In this article, FY 2005 is the fiscal year ending March 31, 2006.

A lpine Electronics
FY 2005 C onsolidated N et Sales: ¥254 billion ($2.3 billion)
C hange from FY 2004: up 14%
FY 2005 N et I ncome: ¥6.2 billion ($55.1 million), or 2.4% of sales. Net income fell 22.2% compared with the prior year.
FY 2006 Estimated N et Sales: ¥250 billion ($2.2 billion), down 1.5% from FY 2005
FY 2006 Estimated N et I ncome: ¥6 billion ($54.4 million)

The Audio Products segment contributed 51% of A lpine's sales in FY 2005. Audio Products sales grew just 5% during the period, but A lpine shifted a portion of the segment's sales to the Information and Communication Equipment segment. According to the company, this adjustment better reflects the growing trend toward more integrated audio, navigation and video systems.

Information and Communication Equipment sales were up 25.1% over the prior year, aided by the introduction of new aftermarket in-dash navigation and audio/video products as well as increased penetration of integrated systems. A lpine also benefited from increased vehicle sales in the U.S. and Europe by H onda, A lpine's major O EM customer. O EM customers accounted for 77% of sales.

D enso
FY 2005 C onsolidated N et Sales: ¥3,188.3 billion ($28.4 billion)
C hange from FY 2004: 13.9% growth
FY 2005 N et I ncome: ¥169.6 billion ($1.5 billion), or 5.3% of sales. Net margin in FY 2004 was 4.7%.

I had the opportunity last month to visit individually with top electrical engineers from the N orth A merica Big T hree carmakers: R onn J amieson, formerly the controls and software engineering director for G M N orth A merica, recently put in charge of H VA C/supplier integration; B ill M attingly, vice president of electrical/ electronics engineering at C hrysler G roup; and G raydon R eitz, director of electrical systems engineering at F ord.

Generous with their time and insights, these experts shared their views on a number of topics including the role suppliers play and the development of active safety features.

In an attempt to off-load overhead, some carmakers have been relying heavily on suppliers for engineering support. I asked the electrical engineers which way their companies were heading these days, toward or away from reliance on suppliers.

For all of them the degree of reliance on in-house competencies versus suppliers' expertise depends on which part of the vehicle you are talking about. According to G M's M r. J amieson, "Powertrain is clearly core, and we view software and controls as a core area of competency that we want to continue to develop."

Since it helps define the vehicle's character, body control is also core. "For years G M defined the functions and modeled those functions; we now are taking the next step—we'll have full control of the application software of those body functions," G M works closely with its chassis systems suppliers, but it will take charge of chassis systems when they "cut across multiple [vehicle control] domains."

C hrysler's B ill M attingly agrees that combining chassis systems with the powertrain can only be done at the vehicle level. "The next one, collision mitigation, is a combination of the safety system, the brake system and the engine management system. That also will be done inside."

C hrysler sees vehicle architecture design and validation as something that must be handled 100% inside. "H owever, we are making a move at the other end of the spectrum—where wiring design and release will be 100% done by the supplier, with Chrysler supervision."

W hen it comes to wiring, Ford also defers to the supplier community, having agreed to a long-term partnership with Y azaki. Ford will pursue other technology partnerships with infotainment suppliers. Ford has had a habit of changing suppliers frequently in search of the lowest cost possible, but that will change says G raydon R eitz: "The fly-by-night, two or three years in, and then out doesn't work. N ow when we talk to suppliers, we are looking at long-term partnership relationships—for 10 or 15 years out." Ford N orth A merica recently concluded an agreement with H itachi subsidiary, X anavi, to supply Ford with navigation equipment, but not yet including infotainment.

A ll three carmakers are keen on the development of safety systems, particularly active safety systems. M r. J amieson believes active safety is "one of the hottest things going right now." O f particular interest to G M is finding active safety sensors that can serve multiple functions, which would help reduce the cost of adding new features.

