Most of the talk about telematics in the States has been about GM’s wireless emergency service OnStar, started in 1996. OnStar currently has 325,000 subscribers, but since the service is now standard on many GM vehicles, OnStar expects 850,000 subscribers by year-end 2000.

Mercedes-Benz USA, however, is also committed to telematics in the United States, and its service, TeleAid, will also dramatically gain subscribers as TeleAid becomes standard on every Mercedes sold in the U.S. by MY 2001. Introduced in the U.S. in March 1999 on the Mercedes S class, TeleAid currently has slightly more than 100,000 subscribers. Now that it is a standard feature, the service expects to add about 200,000 new subscribers a year.

Using a three-button system, a Mercedes innovation according to the company, TeleAid segments subscriber requests into three different categories: emergency, roadside assistance and information about the vehicle or route guidance. Directing different types of requests to the appropriate service center increases efficiency, according to the carmaker. Like OnStar, TeleAid id also automatically

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**TeleAid Standard on Mercedes in the U.S.**

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Ford and GM: Better MPG with Powertrain Controls

Last year after barely missing the U.S. Congress’ CAFE (Corporate Average Fuel Economy) standard for trucks—20.7 miles per gallon—Ford decided to polish up its tarnished image of a company profiting at the expense of the environment. Ford announced that it would improve its SUV fleet average fuel economy by 25% within five years. Not to be outdone, General Motors said that in no way would Ford’s fleet of SUVs be any greener than its fleet of SUVs. The race to improve fuel economy of SUVs is on. Competitive posturing over whether Ford or GM is friendlier to the earth will be a boon to makers of powertrain control systems and components.

It will also be a boon to the environment. In 1997, 160 nations at the United Nations Convention on Climate Change signed the Kyoto Accords, in which they agree to reduce the production of greenhouse gases linked to global warming. U.S. ratification of the Kyoto Accords—the biggest enabler of an improvement in SUV fuel economy is Ford and GM’s new-found determination to finally do something. The carmakers plan to implement that 25% improvement within five years by the following means:

- Better aerodynamics and weight reduction: 5% improvement
- Improved transmission and powertrain controls: 10% improvement
- Selling more small SUVs: 10% improvement

Plant capacity for Ford’s small SUVs, the 24-28-mpg Escape and Mazda Tribute, is 250,000 in the first year of production.

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**Powertrain Control Technologies**

**Deployed in Volume within 5 Years**

- Engine
  - Electronic throttle control
  - Cylinder deactivation
  - Mechanically controlled variable valve timing
- Transmission
  - Six-speed automatic transmissions

**Deployed in Volume after 5 Years**

- Engine
  - Electromechanical valve timing
  - Integrated starter alternator: start-stop, boost and regenerative braking
  - Electric power steering
  - Beltless engine
  - Direct injection, after low-sulfur fuel is mandated
- Transmission
  - Clutch-to-clutch automatically controlled manual transmissions
  - Continuously variable transmissions on larger vehicles
- Other
  - Total vehicle control systems
Low-Cost Video Camera Sensor for ACC

A CC (adaptive cruise control) systems sense what is ahead of the vehicle in the same lane and vary the vehicle’s speed to keep a safe following distance. MobilEye Vision Technologies Ltd. has developed an algorithm and reference platform that needs only a single video camera for a ACC, lane-departure warning and in the future, collision avoidance as well as stop-and-go traffic accuracy. Because MobilEye uses a single video camera mounted in the rearview mirror, the system will be significantly less expensive than systems that rely on two cameras or radar and/or infrared-laser sensors. Multiple video cameras are not needed for depth of field analysis because MobilEye’s algorithm uses an advanced spatial-temporal classification technique, based on a novel learning approach that trains the system with static and dynamic visual information. Founded in May 1999, MobilEye is a startup engineering firm in Jerusalem, Israel, that specializes in computer vision. (Email head.office@mobileye.com or telephone 972-2-586-6989.)

