Human Factors Engineering: Not Much Help with Driver Distraction

Engineering Without Science

Lots of new electronics—both portable and installed—are headed for the automobile. Many of these new features require driver involvement, and yet experts in government, carmakers and suppliers don’t know for certain how much distraction people can take or how much electronics is too much.

While the use of electronics in cars will not be restricted by U.S. or Canadian government mandates at any time soon, many government and industry officials believe that unsafe and over-complicated electronics could lead to significant loss of life, injury and property damage. “You see study after study that shows there are problems, that distraction is real, that certain operations of electronics take too long, that some features draw too much visual attention,” opined Dr. Paul Green, leader of the driver interface group at the University of Michigan Transportation Research Institute (UMTRI) in Ann Arbor, Michigan. “While the pile of evidence is high, some people are saying that the only evidence they’ll believe is tombstones.”

Indeed, it was an excessive number of fatalities associated with tire blowouts and rollover accidents that led the U.S. Congress to pass the TREAD Act in 2000, which among other requirements mandated that tire pressure warning systems be installed on new light vehicles sold in the U.S. Other candidates include blind spot detection, lane departure warning, navigation, traffic information, email and instant messaging—there is no way research is going to catch up,” Dr. Green declared.

Driver distraction is listed among eight subjects that the National Highway Traffic Safety Administration (NHTSA) has prioritized for potential rulemaking in the U.S. Other candidates include rear-end and roadway-departure collision avoidance, dynamic stability control, drowsy driver sensing and reducing tire failures. NHTSA is scheduled to make a decision by 2006 on whether or not rules that address driver distraction are needed. However, NHTSA’s human factors team research leader, Michael Perel, isn’t sure at this point what the degree of the problem is. According to Mr. Perel, “That is a hard question for anybody to answer. ... There aren’t many consumers who have these technologies yet, so you may not see anything like the momentum that led to passage of the TREAD Act. There are a lot more tires out there.”

A number of research studies sponsored by NHTSA have been completed, and several more are underway. NHTSA has been researching driver distraction for ten years, according to Mr. Perel, and yet little...
Investors Wary of TRW Automotive

The financial transactions that led to the separation of TRW’s automotive operation from Northrop Grumman and the creation later of TRW Automotive as an independent, publicly traded company not only provide insights into the viability of TRW as a competitive entity, but also indicate the low regard that Wall Street has for this deal for many automotive stocks, even a company like TRW Automotive, which gets about 20% of sales from automotive electronics.

In December 2002, Northrop Grumman acquired TRW Inc. to offload its aerospace business and in February 2003 sold the automotive business, still called TRW, to Blackstone Group, an investment and advisory firm located in New York City. Blackstone purchased TRW for $4.9 billion, which included fees, outstanding debt and capital—$868 million for all of TRW’s stock. The remainder of the purchase price was paid using borrowed funds.

On February 26, 2004 Blackstone completed an initial public offering of newly issued TRW stock, selling 24.1 million shares, or 24.4% of the company, for an IPO price of $28 per share. As of June 10, 2004, TRW stock had fallen 30% from its all-time high the day of the IPO of $27.58, to $19.33 per share. At $19.33 the value of the company stock (market capitalization) is $1.934 billion, or just 0.17 times sales. (Profiled in this issue, Denso is trading at 0.77 times sales.) TRW showed sales of $11.3 billion in 2003, a 9.7% increase over 2002.

Net proceeds from the IPO after underwriting discounts and offering expenses were about $635 million. The company used $319 million of the proceeds to repurchase 12,068,965 shares of common stock held by an affiliate of Blackstone and approximately $317 million to repay a portion of the notes. TRW is still highly leveraged. Following these transactions, as of March 26, 2004, TRW showed $1,033 million in stockholder’s equity and $8,689 million in liabilities. For its efforts, TRW paid Blackstone a $49 million transaction and advisory fee; TRW must also pay Blackstone monitoring fees of $5 million per year. Blackstone presently owns 57% of TRW stock; Northrop Grumman owns 17%.

Given how highly leveraged the company is and uncertainties about its ability to meet long term financial commitments, Standard and Poor’s has assigned a BB+ credit rating to TRW, one tick below investment grade. With interest rates in the United States heading up, TRW’s borrowing costs are likely to go up. TRW earned just $2 million in the quarter ending March 26, 2004 on sales of $2,923 million.