The cost of some of those sensors must also come down, according to M r. J amieson. "R adar sensors are still too expensive. A promising alternative is laser radar, which is improving in performance and has inherently lower costs," he noted.

A ccording to H ella, laser radar, or lidar, can reduce the cost of an A CC system by 50%. C hrysler's M r. M attingly also sees promise in laser radar, despite the fact that unlike radar, laser sensors can't see through driving rain, snow or heavy fog. "These are situations where you shouldn't be driving with adaptive cruise control."

Turn to EEs, page 3
Drowsy Driver Monitoring Slow to Wake Up

According to the NHTSA-sponsored 100 Car Naturalistic Driving Study, published in April 2006, drowsiness affects crashes and collisions at a much higher rate than expected: Drowsiness was a contributing factor in 12% of all crashes and 10% of near crashes. Most current database estimates place drowsiness-related crashes at approximately 2% to 4%.

A driving weight to the striking findings is the realistic nature of the study, which was the first of its kind done for NHTSA (National Highway Traffic Safety Administration). The study tracked real drivers in northern Virginia and metropolitan Washington, D.C., going about their business with no special instructions and no experimenter present. The data, including 5 channels of video, was collected from 100 instrumented vehicles driven a total of approximately 2 million miles, by 242 drivers, over a 12- or 13-month period.

Before this study’s surprising results, NHTSA had quantified the deadly nature of the drowsiness problem this way: “Approximately 100,000 crashes per year, including 1,357 fatal crashes and approximately 71,000 injury crashes, involved drowsiness.” Given the 100 Car Study findings, NHTSA’s numbers now severely underestimate the problem.

We talked to NHTSA press spokesman Rae Tyson to see if a groundswell has developed for mandated drowsy driver monitors, which carmakers have experimented with for years and have even used in production vehicles. (Nissan deployed a drowsy driver monitor in the 1980s on Bluebird sedans sold in Japan. The system analyzed driving time and steering angle fluctuations and warned the driver when drowsiness was determined. It was withdrawn from the market.)

According to Mr. Tyson, “NHTSA has been concerned about drowsy driving for a long time, has done an extensive amount of research and has launched education campaigns targeting drivers who are prone to drowsy driving. … [But] NHTSA doesn’t know whether or not it is something that’s worthy of federal regulation, or even if the solution lies in technology.”

In contrast with drowsy driving monitors, electronics stability control is on a “fast track” at NHTSA. But no notice of proposed rulemaking concerning ESC has yet been issued. Once announced, 90 to 120 days would elapse to allow for public comment. From that point it would take another 12 to 18 months to issue a mandate, which wouldn’t take effect for another three years. If “fast-track” ESC is going to take almost five years to reach implementation, any drowsy driver warning mandate would take at least that long to be implemented, if at all.

With or without mandates, Volvo will probably introduce its Driver Alert system before the end of 2007, assuming that verification tests continue to be successful. Volvo is conducting tests that require drivers to drive until they risk falling asleep at the wheel, in real vehicles, on closed tracks in Sweden, Belgium and the United States. (Co-drivers with control of the brakes ride along in the test vehicles.) According to Daniel Levin, the Volvo engineer responsible for developing the Driver Alert system, thus far Volvo has seen no significant differences in the behavior of drowsy drivers from different locations of the world. Volvo is also performing so-called “alert tests” in different parts of the world, where subjects drive on public roads under normal conditions, when they are not sleepy, to make sure the system doesn’t produce false alarms.

With a camera mounted in front of the rearview mirror, Volvo’s Driver Alert system keeps video tabs on the road markings ahead of the vehicle and alerts the driver if it detects signs of fatigue or distraction, which can be ascertained in a matter of seconds.

The video analysis and lane position technology is Volvo’s. The video camera and lane tracker will come from a Volvo supplier.