Initially, MobilEye computer vision systems will complement radar or laser ACC systems. One customer is interested in applying MobilEye’s technology to the image from an infrared video camera. MobilEye believes its technology will eventually operate with only a single CMOS video camera and a 32-bit microcontroller to process the algorithm that converts what the camera “sees” into obstacle-detection information. First-generation MobilEye systems will have an OEM price somewhere between $100 and $300 in volume. The next-generation system will cost considerably less, under $50. MobilEye test systems are currently running on PowerPCs, the 32-bit microcontroller from Motorola.

MobilEye already has a number of OEMs and contracts that cover product development with a customer in Japan; the final production contract is expected by the end of 2000, with production by year-end 2002. If development goes as planned, that Japanese OEM will first apply MobilEye’s pattern-recognition and motion-detection technology in a radar ACC system; MobilEye will license its technology to the Japanese OEM’s top-tier supplier. MobilEye would also like to work with one OEM in the States, where it has just begun to explore business opportunities, and one in Europe, where the company is already close to an agreement.

Today’s radar and laser ACC systems are not accurate enough to handle stop-and-go traffic and turn themselves off at low speeds. With the addition of MobilEye’s camera sensor, ACC systems will be reliable enough for collision avoidance applications and accurate enough to handle stop-and-go traffic, according to MobilEye chairman, Amnon Shashua, who has a Ph.D. in computational neuroscience from MIT and is also a senior lecturer at the Institute of Computer Science, Hebrew University of Jerusalem, Israel.

The crucial advantage of MobilEye’s technology is the algorithm. The algorithm does not need depth information, which means the system can work with one, not two, video cameras. Instead of creating a depth map, which takes a computer quite a bit of time to analyze, the MobilEye algorithm looks at an object’s signature to see how its size changes over time, and translates that data into the time it would take to contact the obstacle. Noting that the MobilEye algorithm yields virtually zero false detections (one false detection in hours of driving) and zero missed detections, Mr. Shashua explained, “We know by the relative size of an object that we are close; we don’t need the distance to the object.”

Besides time to contact, the algorithm estimates the curvature of the road, another factor in distinguishing which obstacles the vehicle must avoid. The algorithm also considers parallax information, which is the apparent change in position of an object as the vehicle changes position. Company literature describes its road-geometry detection system as “performing well in poor lane-marking conditions and ... in cluttered marking conditions.” MobilEye’s obstacle-in-lane analysis is accurate up to 120 meters ahead.

Some existing ACC systems use two video cameras, which must be synchronized, calibrated and maintained. Typically, the two cameras are positioned between 60 centimeters and one meter apart. Subaru introduced a two-camera system called ADA (Active Driving Assistant) in the 1999 model year Lancaster in Japan. ◆
Powertrain Control Technologies

The powertrain control technologies now being considered are not new, but they are now more effective and their application is easier with today's faster computers, cheaper memory and better software design tools. For instance, GM first employed cylinder deactivation (the variable displacement engine) in the early 1980s. Today's precise computer control and the electronic throttle make cylinder deactivation transparent to the driver as it switches between four and eight cylinders. Nevertheless, the biggest factor in implementing these technologies today is not technology per se but the opportunity carmakers see in the market for SUV's that provide better fuel economy—without sacrificing performance, of course.

Most of the powertrain technologies, like cylinder deactivation, that will be applied to Ford and GM SUVS have been around for a while. Delphi has been in production with electronic throttle control for at least five years, and in the near future electronic throttle control will be a part of all engines, according to the supplier.

A II the powertrain control technologies employed in the next five years (please see chart on page one) will yield fuel economy by accomplishing the same thing: reduced friction and reduced throttling. Better mileage results from having the engine run slower, thereby reducing frictional losses as parts slide against parts. Better mileage also results from controlling the engine's output with minimal throttling of the air that feeds combustion.

Percentage estimates of fuel saved by these new powertrain features vary greatly, depending on which mileage test cycle is used, the degree of city vs. highway driving, and which old technology is being compared to the new technology. Depending on who you talk to, for example, cylinder deactivation will yield anywhere from 2.5% to 10% improvement in fuel economy.