One reason investors may have a low opinion of TRW stock is that, according to TRW’s SEC filings, it spends just 1.4% of sales on research and development, which at first glance seems low compared with the competition. However, TRW includes only pure research on new programs in its R&D number, “absolutely brand new products that have no prehistory at TRW,” said CEO and President of TRW Automotive, John Plant. “If you include engineering, we spend 4% net on product development.” In 2003, Autoliv spent 5.8% of sales on research, development and engineering; Delphi spent 7.1%. A utoliv and Delphi compete directly with TRW.

According to Mr. Plant, TRW’s future is bright. “We’re focused on safety, both active systems—braking, steering and suspension; and passive systems—crash sensors, airbags and seatbelts.” Safety products, which include high volumes of mature products such as foundation brakes, steering wheels and seatbelts, accounted for about $9 billion in sales in 2003.

TRW also is investing in China. “Look at the amount of joint ventures we’ve done in the Far East in the last couple of years, in China in particular,” suggested Mr. Plant. TRW sales to China grew by 40% in 2003 to $250 million. TRW also is increasing sales and higher margins from new products and applications. Over the next several years, penetration of electronic stability control (ESC) systems is expected to increase in the States. TRW already makes stability control systems for the Cadillac Escalade, GMC Yukon and Chevrolet Tahoe. TRW has also booked orders for slip control (ABS plus ESC) with Fiat, with Peugeot on the new 407 and with Volkswagen on the 2005 Passat. TRW also expects business to grow for its seatbelts with pretensioners, side impact and head airbags, electric parking brake systems and tire pressure monitors, which the U.S. government is mandating. While TRW anticipates only modest sales growth in 2004, over the next several years Mr. Plant expects sales to grow “in the 4% per year range.”

How does TRW go from being a highly leveraged company to one with a healthier debt to equity ratio? “We will grow the company while making higher profits and use that to pay down debt,” said Mr. Plant. Mr. Plant received $5.426 million in total compensation in 2003.

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has been learned that would definitively instruct NHTSA on what to do about the issue. "The research results so far are preliminary," said Mr. Perel. "It would be unfair to talk about what has been learned." NHTSA is spending just a few million dollars per year on research into driver distraction. Some of the research projects are cooperative, where suppliers share the costs.

Canadian Researchers Also Concerned
Transport Canada is in a similar limbo and has even less research funding available than NHTSA. In a pril 2003, Transport Canada's Standards Research and Development branch published "Strategies for Reducing Driver Distraction: A Discussion Document." In that report, Transport Canada expressed great concern that "In-vehicle telematics devices are a threat to road safety, because they increase driver distraction and cause an increase in distraction-related crashes." The document pointed out that "Regulatory initiatives could include requiring the disabling of access to entertainment systems (e.g., DVDs), telecommunications and other devices in moving vehicles, establishing safer limits on visual distraction, and prohibiting open architectures that would allow the use of untested aftermarket, plug-and-play type applications."

However, more than a year after the report's publication, Canada seems no closer to deciding what, if anything, to regulate. Peter Burns, ergonomics chief for the Road Safety and Motor Vehicle Regulation Directorate of Transport Canada, told me in early June that "The technology of assessing the impact of these [telematics and other electronic] devices on safety and distraction is so new, there are no clear performance tests to determine whether or not the systems are safe for use in motor vehicles." Rather than issue new regulations, Canada is pointing toward specific memorandums of understanding between Canada and the industry that limit the safety impact. "We hope to come up with a plan sometime this summer on what to do next," said Mr. Burns.

In order to dissuade governments from issuing debilitating regulations, in A pril 2002 the Alliance of Automobile Manufacturers (AAM) issued a "Statement of Principles, Criteria and Verification Procedures on Driver Interactions with Advanced In-Vehicle Information and Communications Systems," which describes voluntary industry guidelines that address safety and the human machine interface (HMI). Transport Canada's Peter Burns sees the AAM statement as "a positive initiative, but it's incomplete and not stringent enough in some areas."

While human factors are getting more attention, human factors engineers working in the automotive industry often lack influence over what gets installed in the vehicle. "I spent 10 years with Ford and Visteon, so I understand what it's like within the industry," said Dr. Jim Foley, who now conducts human factors research for Mitrek Systems on behalf of the U.S. Department of Transportation's Intelligent Vehicle Initiative (IVI). "All product decisions are a series of compromises, and human factors is just one input that has to be balanced against everything else that it takes to produce a car," he said.