Separately, Delphi has developed a drowsy driver alert system that monitors the driver’s eye movements and keeps track of eye closures, a method that detects drowsiness sooner than the lane monitoring approach, according to the company. “A time proceeds and you continue to become more and more fatigued, you start to lose control of the vehicle,” noted Jerry Witt, manager of advanced driver systems for Delphi. “An infrared camera with illumination helps the camera see the driver’s eyes through eye glasses and most sun glasses. Delphi has so far shipped prototypes to two carmakers, one in Europe and the other in the U.S.

Distracted Driving

A much bigger problem than drowsy driving is distracted driving. Indeed, according to the 100 Car Study, “Almost 80% of all crashes and 65% of all near crashes involved the driver looking away from the forward roadway just prior to the onset of the conflict.”

Toyota has one answer to that problem already on the road in the Japanese market. This past March, Toyota introduced a driver monitoring system on the Lexus GS 450 hybrid that keeps track of the driver’s face position from a digital camera mounted on the steering wheel. If the vehicle’s radar sensor detects a possible collision while the driver is looking away from the road, a warning light and buzzer is activated earlier than if the driver was looking straight ahead. If the driver takes no action in response to the warning, the system automatically applies the brakes slightly to alert the driver to danger. The driver monitoring system will be available on the new Lexus LS coming to both Europe and the U.S. next September.

The results of the 100 Car Naturalistic Driving Study are available at the NHTSA website, www-nrd.nhtsa.dot.gov.
Roundup...

**FY 2006 Estimated Sales**: ¥3,380.0 billion ($30.1 billion)

**Change from FY 2005**: 6% growth

**FY 2006 Estimated Net Income**: ¥173 billion ($1.5 billion) or 5.1% of sales

Sales to customers in Japan contributed 53% of Denso sales in FY 2005, compared with 55.5% in the prior year. Sales to customers in the Americas grew 19% and accounted for 21.7% of FY 2005 sales. Denso noted the increase was due to strong production by Japanese carmakers in North America. OPk (which includes the Chrysler 300 and Dodge Magnum), plus Electronic Roll Stability Control, monitors the vehicle’s roll attitude and lateral force and estimates the potential for a rollover situation. It then applies full braking power to the appropriate wheels to stabilize the vehicle. Of special note, on both LX platform vehicles and the Jeep Commander, according to M. R. Mattingly, is the “very reliable” Alpine navigation radio, with its A/M/FM, 6-disc player and satellite radio. The platform also offers a UConnect hands-free Bluetooth interface and rear seat entertainment system.

**Hitachi A mototive Systems**

**FY 2005 Net Sales**: ¥582.2 billion ($5.2 billion)

**Change from FY 2004**: up 23.2%

Hitachi Group continues to strengthen and expand its automotive Systems business. In February 2006 Hitachi made the public company Hitachi Mobile a wholly-owned subsidiary. Hitachi Mobile operates an aftermarket sales and service network in Japan for automotive parts, including electrical components and mobile communication equipment. Hitachi plans to leverage this network of more than 500 facilities to increase sales of automotive electrical and electronic components and automotive information systems.

Omron Automotive Electronic Components (AEC) Business Segment

**FY 2005 Net Sales**: ¥77.6 billion ($692 million), 12.4% of Omron’s total sales

**Change from FY 2004**: 20.1% growth

**Estimated FY 2006 Sales**: ¥91.0 billion ($811 million), 17.3% growth

Most of AEC’s growth came from overseas sales, which increased 30.6% from the prior year. Part of that growth outside Japan is a result of Omron’s acquisition last year of a relay business in Italy; part was due to new product launches in the U.S. and strong sales in Asia. The company cited steadily increasing sales of laser radar, electric power steering controllers and wireless control devices.

Omron AEC expects overseas sales growth of 27% in the current fiscal year, driven by expanded vehicle production in China, Eastern Europe and South America. Full scale production at a manufacturing subsidiary in China began in January 2006. Domestic AEC sales are projected to decline by about 1%.