Throttling accounts for nearly 20% of the energy-conversion losses in gasoline engines. Throttling is what makes gasoline engines less efficient than diesel engines, which are run at wide-open throttle. As carmakers manage the flow of air through the engine with devices like variable valve timing, cylinder deactivation and better transmissions to minimize [air] pumping losses, "gasoline engines are looking more like diesel engines in terms of thermal efficiency," noted Jerry Haycock, Ford's worldwide director of advanced powertrain engineering.

In summary, the papers on driver distraction point to an enormous need for more research and for industry standards governing the safe use of telematics and communications devices in the vehicle. A author Paul Green writes that guidelines for automotive speech interfaces are urgently needed, but research to create such guidelines is sorely lacking. He also suggests a vehicle "workload manager," a function that a Motorola paper refers to as a "driver advocate," which would manage and prioritize information flow to the driver, based on his/her ability to handle such input while driving safely. New products that safely manage what, when and how information is presented to the driver are a big opportunity for auto electronics companies.

"Convergence is the premiere automotive electronics conference in the world," claimed Chris Borroni-Bird of GM, who chairs one of the technical sessions on safety. "Not only are the papers great—they are more business-oriented and less technical than SAE papers. Convergence is a great place to network and meet people at the highest levels." To register, visit www.convergence2000.org.
Background
Established in 1948, near Nagoya, Japan, as a supplier of automotive switches and locks, Tokai Rika first appeared on the Tokyo and Nagoya Stock Exchanges in 1961. From the early 1960s on, Toyota has owned a good part of Tokai Rika and today has a 31% share. While most of the parts Tokai Rika produces worldwide are for the automotive market (95.4% of sales), the company also makes parts for construction and agricultural equipment markets, parts for medical electronic equipment as well as home appliances.

Tokai Rika takes its social responsibilities in the business community very seriously, as reflected prominently in its literature. The three goals of the company’s business philosophy are: (1) Create products to satisfy customers and contribute to a higher quality of life; (2) Maintain a youthful and promising enterprise while respecting originality and challenging the spirit; (3) Honor the language and spirit of the law and ethics of every nation and work in harmony with nature and the local community.

The company has five plants in Japan and twelve overseas. In 1986, the company built an automotive switch manufacturing plant in Michigan; nine years earlier, Tokai Rika had set up an automotive sales office in Detroit. In 1998, the corporate name Tokai Rika USA was changed to TRAM (Tokai Rika America), and the manufacturing facility became known as TRMI for Tokai Rika Manufacturing, Michigan. The two other U.S. plants that make electrical parts are TRIN (Indiana), also producing switches and TAC (Michigan), producing airbags, shift levers and steering wheels. During the last decade, the company established five more overseas plants, in the Philippines, India, Taiwan, Thailand and the United Kingdom and is planning to establish one in China.

Tokai Rika’s sales have been flat, growing just 0.3% per year since 1995. The change in sales from FY 1998 to FY 1999 (March 31, 2000) was better, 2.3% and given the recent improvement in Tokai Rika’s profitability, the Japan Credit Rating Agency upgraded some Tokai Rika bonds from A- to A. By 2005, Tokai Rika expects to reach ¥240 billion ($2.3 billion) in sales, a modest 3.5% annual growth rate from 1999.

According to Tokai Rika, the reason for its lackluster sales is that the Japanese economy has been in the doldrums. Over 80% of Tokai Rika’s sales comes from Japanese customers, the majority (55.3% in 1999) from Toyota. In the future, while sales to Toyota will increase, Toyota’s share as a percentage of total sales, will
Penetration of Solid-State Switches in Automotive Applications

Over the next ten years, switches made using power semiconductors will increasingly replace electromechanical switches. Tokai Rika believes its key technologies will help the company make the transition. In 2005, 20% of automotive switches will be solid state; by 2010, penetration will be 50%, according to Tokai Rika.