Although Dr. Foley believes that human factors engineering has some scientific foundation, the science is inexact, which makes it difficult to accept. "Human factors science comes from experimental psychology. Engineers are not used to dealing with the variability that a human being brings to the equation. Everybody would like to define the point when driver distraction leads to a crash, but there are so many variables: the scene outside the vehicle, the mood of the driver, how alert he is, etc."

Still, human factors experts would like to see much more research. "We need to be able to model the interactions of people just the same as we would do finite element analysis of a structure," said UMTRI's Paul Green. "It needs that kind of rigor." A coing to Dr. Green, tens of millions of dollars should be spent over many years on fundamental human factors research. "A better understanding of how people drive will have implications for all kinds of safety systems, not just how we enter destinations into a navigation system."

Dr. Green will give a paper on driver distraction Tuesday, October 19, 2004 at Convergence 2004 in Detroit, as part of the human factors technical session called "User Interface Challenges Amid the Increasing Complexity of Automobile Interiors."

Freedonia Group Forecasts North American Auto Electronics

In February 2004, the Freedonia Group, Cleveland, Ohio, published a new report, OEM Automotive Electronics in North America, which includes industry forecasts to 2008 and 2013 for the U.S., Canada and Mexico, as well as historical data through 2003. Freedonia sees the North American market growing by 7.3% per year from 2003, to reach $33.8 billion in 2008. Safety electronics are projected to grow 11.5% annually through 2008.

The 300-page report is priced at $4,000. For more information or to order, contact Freedonia at 440-684-9600 or www.freedoniagroup.com.
The Company Profile... Denso

Headquarters: 1-1, Showa-cho, Kariya, Aichi 448-8661, Japan; telephone: 81-566-25-5511; www.globaldenso.com; www.denso.co.jp
FY 2003 Consolidated Sales: ¥2,562 billion ($22.8 billion)
FY 2003 R&D: 8.4% of sales
FY 2003 Net Margin: 4.3%
FY 2003 Net Cash Provided by Operation: ¥231.8 billion ($2.1 billion)
Major Products: Automotive HVAC and powertrain control systems, navigation
Top Customer: Toyota Group, with 51.0% of sales
As of March 31, 2004:
Return on Equity: 7.6%
Return on Assets: 4.5%
Current Ratio*: 1.6
Working Capital: ¥409 billion ($3.6 billion)
Shareholder Equity: ¥1.509 trillion ($13.4 billion)
Market Capitalization: ¥1.976 trillion ($17.6 billion)
Employees: 95,461
Sales per Employee: ¥26.8 million ($239,000)
Ownership: Number-one shareholder, Toyota, owns 23.2% of the company.
*Current assets divided by current liabilities
Note: Denso’s 2003 fiscal year ended March 31, 2004.

Denso Background
The business that began as Toyota’s electrical and radiator department is today among the four largest global suppliers of automotive components and systems. Fifty-five years ago, Nippondenso began operating as a stand-alone company. The corporate name was changed to Denso in 1996 to reflect the company’s global reach. Ties to Toyota, which still owns 23.2% of Denso, remain strong: Toyota Motor Corp. accounted for 46.9% of Denso’s consolidated net sales in the year ending March 31, 2004, about the same percentage over the last ten years. Toyota Group companies Daihatsu and Hino together made up another 4.1% of Denso’s sales.

Denso manufactures an extremely broad product line, from 32-bit microprocessors to air-conditioning systems and radiators. Denso’s use of the term “air conditioning” encompasses heating, ventilating and cooling systems. While powertrain and thermal systems account for 58% of sales, Denso also makes in-vehicle electronic toll payment systems, navigation systems, electronic control units, instrument clusters, radar-based safety systems, alternators and much, much more. (See the list of products, page 7.) It is a tribute to the company’s engineering productivity that it can stay globally competitive in so many disparate technologies.

Despite the fact that Denso is largely captive to Toyota, Denso has remained competitive in quality and price, largely because Toyota demands no less from Denso than it demands from other suppliers. A nother demanding customer, Honda, accounts for 11.3% of Denso sales.

Denso is consistently profitable, tallying net margins of 3.0% to 4.8% since fiscal 1997. In a statement to The Hansen Report, Denso explained how the company manages to produce consistent profits year after year: “Denso’s most important management principles are quality, technology innovation and customer satisfaction.” Its greatest challenge, like that of most suppliers, is to cut costs while maintaining high quality.