Pioneer Car Electronics Business

**FY 2005 Consolidated Sales**: ¥330.5 billion ($2.9 billion)

**Change from FY 2004**: 8.9% growth

**FY 2005 Operating Income**: ¥17.5 billion ($156 million), down nearly 6% from fiscal 2004

A significant factor was last year, Car Electronics was the most profitable business segment; Pioneer Corporation posted a net loss of ¥85 billion ($758 million) for fiscal 2005. Regionally, Car Electronics’ total sales increased 16.3% overseas, but domestic sales dropped 2.2%. OEM sales accounted for 35% of the Car Electronics’ segment sales in FY 2005, down from 36% the prior year.

A recording company, sales of car audio products grew in both the OEM and consumer markets. OEM sales growth came primarily from North America and Japan. Aftermarket sales grew in Central and Western Europe as well as in North America and Russia.

OEM navigation sales grew in North America, but declined in Japan; aftermarket navigation grew in both regions. Pioneer sees opportunity in the emerging navigation aftermarket in North America and Europe.

EEs...

When lidar-based ACC realizes it’s blind, it turns itself off,” he noted.

Ford North America wants to replicate what Volvo and Jaguar have done in active safety in Europe. But the number of active safety system suppliers is limited, in M. R. Reitz’ view. “In active safety I’d like to have a larger choice of supply partners,” he said.

I asked each of the electrical engineers to name the vehicle which exemplifies the best automotive electronics at his company. Bill M attingly’s choice was the Jeep Commander SUV, which has all of the features of Chrysler’s LX platform (which includes the Chrysler 300 and Dodge Magnum), plus Electronic Roll Mitigation (ERM). A n extension of electronic stability control, the calibration of ERM was done within Chrysler for use on Chrysler Group vehicles. ERM monitors the vehicle’s roll attitude and lateral force and estimates the potential for a rollover situation. It then applies full braking power to the appropriate wheels to stabilize the vehicle. Of special note, on both LX platform vehicles and the Jeep Commander, according to M. R. Mattingly, is the “very reliable” Alpine navigation radio, with its A/M/FM, 6-disc player and satellite radio. The platform also offers a UConnect hands-free Bluetooth interface and rear seat entertainment system.

Ron Jamieson named two exemplary vehicles from Cadillac: the STS and the Escalade. The STS can be ordered with numerous luxury features including Magnetic (electrorheological fluid) Ride Control, all-wheel drive, a Bose 5.1 surround-sound system with 15 speakers, adaptive cruise control and head-up display. The Escalade stands out, says M. R. Jamieson, for its standardized infotainment architecture, which is shared throughout GM’s truck line. Those high volumes led to significantly lower costs.

Graydon Reitz, who was in his job for just nine months, asked us to come back to him during the next Detroit auto show, in January 2007, when he’ll be able to talk about a new Ford vehicle that showcases automotive electronics. Stay tuned.
The Company Profile... Tele Atlas

Background


Tele Atlas expanded further with the acquisition of another U.S. company focused on North American map data, Geographic Data Technology (GDT) of Lebanon, New Hampshire, in July 2004. When it was acquired, GDT had annual revenues of more than $40 million. GDT was founded in 1980 and was spun off from map publisher R.L. Polk in 2000. In November 2005 Tele Atlas completed a second stock offering, this one on the Euronext Amsterdam Exchange.

Tele Atlas shipped more than 6 million maps in 2005, more than double the 2.6 million it shipped in 2004. Tele Atlas maps cover 19.4 million kilometers of roadway including 20 million points of interest, almost all of which are in Europe and North America. Its maps cover 360 million addresses in Europe and more than 300 million addresses in North America. The company engages more than 2,300 full-time staff and contract cartographers in nearly 30 countries. Since its founding, Tele Atlas has invested more than $1 billion in the company.

Between 2001 and 2005 Tele Atlas’ sales have grown annually at the rate of 30%. Over the next several years Tele Atlas expects sales will grow at least 20% per year. Tele Atlas’ two most important markets— portable navigation and in-car navigation— are growing quickly, and those markets will underpin double-digit sales growth probably for the next five years.