Distinctions

While a little more than half of sales still comes from switches, keys and locks—about the same breakdown as a decade ago—Tokai Rika is moving ahead to add electrical and electronics capabilities to its mechanical products. Japanese carmakers, slower than European and U.S. carmakers to embrace modular assemblies, are now more interested. As Tokai Rika combines its existing products with other parts, packaged together in designs based on ease of use, ergonomics and reasonable prices, modular assemblies will increasingly add to sales. According to the company, four distinctions make it stand out from its competitors:

- Pre-assembled modular design capability: Applications include the overhead console module with electronic-toll card reader, lamp, sunroof controls and attached electrochromic antiglare mirror.
- Research and development of products based on ergonomics, which makes them easier to operate: For example, solid-state switches are incorporated into the steering-wheel pad for ease of operation.
- Superior zinc and magnesium die casting capability: Magnesium alloys reduce the weight of steering wheels and key lock bodies.
- The company has a strong design team, capable of creating appealing products: Using wind tunnel simulation tests to reduce wind noise, designers created an attractive streamlined outer mirror that electrically folds flush to the vehicle for storage.

Key Future Technologies

- Mechatronics: The company’s best example of mechatronics—optimizing mechanical switch functions and incorporating electronics—is the center cluster module, which Tokai Rika brought to market a few years ago. The center cluster module is the control head for the climate control system and integrates switches, indicators, electrical circuits and a temperature sensor.
- Electronics systems and modular design capability: The products with the greatest promise of yielding higher revenues come from pre-assembled modules that combine mechanical hardware with some electrical and electronic parts. Tokai Rika is developing a number of modules: instrument panel, door trim, center consoles, as well as the most promising, the steering column-post module, which combines steering wheel, steering lock, airbag and some switches. The main advantage of the column-post module is the reduction of the size of the wiring harness, according to Tokai Rika, which already has an order to start shipping the product in the 2004 timeframe.
- Ergonomics: The company sees the need to make the interaction between driver and vehicle safer and less distracting. Toward that end, Tokai Rika is focused on alternatives to switches, for instance, point-and-click touch pads and speech-recognition components. In Japan, more often than in the West, drivers use navigation and even TV while stuck in slow traffic. While no direct link has been found to those activities, the number of traffic accidents in Japan increased 5.8% in 1999, according to the National Police Agency, motivating the company to look at safer product design.

New Products

- Electronic Key: Security-related products, including keys, locks, remote key systems, steering lock assemblies and mechanical door-lock/key assemblies accounted for 15.7% of sales in 1999. That share is expected to grow as Tokai Rika brings new electrical security products to market. The hottest of these, called Smart Key, is an electronic key that automatically locks the vehicle as the driver walks away and unlocks it as the driver approaches. Smart Key consists of an electronic control unit, an electrical steering-column lock and three antennas: one at the driver's door, one at the trunk and a third inside the cabin. Smart Key with a transponder key fob will go into production in 2001; by 2005, a transponder card key will replace the key fob. The card key is the size of a credit card, but much thinner, 0.8 mm. RF transmission between the key and the vehicle is at 131 KHz.
- 42-Volt Switches: As with modular design, Japanese carmakers have been slower than European and American carmakers to start developing 42-volt systems. Recently, some Japanese OEMs have asked Tokai Rika to begin R&D on 42-volt switches, although the particular 42-volt switch requirements are still unknown. Following Toyota’s lead, Tokai Rika recently joined the MIT Consortium on Advanced Automotive Electrical/Electronic Systems and Components. One problem with 42-volt switches comes from...
Tokai Rika

