design work. Huntsville and Motorola AIEG supply in equal proportion engine controllers for Jeep and for Chrysler trucks. That makes an interesting min-case study on product reliability and packaging. Chrysler gave each supplier identical design requirements but allowed them to implement the design in the best way they saw fit. Chrysler uses each supplier's product in almost identical underhood applications.

The two suppliers adopted quite different approaches to the electronics packaging. Huntsville's version uses FR-4 (fire-retardant epoxy/fiberglass) conventional printed circuit boards, while Motorola uses its proprietary Polybent packaging, which is promoted as being more reliable than conventional approaches, particularly at elevated ambient temperatures. Polybent uses polyimide on an aluminum substrate. The polyimide insulates electrically the electronics components that are mounted on it; heat is conducted to the aluminum for dissipation. The aluminum substrate folds to become the housing. Mr. George revealed, "For a couple of years, Motorola's product was substantially better. But now there is no difference [in reliability compared with Huntsville's conventional approach]."

Ball Grid Arrays: While Huntsville prides itself on making high-quality electronics using conventional electronics components, the company has been packaging more integrated circuits as ball grid arrays and is looking at the cost effectiveness of BGAs for most new products. Last year Huntsville used about 900,000 BGAs, which have connections that appear as tiny balls set uniformly in rows and columns. Mr. Voetsch explained: "When you get the process right, they are quite easy to solder. They sort of self-align in the oven so you don't have to worry as much about solder bridging [from connector to connector]." For instance, the smaller quad-flat packs are more troublesome to solder than BGAs.

More New Products

Integrated Engine and Transmission Controller: In 2000, Huntsville's capital outlays included setting up equipment to produce Chrysler's new integrated engine and transmission controller; the powertrain controller is called NGC (Next Generation Controller). First available for MY 2002, the new controller is based on a 32-bit microcontroller, and eventually Chrysler will use it on all its vehicles, even those with manual transmissions.

Integrating Body Controllers with Instrument Clusters: Huntsville has been making more body controllers, which combine a variety of minor controls located in the cab of the vehicle into larger modules. Since Huntsville was making instrument clusters already, it has begun integrating body controllers within the instrument cluster. Huntsville is currently launching a new DR (body model) truck cluster with a body controller that is a node on the vehicle's communications bus.

Huntsville Facilities

Manufacturing Space
Main Plant 564,000 sq. ft.
Plant II 232,000 sq. ft.
Engineering 125,000 sq. ft.
Administration 115,000 sq. ft.
Total Plant 1,036,000 sq. ft.

Facilities

In 1988, Chrysler built a new 564,000 square-foot electronics-manufacturing complex, intending to abandon its two original Huntsville Electronics manufacturing facilities seven miles away. One of the two earlier plants was sold, but as the need for auto electronics grew, Chrysler kept the second plant, and in 1998 renovated it. That second plant is now devoted exclusively to making instrument clusters.
most of the potentiality of integrated chassis controls. Left to accomplish is eking out the last 10% or so in performance. “So much depends on the tradeoffs between stopping quickly, stability vs. roll and what sort of driving features are wanted,” noted Mark DePoyster, chief systems engineer at Delphi Automotive Systems. Further, the ability of the tire itself to grip the road severely limits chassis control performance.

The difficulty of quantifying the benefits of new chassis control systems is one of the biggest challenges in moving beyond present systems. The following are some of today’s developments in chassis control systems.

◆ Electronic Stability Control

Mercedes was the world’s first carmaker to introduce electronic stability control, first brought to market on the Mercedes 1995 S class, but the benefits of stability-control systems were not well understood, and sales were limited. That changed amid heavy press coverage when the Mercedes A class subcompact failed the Swedish moose-avoidance test by rolling over, and the company subsequently solved the problem by installing stability control on the A class in 1998.