Tele Atlas’ sales to the personal navigation segment grew 87% in 2005 to €62.3 million, from €33.4 million in 2004. Sales to the in-car navigation segment grew 43% in 2005 to €52.9 million, from €37 million in 2004.

Seventy-three percent of Tele Atlas’ 2005 sales come from Europe; North America accounts for the rest. While Tele Atlas sees growth opportunities in Asia, its revenues from that region will be insignificant for at least the next several years. In the first quarter of 2006 Tele Atlas advanced €3.5 million in funds to its Chinese joint venture, NaviAtlas. It also staffed a new position in the region, that of chief operating officer, A sia Pacific. Tele Atlas employs two other C O Os: Mike Gerling is in charge of the Americas and Jack Reinelt is in charge of operations in Europe, Middle East and Africa. M r. Gerling was president and CEO of GDT when it was acquired by Tele Atlas in 2004. He holds a bachelor’s degree in business and finance from Cornell University.

The company in 1998 founded Tele Atlas India, which it sold in March 2005 to Infotech for €1.2 million, to cut overhead. Infotech still provides cartographic content.
services on behalf of Tele Atlas. Eight hundred to 1,000 cartographers work at the facility in Noida, India. A year end 2005 all but nine of Tele Atlas' 1,391 full-time employees worked in the West.

North America Key to Profitability

Tele Atlas claims numerous firsts: first to introduce map-matching navigation, first to have digital road map coverage of the U.S., first to launch navigation CDs in Europe and first to realize open application program interface standards for data access to navigation map data.

Yet despite these firsts, Tele Atlas has grown more slowly since its founding than NAVTEQ, the company's major digital mapping competitor in its two key markets, Europe and the United States. Tele Atlas is 40% the size of NAVTEQ and isn't yet profitable. NAVTEQ was founded in 1985, one year after Tele Atlas, and in 2005 produced $497 million in sales along with a very healthy net margin of 34%.

Why is NAVTEQ profitable and Tele Atlas not? According to Mike Gerling, Tele Atlas COO for the Americas, "Tele Atlas has devoted resources to integrating the GDT and Tele Atlas databases. "In North America, NAVTEQ had a better position in the in-vehicle navigation marketplace, which are they enjoying right now," Mr. Gerling noted. "Up until 2001, they really had no competition in North America. Tele Atlas wasn't there. It was in and out of the business, and GDT deliberately decided not to play in that business."

In 2005 NAVTEQ maps were used in 57% of the 1.27 million in-car navigation units sold in North America; Tele Atlas maps were used in 21% of them. The remaining 22%, made for Toyota by Denso, used maps made by merging map data from both companies. In 2005 North America accounted for 51% of NAVTEQ's revenue.

Mr. Gerling observed: "This is a high fixed cost business—building and maintaining the data set—with relatively low variable costs. In the last few years, NAVTEQ has broken through the fixed cost barrier and started becoming very profitable." He believes that as sales pick up, aided by the burgeoning portable navigation market in North America and Europe, Tele Atlas, too, will break through that fixed-cost barrier and then start becoming profitable.

Tele Atlas is also investing in expanding its geographic coverage in Mexico, Eastern Europe and Asia in anticipation of future growth in those markets.

Despite Tele Atlas' lack of profitability, the capital markets have behaved very favorably toward Tele Atlas stock. In November 2005 the company successfully completed its third offering, this one of about 29 million shares on Euronext Amsterdam in addition to its existing listing on the Frankfurt Stock Exchange. The offering comprised the sale of roughly 7 million new shares as well as 21 million existing shares; Stanford University and Robert Bosch were among those selling significant holdings. Bosch still owns 7% of the company. A result of the offering, the free float increased from 21% to 51% of shares outstanding, and Tele Atlas raised about €134 million (gross) from the issuance of new shares. The company is using the proceeds for general corporate expenses and to acquire new map data.