Tokai Rika Sales by Customer

<table>
<thead>
<tr>
<th>1999 Worldwide Sales:</th>
<th>¥195,508 million ($1.85 billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toyota Motor Corp.</td>
<td>55.3%</td>
</tr>
<tr>
<td>Daihatsu Motor</td>
<td>4.7%</td>
</tr>
<tr>
<td>Mitsubishi Motors</td>
<td>4.1%</td>
</tr>
<tr>
<td>Suzuki Motor Corp.</td>
<td>4.0%</td>
</tr>
<tr>
<td>TMMK (Toyota, Kentucky)</td>
<td>3.6%</td>
</tr>
<tr>
<td>NUMMI (GM/Toyota)</td>
<td>2.3%</td>
</tr>
<tr>
<td>Mazda Motor Corp.</td>
<td>2.0%</td>
</tr>
<tr>
<td>TMMC (Toyota, Canada)</td>
<td>1.9%</td>
</tr>
<tr>
<td>Isuzu Motor</td>
<td>1.5%</td>
</tr>
<tr>
<td>Others</td>
<td>20.6%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1999 North American Sales by Customer in $ Millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRAM² QSS³ Total</td>
</tr>
<tr>
<td>Toyota Motor Mfg. Kentucky</td>
</tr>
<tr>
<td>NUMMI Mfg. Canada</td>
</tr>
<tr>
<td>Others¹</td>
</tr>
<tr>
<td>Totals⁴</td>
</tr>
</tbody>
</table>

¹ Others in order of sales: Saturn, Chrysler, Ford, CAMI (GM/Suzuki), TMMI (Toyota Motor Manufacturing Indiana)
² Tokai Rika America
³ Quality Safety Systems, Tecumseh, Ontario, Canada, joint venture between Tokai Rika (40%) and TRW (60%)
⁴ A significant amount of sales for TRAM and QSS are intercompany sales.

Forty-two-volt arcs can destroy the switch's contacts. A rec energy is a function of the speed with which the contacts are broken, so developing fast-acting switches would help solve the problem. Tokai Rika has already developed non-contact switches and makes some 36-volt and 48-volt switches used in industrial vehicles. The company will also look at developing high durability contact materials.

The need to handle ten-times or more arc energy than found in 14-volt switches.

Tokai Rika’s Major Automotive Production Facilities

<table>
<thead>
<tr>
<th>Facility/Location</th>
<th>A=Associated Floor Space in square meters</th>
<th>S=Subsidiary</th>
<th>Employees</th>
<th>Automotive Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head Office and Plant</td>
<td>89,000</td>
<td>2,900</td>
<td></td>
<td>Electronic parts, power-window switches, pressure switches, plungers, mirrors</td>
</tr>
<tr>
<td>Oguchi-cho, Niwa-gun, Aichi</td>
<td></td>
<td></td>
<td></td>
<td>Multifunction switches, automotive switches</td>
</tr>
<tr>
<td>Nishibiwajima Plant</td>
<td>12,000</td>
<td>400</td>
<td></td>
<td>Locks and keys, airbags, shift levers, cigarette lighters, neutral safety start switches, steering wheel, housing connectors</td>
</tr>
<tr>
<td>Nishibiwajima-cho, Nishikasugai-gun, Aichi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Otowa Plant</td>
<td>88,000</td>
<td>1,900</td>
<td></td>
<td>Airbags, child safety seats, neutral safety start switches, steering wheels</td>
</tr>
<tr>
<td>Otowa-cho, Hoi-gun, Aichi</td>
<td></td>
<td></td>
<td></td>
<td>Power window switches</td>
</tr>
<tr>
<td>Hagi Plant</td>
<td>15,000</td>
<td>140</td>
<td></td>
<td>Switches</td>
</tr>
<tr>
<td>Otowa-cho, Hoi-gun, Aichi</td>
<td></td>
<td></td>
<td></td>
<td>Steering wheels, airbags, shift levers</td>
</tr>
<tr>
<td>NSK Co. Ltd.</td>
<td>S</td>
<td>6,600</td>
<td>180</td>
<td>Automobile switches</td>
</tr>
<tr>
<td>Mitake-cho, Kani-gun, Gifu, Japan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRMI</td>
<td>S</td>
<td>19,000</td>
<td>670</td>
<td>Switches</td>
</tr>
<tr>
<td>Battle Creek, Michigan, USA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAC Manufacturing Inc.</td>
<td>S</td>
<td>18,400</td>
<td>290</td>
<td></td>
</tr>
<tr>
<td>Jackson, Michigan, USA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRIN</td>
<td>S</td>
<td>4,700</td>
<td>160</td>
<td>Switches</td>
</tr>
<tr>
<td>Ashley, Indiana, USA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRB</td>
<td>S</td>
<td>6,000</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Dengighshire, North Wales, UK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shinchang Electric</td>
<td>S</td>
<td>27,000</td>
<td>700</td>
<td>Switches, locks, keys</td>
</tr>
<tr>
<td>Gyeonggi-do, Republic of Korea</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mindarika LTD</td>
<td>A</td>
<td>6,000</td>
<td>270</td>
<td>Switches</td>
</tr>
<tr>
<td>Haryana, India</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Brought to market in 1999, the system is 95% accurate; vocabulary can be expanded up to 500 words but currently controls just lighting and windshield wipers. While the company did not develop its own speech engine, it did modify an existing system to make it more accurate in noisy automotive environments. Two microphones are used, one to pick up the driver's voice and the other to pick up noise, which is then removed from the voice signal.