Future Growth Outside Japan

Fifty-six percent of sales today are made to companies in Japan. Denso anticipates only modest sales growth for its products there, so it is focusing on new high value-added products such as the telecommunications module it makes to access Toyota’s G-Book services.

Denso continues to expand its global manufacturing footprint in order to supply systems and components anywhere in the world. The company is particularly focused on Europe, where it expects market growth in air conditioners and diesel common rail systems, and China, where it sees the greatest opportunities for growth across a broad product range. Denso writes in its annual report for the year ending March 2003 that China “is poised to become the world’s third-largest producer of automobiles, after the United States and Japan,” on a country by country basis, not regionally. Denso is also focusing on South Korea, “already the world’s fifth-largest producer of automobiles.”

To support its expansion in Europe and China, Denso has been investing heavily in those regions, at the expense of Japan and the United States. Denso recently made investments in the Czech Republic and the United Kingdom to produce air-conditioning systems, and in Hungary to produce diesel common rail systems.

Denso has also made investments in Thailand to produce diesel common rail systems and air-conditioning systems, in Indonesia to produce gasoline engine components such as oxygen sensors, in Malaysia to produce air-conditioning systems and electronic components, and in South Korea to produce small motors.

Denso is also expanding its supply network to support its expansion in Europe and the United States. Denso recently invested in China, expanding manufacturing facilities in South Korea to produce small motors, and in Thailand to produce diesel common rail systems.

As of the end of fiscal 2003:

- Price-earnings ratio was 18.27
- Price book-value ratio was 1.31
- Number of shareholders was 47,770
- Denso is traded on the Tokyo, Osaka and Nagoya Stock Exchanges in Japan.

Distinctions Claimed by Denso

- Among the world's four largest automotive suppliers
- Holds the number one market share for 19 automotive products
- Developed world's first automotive CO₂ air conditioning system
- Developed world's first 1,800-bar diesel common rail system
- 2002 and 2004 winner of U.S. EPA Climate Protection Award
- 1961 recipient of Japan's Deming Quality Prize

Navigation

Sales of Denso navigation units jumped from 467,000 in fiscal 2002 to 720,000 units in fiscal 2003, a 54% increase, mainly from new applications at their largest navigation customer, Toyota, and at GM and Ford. Denso launched several new navigation systems in 2003, including a system for the Toyota Crown, which began shipping in December 2003. Denso says it is the world's first navigation unit to make use of Bluetooth technology. In the U.S., Denso's DVD navigation system on the 2004 Lexus LS offers compatibility with some Bluetooth handsets.

In order to make its products useful to carmakers that sell vehicles in different countries, Denso navigation units can be operated worldwide using map and traffic data that's unique to the particular region.

continued on following page
The navigation unit's voice recognition system can understand eight different languages with at least 90% accuracy. In the U.S., Denso navigation products are available on all Lexus models, on the Seville, DeVille, XLR and SRX models from Cadillac, and Lincoln LS, Town Car, Navigator and Aviator models from Ford.

Denso intends to capture a greater share of the global market for navigation products by focusing on expanding opportunities in Europe, the United States, China and South Korea. In May 2003, Denso set up a joint venture with Bosch to develop components for car navigation and multimedia systems. Denso believes this cooperation will help it increase sales of those products worldwide.

In December 2003, Denso issued a press release announcing the joint development with Toshiba of operating system software that works with either micro-ITRON or Microsoft's Windows Automotive operating systems. The software can be run on Toshiba's TX49 embedded CPU. The TX49 core is based on RISC architecture developed by MIPS Technologies.

Air Conditioning

As the world's number-one supplier of air-conditioning systems since 1990, Denso sees great opportunity as the market shifts from components to systems. According to the company, “We are the only supplier capable of system development with our own technologically advanced components.” Denso makes evaporators, condensers and heater cores that are smaller, lighter and more functional than their predecessors.

Denso lists its electrical inverter air-conditioning system used in the 2004 Prius hybrid vehicle as one of its most promising new E/E products in terms of future sales. Driven by an alternating cur-
rent electric motor, the compressor works off the battery to cool cabin air even when the engine shuts down, as it does to save fuel when the hybrid vehicle is stopped at lights or in traffic. The inverter converts battery voltage into alternating current to run the motor.

According to Denso, the electric-powered air-conditioning system is 40% smaller and 53% lighter than traditional electrical compressors and leaks 25% less refrigerant than traditional belt-driven compressors. The compressor’s light weight means it can be mounted on the engine, as it is in the Prius. The U.S. Environmental Protection Agency awarded Denso one of eleven 2004 Climate Protection Awards for the new system.