On May 9, 2006, the markets valued Tele Atlas stock at €1.8 billion, or nine times sales. (For comparison, Continental recently purchased Motorola's Automotive Unit for $1 billion, or 0.63 times sales of $1.6 billion.) Tele Atlas has no plans to pay a stock dividend.

Company Strengths

Tele Atlas does not compete with its customers, a point it makes by consistently referring to its customers as “partners.” This more than anything distinguishes the company from its main rival. "Unlike NAVTEQ, we aren't necessarily into having our brand and logo all over the place where navigation equipment is retailed," pointed out Jon Husby, director of automotive and in-vehicle applications for North America. "We have you continued on following page
**Tele Atlas Content Features**

- Geometric Accuracy - Comprehensive network of accurately positioned streets to support map matching
- Geo-coding Accuracy - Industry best, according to Tele Atlas, guarantees drivers find the address they’re looking for
- Turn-by-Turn Content - Complete turn restrictions and one-ways ensure the recommended route actually works
- Extended Attribution - Information on surface type and access restrictions allows users to customize routes
- Dynamic Content - Support for real-time traffic feeds
- Phonemes - Integrated phonetics for voice guidance
- Points of Interest - Restaurants, hotels and airports, for example

**Tele Atlas Employees**

<table>
<thead>
<tr>
<th>Average Number of Full-Time Employees</th>
<th>2001 to 2005 CAGR: -6.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>1,700</td>
</tr>
<tr>
<td>2002</td>
<td>1,819</td>
</tr>
<tr>
<td>2003</td>
<td>1,865</td>
</tr>
<tr>
<td>2004</td>
<td>1,904</td>
</tr>
<tr>
<td>2005</td>
<td>1,329</td>
</tr>
</tbody>
</table>

By Department

- Support, 183
- Marketing, 106
- Sales, 146
- Customer delivery, 956

By Region

- Europe: 741
- North America: 641
- Rest of World: 9

**Tele Atlas Map Offerings**

- Number of Countries: 50+
- Worldwide points of interest: 20+ million

**Tele Atlas Map Offerings**

<table>
<thead>
<tr>
<th>Region</th>
<th>Coverage Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>Road: 11.7 million km (7.3 million miles)</td>
</tr>
<tr>
<td></td>
<td>Address: 300+ million</td>
</tr>
<tr>
<td>Europe</td>
<td>Road: 7.5 million km (4.6 million miles)</td>
</tr>
<tr>
<td></td>
<td>Address: 360 million</td>
</tr>
</tbody>
</table>

Tele Atlas says its map database is superior to the competition because of the way Tele Atlas develops and updates the data. Prior to 2004, Tele Atlas collected map data the traditional way, by actually driving the roads. But with the acquisition in 2004 of GDT, Tele Atlas gained access to GDT’s “compile and drive” approach to map data collection, which compiles data from a variety of secondary sources including aerial photos, government entities, business partners and end users.

Tele Atlas says it now utilizes 50,000 separate sources of map data globally, which provide data updates, confirmed by multiple sources, faster and more frequently than can be done by actually driving. With 200 vehicles operating around the world, Tele Atlas collectively is able to drive just 3.2 million kilometers per year, not nearly enough to keep the data fresh without other input. In Europe and the U.S. alone, Tele Atlas maps cover nearly 20 million km of road. According to Tele Atlas, the road network changes about 20% annually.

The acquisition of GDT also gave Tele Atlas a unique opportunity to create an especially accurate map of North America, since before the merger both companies maintained separate maps of North America. The melding of those two databases will be completed sometime this year. Tele Atlas reports that its maps correctly geo-locate residences and businesses 95% of the time. The company owns five mapping, four retrieval and eight path-finding patents.

In October 2005 Tele Atlas acquired Warsaw-based PPWK GeoInvent, which developed a faster approach to collecting map data using mobile vans. “We went after them to get exclusive rights to that proprietary technology,” noted Mr. Husby. Presently, Tele Atlas employs 20 to 25 mobile mapping vans in Europe and 10 in North America. “Each van is outfitted with four cameras, two looking at slight angles to either side in the front and two looking slightly to either side in the back,” explained Mr. Gerling. “At highway speeds they do image collection while laying down a GPS trail. They collect data about the surface of the road, signage, lane counts, turn restrictions and bridge heights.”