**Voice Command System:** Tokai Rika has been conducting speech-recognition R & D so speech interfaces can be used to complement switches. Speech input is particularly important for the safe use of navigation equipment, which increasingly is used to access the Internet in Japan. Tokai Rika's first speech-recognition product is called Voice Command, and it includes a push-to-talk switch and a voice-recognition ECU. The ECU triggers relays that switch the various loads.

**Touch Tracer:** Tokai Rika has developed a point-and-click touch pad that allows drivers to safely interact with navigation units and the Internet while driving. Touch Tracer is an alternative to the switches located on the monitor. OEMs could install the monitor out of reach of the driver and install Touch Tracer within easy arm's reach, such as on the center console, near the transmission gearshift lever. Touch Tracer is no more expensive than touch screens installed as part of monitors. A nother selling point is that the time necessary to implement point-and-click functions on Touch Tracer is roughly equivalent to using touch screens on the display. Measuring 50 by 70 mm in the large size or 30 by 45 mm in the
The Company Profile Continued

smaller version, Touch Tracer uses infrared LEDs and photo detectors. With an order already in hand, Tokai Rika goes into production next autumn.

- **Seatbelt Pretensioner with Force Limiter:** In 1998, Tokai Rika developed a new seatbelt pretensioner with force limiter that has 22% fewer parts and is 40% less expensive than its predecessor. Moreover, the seatbelt mechanism has 30% more power to keep the body belted to the seat yet reduces the impact of the forces on the body—a further ergonomic innovation from Tokai Rika.

- **Multiplexing:** In Japan, a number of different multiplexing protocols are used to link switches to actuators, but no single standard has emerged, according to Tokai Rika. LIN (Local Interconnect Network) protocol is an open, class-A, single-wire protocol, based on common UART SCI hardware. Considered as a possible standard by Western carmakers, Tokai Rika indicated that it too is interested in LIN and will adopt it as soon as the company is satisfied that reasonable cost, reliability and availability are assured.

- **Mirror Modules:** Tokai Rika has been working to integrate electronics into its mirrors. For example, the company has been developing an overhead mirror console with an overhead mirror console and a short-range communications terminal for electronic toll collection. Tokai Rika is integrating CCD (charge coupled device) cameras into side mirrors to use as sensors in lane-keeping systems. The company has not yet received production orders for either new mirror.

**TeleAid...**

Triggers a call to the emergency response service if the vehicle is in an accident. TeleAid equipment embedded into the vehicle includes a cellular transceiver, a modem and a GPS receiver.

**ATX** (Irving, Texas) provides Mercedes’ emergency response service and is also the content aggregator for new telematics options coming along. Mercedes’ Client Assistance Center, with 240 full- and part-time employees, handles roadside service and information requests, the vast majority of calls. The Client Assistance Center answers a variety of questions for instance, how to program the car’s radio or what new Mercedes products are available for purchase. Route guidance assistance is currently available for an additional $50 per year. After six requests, Mercedes charges the subscriber’s credit card $6.95 for each additional request.