By 2004, electronic stability-control systems will penetrate 33% of all new European vehicles and 10% of vehicles in the United States, according to Continental Teves, one of six companies that make stability-control systems. In the United States, electronic stability control was offered on seventeen MY 2001 carlines.

Electronic stability control uses a yaw sensor and a lateral acceleration sensor, along with a B5, wheel-speed sensors and a steering-wheel-position sensor to sense when the vehicle is slipping laterally from the driver’s intended path. When an unstable condition is sensed, the electronic-stability control system calls upon the traction-control system and/or a B5 to intervene to prevent skidding, bringing the vehicle back under the control of the driver. Sales of electronic stability-control systems have been growing each year as the systems are applied not just to luxury vehicles, but also to less expensive vehicles, especially SUVs. Ford says it will offer electronic stability control on all light trucks by the MY 2005, starting in MY 2002.

◆ Stability-Control Systems and Electric Power Steering

Today’s electronic stability-control systems introduce an unwanted vibration into the steering wheel when activated. TRW has been working on a system that further integrates electronic stability control with the vehicle by linking stability control with power steering, either electrohydraulic or electric power steering. TRW’s electric power steering system would sense the steering wheel torque and null out the vibrations. TRW, working with two European suppliers on the system, says it could be in production with the new system by 2005 or 2006.

◆ Tire-Force Sensors

Continental announced in December that it had successfully tested an integrated chassis control system that, with the help of new advanced tires, improved the vehicle’s stopping distance by 22%. Before the Continental improvements, the vehicle stopped in 38.5 meters from a speed of 100 km/h, and after the improvements, within 30 meters. The most significant factor in the system’s improvement was the tires. A mong several tire improvements, two important ones were design changes to maximize the area of the tire that is in contact with the road surface, and tire dimensions were “tuned” to keep them from bouncing off the road’s surface, since activated A BS pulses the brakes and tends to bounce the tires. Sensors built into the tires also helped. Continental’s tire sidewall torsion sensor system, comprised of 96 strips of alternating north-south magnetic poles along with magnetic sensors attached to the suspension strut, measures the lateral and longitudinal forces acting on the tire. That information enables the A BS controller to maximize the braking forces exerted by each wheel.

◆ Electrohydraulic Brakes

Engineers at Mercedes and BMW told us that after electronic stability controls, electrohydraulic brakes will be the next major new chassis control system to come to market. TRW is saying that it will have an electrohydraulic brake system in production by 2003. In addition to TRW, other developers of electrohydraulic brakes include Continental Teves and Delphi A utomotive Systems, among others.

Electrohydraulic brakes, a precursor to electromechanical brakes, do away with the mechanical connection from the brake pedal to the hydraulic braking system. Instead, as the driver depresses the brake pedal, she activates a feel simulator and a pedal-position sensor. The sensor sends a signal to a computer that controls a hydraulic valve, which then delivers optimal pressure to the brake calipers. Electrohydraulic brakes do not require engine-supplied vacuum.

Electrohydraulic brakes are needed if future adaptive cruise control systems are to automatically call for full-authority braking. Since the brake pedal is not directly connected to the hydraulic system, another benefit of electrohydraulic braking is that the driver feels no vibration in the A BS mode.

◆ Roll-Control Systems

A ccording to NHTSA and the Wall Street Journal, about a quarter of all road fatalities result from rollover crashes and nearly two-thirds of those fatalities involve SUVs. To solve the problem, not only will carmakers implement electronics stability-control systems, which are actuated by means of controlling the slip on each wheel, but carmakers will also begin to deploy roll-control systems that act on the suspension to lower the vehicle’s center of gravity during sharp cornering maneuvers.

BMW plans to introduce a vehicle with active roll-control this year. One such system developed by TRW is called A ctive Roll Control. TRW’s system takes sensor inputs from a lateral accelerometer and a steering-angle sensor to determine roll force caused by cornering. The controller then signals hydraulic actuators that apply an offsetting force to the ends of stabilizer bars, one in the front suspension and one in the rear suspension. ◆