**Tele Atlas Customers**

For Personal Navigation Devices

- #1 TomTom
- Destinator
- Gate5
- Mitac
- Navman
- Pharos
- TeleType
- ViaMichelin
- Wayfinder

For Automotive Navigation Devices

- Blaupunkt
- Clarion
- Denso
- Harman/Becker
- IPC/Pioneer
- Kenwood
- Siemens VDO
equipment as an input to lane departure warning systems.” Such map-data precision could also be used to warn the driver when the vehicle’s speed is too great for an oncoming curve.

In the past, navigation device makers tended to work with just one map supplier, but that is changing as they make the engineering investment necessary to accommodate maps from more than one supplier. This trend will work in Tele Atlas’ favor in North America, where NAVTEQ maps have been used in the majority of applications.

Tele Atlas gets most of TomTom’s map business. Fast-growing TomTom is the leading portable navigation device supplier in Europe, where it has 30% of the market. Unfortunately, the trend away from the use of exclusive map suppliers will drive down map prices. According to industry estimates, in-vehicle maps currently sell for approximately $50 each and personal navigation device maps sell at prices in the $20 range.

### Tele Atlas Automotive End-Use Customers

All of these carmakers use Tele Atlas maps, but not exclusively.

<table>
<thead>
<tr>
<th>Carmaker</th>
<th>Map Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfa Romeo</td>
<td>Nissan</td>
</tr>
<tr>
<td>Audi</td>
<td>Opel</td>
</tr>
<tr>
<td>BMW</td>
<td>Peugeot</td>
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<tr>
<td>Cadillac</td>
<td>Pontiac</td>
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<td>Chevrolet</td>
<td>Porsche</td>
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<tr>
<td>Citroën</td>
<td>Renault</td>
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<td>Fiat</td>
<td>Rover</td>
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<td>Ford</td>
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<td>Honda</td>
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</tr>
<tr>
<td>Maserati</td>
<td>Toyota</td>
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<tr>
<td>Mazda</td>
<td>Volkswagen</td>
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</table>

### Inrix - Tele Atlas Traffic Data Partnership

In September 2005 Tele Atlas announced a partnership with traffic data aggregator Inrix of Kirkland, Washington, to jointly deliver traffic services to Tele Atlas customers in the United States through a reseller agreement. Furthering that agreement, in May 2006 the two companies announced they would form joint operations to collect, integrate and deliver Tele Atlas traffic solutions and related map information through wireless connections to personal navigation devices and in-car navigation devices. Tele Atlas’ objective is to provide dynamic route guidance that comprehends traffic conditions, a feature that would stimulate the demand for navigation devices.

Inrix currently provides real-time traffic incident information covering 138 metropolitan markets and real-time traffic speed and dynamic predictive information covering 20 markets. Not only does Inrix collect traffic data from the usual sources, including occupancy and speed measurements from Department of Transportation sensor networks, it also collects real-time GPS probe data from more than 500,000 commercial fleet, delivery and taxi vehicles. Probe data—which are based on wireless transmissions from moving vehicles—could ultimately replace traffic data developed from stationary roadside detectors, which require a huge investment in infrastructure.

Inrix competes directly with digital mapmaker NAVTEQ, which has been providing U.S. traffic data to Honda customers since the fall of 2004 via XM Satellite Radio. Inrix’s traffic information is compatible with both Tele Atlas’ and NAVTEQ’s map databases.

According to an Inrix press release: “Inrix aggregates and enhances traffic-related content from hundreds of public and private sources for key metropolitan areas throughout the United States. The metadata includes existing speed and incident data, historical data, weather conditions and forecasts, school calendars, major events, construction, holidays and other local variables unique to each market. The company then detects and corrects erroneous sensor data and uniquely utilizes Bayesian analysis, initially developed by Microsoft Research and exclusively licensed to Inrix, to calculate future traffic conditions with a high degree of accuracy.”