Also available in MY 2001 will be navigation, on every M ercedes sold in the U.S.—with the exception of the SLK roadsters—or up to 200,000 vehicles a year. Last year in the U.S., the total number of M ercedes sold with navigation equipment was about 50,000, or 25% to 30% of all M ercedes sold. Navigation with a multifunction display is currently standard equipment on M ercedes S class, CL class and on V-8 versions of the M-class SUV. When it is an option, M ercedes navigation currently adds an extra $2,000 to the price of the vehicle. Bosch makes the navigation unit, with the exception of the M class S UV navigation unit, which Alpine makes.

“O ur strategy at M ercedes is to build close relationships with our customers, and telematics fits perfectly with that strategy,” suggested Peter Petrone, manager of advanced product planning for M ercedes-Benz U.S.A. The first year of subscription to TeleAid is free, and while renewal costs $205 per year, only 5% of subscribers decide not to renew. M ercedes does not expect to offset its sizable telematics investment from its subscription and service fees. Rather, the company is counting on TeleAid to garner customer loyalty. Feedback from TeleAid information requests is also used in new product planning; call summaries are kept in a database that can be searched by subject and by keyword.

These TeleAid features will be new for M Y 2001:

- Remote unlocking
- Theft notification: If the vehicle’s antitheft system is triggered, the onboard system will automatically put a call into ATX, M ercedes’ emergency services provider, which will notify police that the car is being stolen and its location.

**Tokai Rika Products**

**Switch-Related Products**
- Multifunction switches
- Shift-lever assemblies
- Power-window switches
- Center cluster modules
- Voice controllers

**Security-Related Products**
- Remote key systems
- Steering lock assemblies
- Mechanical door lock/key assemblies

**Safety-Related Products**
- Steering wheels
- Airbag systems
- Crash-sensing controllers
- Seatbelt systems
- Interior & exterior rearview mirrors
- Child safety seats

**Future telematics features are likely to include:**

- Restaurant referral service: Restaurant reviews from multiple sources would yield recommendations for the best restaurants near the vehicle location.

- Traveler services: A digital tour guide could point out and provide information about attractions along the route.

- Subscribers will be able to set personal preferences for information and entertainment, not only from the vehicle as is currently done, but from any computer connected to the Internet.

- In 12 months or less, TeleAid subscribers with navigation equipment will be able to have their customized news, weather, sports, stock and traffic information downloaded as text-to-speech and read to them by the server.
Cylinder Deactivation

GM is likely to implement cylinder deactivation on 8-cylinder engines, which would switch between eight and four cylinders depending on load. A situation is accomplished by means of a solenoid valve that uses hydraulic pressure to muscle both the intake and exhaust valves closed. With the valves closed, the combustion chamber acts like a pneumatic spring.

Cylinder deactivation yields better mileage by keeping the engine running as close to wide-open throttle as possible, and with half the cylinders operating, frictional losses are also dramatically reduced. Without direct mechanical link between the pedal and the throttle, electronic throttle control helps make cylinder deactivation transparent to the user, since the pedal serves only as an input device indicating how much torque the user wants. The electronic throttle control unit decides how best to implement that torque.

Both Bosch and Delphi have developed systems based on cylinder deactivation technology. Delphi’s product line chief engineer for engine management systems, Steve Kiefer, noted that Delphi is designing such systems as drop-in replacements for customers like Ford and GM, with minimal disruption to the engine packaging and cylinder heads.

Valve Control Systems

GM will debut in 2002 a new truck engine with variable valve timing, the Vortec 4200, according to Automotive News. Indeed, several redesigned engines are in the works that regulate the intake and exhaust valves. Delphi refers to variable valve timing systems as variable load control systems and believes they yield fuel economy improvements of 12%. Visteon refers to such systems as throttle-less control systems. Cam phasing refers to systems that adjust the opening and closing times relative to top-dead-center, whereas, the throttle-less engine also varies the lift of the valves.