In 2002 Denso developed the world’s first non-fluorocarbon car air conditioner that uses CO₂ as the refrigerant. The global warming coefficient of CO₂ is 1/1300 that of the most common refrigerant, HFC-134a, which makes CO₂ a top candidate for next generation AC systems. Denso’s CO₂ system is installed in Toyota’s prototype hybrid fuel cell vehicles.

In its annual report for the year ending March 2003, Denso writes that its “current strength in air-conditioning products was born out of heat exchange technology used in early car radiator components.” Denso first introduced car air conditioners in 1967. In the 2003 fiscal year, the Thermal Systems product segment, which includes air conditioning (80% of Thermal sales), radiators and cooling fans, produced sales of ¥893.5 billion yen ($8 billion), 34.9% of Denso’s total.

In North America, about one-third of Denso’s business is air-conditioning systems. In fiscal 2003, the company sold approximately 2.8 million air-conditioning units in North and Central America. Denso expects to boost its share of the global air-conditioning market to 30% in fiscal 2005 from 25% in 2002.

Diesel Engine Management

Sales of Denso common rail systems have grown fast, and Denso expects that growth to continue—from 30,000 units in the year ending March 2000, to an estimated 1 million units in the year ending March 2005. A recording to the company, much of that growth in unit sales is the result of its new 1,800-bar common rail system, which was introduced in Europe in June 2002. A recording to Denso the 1,800-bar injection pressure is the highest in the world. Given the high pressure, Denso’s new injectors can inject very small quantities of fuel, as small as one cubic millimeter, at intervals of 0.4 seconds, five times during each combustion stroke. Such fuel management precision significantly reduces particulate matter and nitrous oxide emissions and keeps the engine noise level equivalent to a gasoline engine. On a 2.0 liter diesel engine, the 1,800-bar system increased engine torque by 35%, engine power by 24% and decreased low idle noise by 6.5 dB compared with Denso’s conventional system. The system comfortably passed the Euro4 emission regulations without a particulate filter. Production of the 1,800-bar common rail system began in Hungary in 2003 and will start in Thailand in 2004. The system is comprised of a supply pump, common rail, solenoid injectors and an electronic control unit. To bring down the pilot interval even further, from 0.4 to 0.1 milliseconds, in 2005 Denso will begin manufacturing piezoelectric injectors for its 1,800-bar system. Denso is also developing a 2,000-bar common rail system.

In Europe, Denso is supplying its 1,800-bar diesel common rail system for the Toyota Avenis and Corolla; Mazda MPV and 6; and Nissan’s Primera, Almera, Tino and X-Trail. Denso will begin supplying the 1,800-bar common rail system to Ford of Europe in 2005. In Japan, the 1,800-bar common rail is on Toyota’s Land Cruiser, Prado, Dyna and Hilux Surf; the Isuzu ELF, Hino’s Dutro Ranger and Super Dolphin and Nissan Diesel’s Condor. In the U.S., the 1,800-bar common rail is on Isuzu’s N series. While vehicles with the Denso system are sold in Europe, the United States and Japan, Denso expects to expand its diesel business most quickly in Europe, where more than 40% of vehicles produced there are fitted with diesel engines.
Roundup...

Continued from page 1

tems, which more OEMs are offering as standard products. Car audio sales accounted for 63% of total sales in fiscal 2003. Navigation, audio/video and integrated products accounted for 36%, compared with 31% the prior year.

Hoping to strengthen its competitive position, Alpine invested 9% of sales in R&D and production facilities in China to serve the growing automotive market there.

**Calsonic Kansei**

**FY 2003 Consolidated Sales:** ¥615 billion ($5.5 billion)

**Change from FY 2002:** up 12.8%

**FY 2003 Net Profit:** ¥8 billion ($71 million), or 1.3% of sales, roughly the same margin as the prior year.

**FY 2004 Estimated Sales:** ¥620 billion ($5.5 billion)

The company recorded a special ¥5 billion ($45 million) loss in FY 2003 as a result of warranty problems with two parts. Calsonic Kansei’s main products include car air conditioners, compressors, condensers, instrument panels, meters, electronic components, cockpit modules, front-end modules, radiators, mufflers and converters.

Aproximately 67% of sales are to Nissan Motor. Calsonic Kansei increased sales of front-end and cockpit modules from 20% in FY 2002 to nearly 30% of total sales in FY 2003.