### Tele Atlas’ Served Automotive Market

<table>
<thead>
<tr>
<th>Region</th>
<th>2006 Sales in millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>2.23</td>
</tr>
<tr>
<td>North America</td>
<td>1.87</td>
</tr>
<tr>
<td>Total Served Market</td>
<td>4.10</td>
</tr>
</tbody>
</table>

Data: Telematics Research Group, Canalys

### European Navigation Market, 2003 - 2008

<table>
<thead>
<tr>
<th>Year</th>
<th>TEQ Map</th>
<th>Car &amp; Home Map</th>
<th>Car &amp; Home Map CAGR</th>
</tr>
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<tbody>
<tr>
<td>2003</td>
<td>1.58</td>
<td>1.91</td>
<td>2.05</td>
</tr>
<tr>
<td>2004</td>
<td>2.36</td>
<td>1.77</td>
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<tr>
<td>2005</td>
<td>1.82</td>
<td>1.94</td>
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<tr>
<td>2006</td>
<td>1.65</td>
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<tr>
<td>2007</td>
<td>1.54</td>
<td>1.52</td>
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<tr>
<td>2008</td>
<td>1.48</td>
<td>1.42</td>
<td>1.51</td>
</tr>
</tbody>
</table>

Data: Tele Atlas and Canalys
Last month at the dSPACE User Conference Panel on Software Development Tools, moderated by General Motors, with the theme “Convergence Reinvents the Automobile,” Convergence 2006 was the perfect venue to network with the movers and shakers, and to learn about the companies and technologies that will shape our industry's future.

What I especially like about Convergence is that it is run and planned by our industry's leading lights from around the world. It is truly an international event that balances the interests of carmakers and suppliers from North America, Europe and Asia. Hats off to conference vice-chair Ronn Amieson, director HVAC supplier integration for General Motors, and to technical program chair Patrick Popp, director of GM's Electrical and Controls Integration Lab, for their hard work guiding this year's promising event.

Among the highlights of Convergence 2006:

◆ A keynote speech by conference chairman Larry Burns, vice president R&D and strategic planning for General Motors.
◆ The Blue Ribbon Panel, moderated by Gerhard Schmidt, vice president R&D and advanced engineering for Ford, will tackle the challenges and opportunities of software development.
◆ I am honored to again be moderating the “Car Makers Speak” panel, this time joined by top electrical engineers from Nissan, General Motors, DaimlerChrysler, Honda, Ford and Hyundai, who will discuss a wide range of topics including international standards, the major challenges they face and how suppliers can help.

They wanted to get ownership of functions that differentiate the OEMs, and so a good way out of that problem was to use design tools.

“Modal-based design is a way to facilitate the clarification of requirements. Instead of trying to write a text specification and toss it over the wall to the design team, I take the next step and say, this is what I want to do. I model it, I simulate it, I validate it,” explained Salim Momin, director of Freescale Semiconductor's Virtual Garage. Then, he added, “Implementation becomes easy.

What's driving demand? To stay competitive, carmakers must strive mightily to quickly develop cars with more and more features, at prices people can afford. These days more features mean more electronics and more software, and that leads to mind-boggling complexity. Particularly problematic are features that require the interaction of powertrain, steering, braking, suspension and even infotainment systems. “You can't design, validate or manage that complexity without the help that tools and automation provide,” declared Jim Kolhoff, director of software engineering for GM Powertrain. “They are mandatory in order to achieve confidence that your product works. I will deliver the features you intend, not to mention the potential for efficiency and quality improvement.”

While many engineering organizations around the world have made significant investments in software development tools, the panelists agree that there is still a long way to go before the industry has its fill. “We already have a large investment in these tools, but tools are evolving, and if we see something that can make us more effective and efficient, more will be invested,” noted Mark Tho-