For years, carmakers have been working on electromagnetic versions of valve control systems; EM valves are powered open and shut by electromagnetic energy, instead of by cams and pushrods. Once expected to come to market as early as 2002, electromagnetic valve control systems will not be ready for production until at least 2005; German carmakers developing them ran into trouble making the valves land softly enough so they are not damaged. “From a technology-reach perspective, valve controls built from existing valve-train technology that are cam-based are probably closer to reality than electromagnetic valve control systems,” opined Visteon’s Jim Winkleham, manager of advanced energy transformation systems.

Transmissions: Six-Speed Automatics and Later, CVTs

While most development has focused on engine control methodologies, new transmissions hold even greater promise in terms of percentage increases in fuel economy. New transmissions, however, take a great deal of time to develop and validate, so the most promising new transmissions, such as continuously variable transmission (CVTs) and automatic manual transmissions will not be applicable within the five-year timeframe of Ford’s mileage improvement goal. In the near term, more six-speed automatic transmissions, based on conventional planetary gear technology will be used at Ford, according to Mr. Haycock. Six-speed transmissions will provide a 3% to 3.5% improvement in mileage compared with automatics.

Automatic manual transmissions and CVTs need to be proven effective with the large engines typically used in trucks. A automatic manual transmissions, which work like manual transmissions but without the need of a manual clutch, improve fuel economy by 7% to 10% compared with automatic transmissions, according to Siemens Automotive. Continuously variable transmissions offer a 7% improvement over automatics.

According to Bosch, CVTs are usually associated with the small-displacement engines more common in Europe, but the company is working on CVTs for larger engines. Director of powertrain control systems at Bosch, Gottfried Shiller, suggested: “There has been considerable improvement in the capability to put CVTs in engines more commonly found in the American market. ... For example, Bosch can now cover up to five-liter engines, which are in the biggest SUVs, but it will be a while before these are widespread since we still have to prove the fuel economy benefits and go through a lot of validation.”

Telematics Markets Comparison

<table>
<thead>
<tr>
<th>MARKET</th>
<th>EUROPE</th>
<th>JAPAN</th>
<th>UNITED STATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 End User Revenues</td>
<td>$23 billion</td>
<td>$2.68 billion</td>
<td>$0.28 billion</td>
</tr>
<tr>
<td>2010 End User Revenues</td>
<td>$13.47 billion</td>
<td>$13.54 billion</td>
<td>$21.72 billion</td>
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<tr>
<td>Main Consumer</td>
<td>Navigation, traffic safety</td>
<td>Navigation, traffic</td>
<td>Safety, security</td>
</tr>
<tr>
<td>Main Revenue Source</td>
<td>Hardware, services - upfront costs, subscription revenues and pay-per-use</td>
<td>Hardware - upfront costs, some pay-per-use</td>
<td>Services - subscription revenues, some pay-per-use</td>
</tr>
<tr>
<td>Projected Main Revenue Source</td>
<td>Services</td>
<td>Hardware, Services</td>
<td>Services</td>
</tr>
<tr>
<td>2000 Main Players (Company Types)</td>
<td>Wireless, OEM, Content</td>
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<td>Wireless, OEM</td>
</tr>
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</tr>
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<td>Vodafone, Tegaron, TrafficMaster</td>
<td>DoCoMo; Denso, Pioneer</td>
<td>Motorola, GM</td>
</tr>
<tr>
<td>Projected Main Players</td>
<td>Vodafone, Webraserka, PSA, Tegaron, TrafficMaster, Global Telematics</td>
<td>DoCoMo, Denso, Toyota</td>
<td>Motorola, U.S. Wireless, GM, ATX, Ford, DCX</td>
</tr>
<tr>
<td>Coordinating Organization</td>
<td>ERTICO</td>
<td>VERTIS</td>
<td>ITS America</td>
</tr>
<tr>
<td>Digital Wireless Standard(s)</td>
<td>GSM</td>
<td>CDMA, PDC</td>
<td>CDMA, TDMA, GSM</td>
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</tbody>
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