**Clarion**

**FY 2003 Consolidated Sales:** ¥168.9 billion ($1.5 billion)

**Change from FY 2002:** down 8.9%

**FY 2003 Net Profit:** ¥6.3 billion ($56 million), or 4% of sales

**FY 2004 Estimated Sales:** ¥170.0 billion ($1.5 billion)

**Deon**

**FY 2003 Consolidated Sales:** ¥2,562 billion ($228.8 billion)

**Change from FY 2002:** up 9.8%

See page 4 for the company profile of Deon.

**Hitachi Automotive Systems Division**

**FY 2003 Sales:** ¥386.7 billion ($3.4 billion), including roughly ¥200 billion ($1.8 billion) in sales from Hitachi-UNiSa.

In May 2004, Hitachi announced it will take over brake and suspension manufacturer Tokico and, effective October 1, 2004, merge it with Hitachi’s wholly-owned subsidiary Hitachi-UNiSa. Hitachi owns 23.9% of Tokico, which in fiscal year 2003 had sales of ¥125 billion ($1.1 billion). Hitachi Group’s medium-term management plan includes A utomotive Systems among four advanced technology product areas targeted for growth.

**Nippon Seiki**

**FY 2003 Consolidated Sales:** ¥139 billion ($1.2 billion)

**Change from FY 2002:** up 5%

**FY 2003 Current Profit:** ¥8.4 billion ($75 million), or 6% of sales

**FY 2004 Estimated Sales:** ¥145 billion ($1.3 billion)

**FY 2004 Estimated Net Profit:** ¥9.2 billion ($82 million)

While Nippon Seiki has traditionally been known for its automotive meters, the product line now includes OLED (organic light-emitting diode) displays. Nippon Seiki provides the optional HUD (head-up display) on the M Y 2004 Cadillac CXL R. In May 2003, Nippon Seiki and Optrex Corp. (Tokyo) set up a 50-50 joint venture called Adeon to manufacture OLED displays in Japan.

**Omron A utomotive Electronic Components Segment**

**FY 2003 Sales:** ¥58.8 billion ($524 million)

**Change from FY 2002:** down 1.1%

**FY 2004 Estimated Sales:** ¥62.4 billion ($556 million)

A utomotive electronics sales, primarily ECU s, switches and relays, represent just over 10% of Omron’s total sales. Omron reported strong sales in Korea, A sia and to European component manufacturers, but flat or reduced vehicle production in Japan and N orth America, combined with price pressures, affected sales in those regions.

The company expects strong future growth from increased penetration of new electronics applications such as laser radar, electronic power steering and door lock controllers.

**Pioneer Car Electronics Segment**

**FY 2003 Net Sales:** ¥292.2 billion ($2.6 billion)

**Change from FY 2002:** up 3.9%

**FY 2003 Operating Profit:** ¥28.9 billion ($257 million), or 9.9% of segment sales

**FY 2004 Estimated Net Sales:** ¥312 billion ($2.8 billion)

**FY 2004 Estimated Operating Profit:** ¥27.0 billion ($240 million)

Car Electronics accounted for 42% of total Pioneer sales in FY 2003. Car navigation sales to the aftermarket and OEMs increased in Japan. In N orth America, aftermarket navigation sales increased but car audio sales to OEMs declined. OEM sales accounted for 32% of the Car Electronics segment sales in fiscal 2003.

**Sumitomo Electric Industries**

**Automotive Segment**

**FY 2003:** ¥664 billion ($5.9 billion)

**Change from FY 2002:** up 7.8%

**FY 2003 Operating Income:** ¥43.7 billion ($389 million), or 6.6% of Automotive Segment sales

**FY 2004 Net Sales (Forecast):** ¥679.6 billion ($6.1 billion)

Forty-three percent of total SEI sales come from the Automotive Segment, mostly from sales of wiring harnesses. SEI expects to have a 15% share of the automotive wiring harness market by the end of the next fiscal year. Over the last several years, SEI has been shifting more production to M exico, China and Eastern European countries.

**Tokai Rika**

**FY 2003 Consolidated Sales:** ¥285 billion ($2.5 billion)

**Change from FY 2002:** up 16.8%

**FY 2003 Net Profit:** ¥9.1 billion ($81 million), or 3.2% of sales

**FY 2004 Estimated Sales:** ¥291 billion ($2.6 billion)

**FY 2004 Estimated Net Profit:** ¥9.7 billion ($86 million)