Edited by **Kevin Jost**

Navigation attracting info providers

Though navigation had a slow start in the 1990s, it's now making up for lost time. As prices fall and capabilities rise, navigation is seeing rapid growth. That is prompting a number of service providers to enter the field or expand their offerings.

iSuppli predicts that shipments of automotive navigation systems will hit 65.1 million by 2012, more than tripling the 19.8 million shipped in 2006. However, the company noted that the market has transformed from embedded systems installed in cars to domination by Personal Navigation Devices. These handheld devices are carried into vehicles.

Regardless of the hardware being used, the growth is attracting many vendors, not just startups and automotive-related companies, who want to reach the millions of consumers using those systems.

One of the nation's largest real-estate title companies, **First American**, is among them. The company contends that its databases can help navigation software developers improve the accuracy of their directions.

"Right now, many systems say that house number 150 is in the center of the 100 block," said David Rogers, Marketing Director at First American. "We derive the longitude and latitude of the parcel of land, and we can augment that with aerial photos and other materials that have the exact location of the house or business."

Using real-estate data logged in the 3000-plus counties in the U.S. is particularly helpful when lots are very large, as in ranches, estates, and farms. Adding precision should benefit emergency responders and deliverymen as well as conventional drivers, Rogers added.

Many companies feel that navigation will cement its role as a necessary technology by providing information that is constantly updated. Providing fresh information requires many elements, with a number of information providers and reliable delivery systems that cover a wide area.

"Dynamic content is critical for making navigation truly indispensable," said Matti Suokko, Director of Business Development at **Microsoft**'s MSN Direct group, at the recent Telematics Detroit conference. "For this to happen, all the building blocks have to be in place, with traffic, weather, gas prices, and so on. Direct content is a widespread bucket."

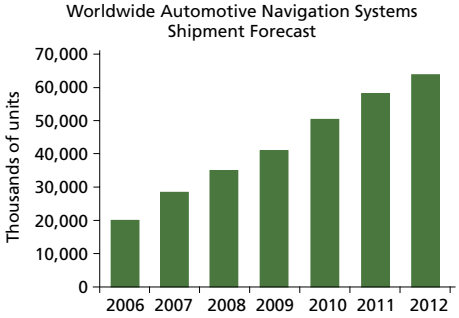
These arrangements are already being developed. For example, navigation software provider **Navigon** now partners with **Clear Channel** to get real-time traffic information. To gain market share, the company is removing the fees that many providers charge for real-time updates. It's also providing more visual information.

"We're offering subscription-free traffic information," said Matthew Mowat, Product Marketing Director at Navigon. "At complicated junctions, we put up signs and other information to help guide drivers through, and to augment points of interest, we put up logos instead of saying McDonald's, Wendy's, or whatever."

A big task for service providers is to digitize information gathered from various governments, restaurants, and others who use many different formats for presenting data. However, this transition is moving forward fairly quickly as vendors attempt to gain a share of the growing market.

"By the end of the year, we should have most of the population mapped," said Scott Little, Senior Vice President of Operations at First American. "By 2008, we should have the rest of the country mapped." He noted that precise geographical information linked to roads and buildings is important when telematics services get alerts that a vehicle's airbag goes off and they must direct paramedics to the site.

Terry Costlow



iSuppli predicts sharp growth, roughly tripling last year's 20 million shipments by 2012.

First American is leveraging its knowledge of real estate to pinpoint the important location on a property.

VW active safety with a practical bent

As passive safety devices approach their practical limits, active safety initiatives have moved to the forefront. The most dramatic ones depend on high-tech communication with on-roadway traffic management computers and the ability to command automatic response from the cars. However, at its Hanover, Germany, proving grounds, **Volkswagen** showed two feasible systems that could be integrated into conventional automobiles with potentially dramatic effect.

An electronic "sun visor" is perhaps one that most motorists can appreciate when they are driving into morning or evening sun and frantically trying to move a limited-range mechanical sun visor to prevent being blinded. Similar in concept to the electrochromic mirror, the electronic sun visor is an upper section of the windshield that is a proprietary form of what VW calls "switchable transparency."

Sensors for the driver's eye position and the sunrays reaching the windshield report to a computer, which calculates the point on the windshield where the sunrays would be blinding to the driver. The computer blackens only that section, and changes the area it blackens in accordance with the sunray angle as the car follows a curved road or makes turns. It also can darken, even blacken, a larger area to reduce glare.

The long-term objective is broad coverage, including side window glass. In a fully developed stage, it also would block the glare of headlights from an oncoming car.

However, the technology is in a developmental stage, and because it does have some effect on glass clarity, it cannot be applied to the entire windshield. But even the limited extent to which it works is an improvement from the most flexible of the mechanical sun visors used to date.

Another interesting VW development relates to keeping the car in its lane. When a driver becomes drowsy or inattentive, a system that works even at highway speeds on curved roads has been developed by company engineers to the point where it is robust enough to let *AEI* test-drive it. Once we developed the needed confidence, we even could take our hands off the steering wheel and find how well it works.

The lane control, called Integrated Lateral Guidance, is designed for use on highways and other "well-improved roads." It uses electric power steering with a computer control signaled by a sophisticated camera system that reads highway lane markings, guard rails, *etc.* Early versions of lane-reading cameras and software are being used for lane-departure-warning systems already on some cars to sound a friendly warning. VW showed an advanced camera system, plus sensors at the rear and sides. All photos and sensor signals are augmented with digital maps and global positioning data.

In normal operation, the electronic sun visor blackens only a spot on the windshield that's necessary to keep sunlight from blinding the driver. However, it can also blacken a large upper area of the windshield.

Integrated Lateral Guidance is very aggressive in operating the steering when the car is drifting out of the lane, and it kept our test car in its lane at speeds of over 75 km/h (45 mph) on a curved section of highway track at the VW proving grounds. However, we could manually override it with moderately forceful operation of the steering wheel.

The camera and hardware worked well, but questions remain about the overall software strategy. Sensors that record driver heartbeat and skin conductance were on our test car, and other indicators of possible drowsiness are available. But the extent of software control of steering is a legal matter, which would be reflected in the human-machine interface code. This is an assistance device, not total control of the steering, so the opportunity for production use is better.

In addition, such strategy as canceling the system when there's a turn signal for a lane change is an obvious one. Having the computer read photos to determine that the driver might want to change to a traffic-clear lane could be another. As a further safeguard, Integrated Lateral Guidance is likely to be combined with the forward guidance of an adaptive cruise control that can respond to an inline traffic slowdown or stoppage.

VW's Integrated Lateral Guidance system uses camera analysis of road and lane markings and a computer to control steering in the event an inattentive driver does not make the necessary adjustments to keep the car in lane.

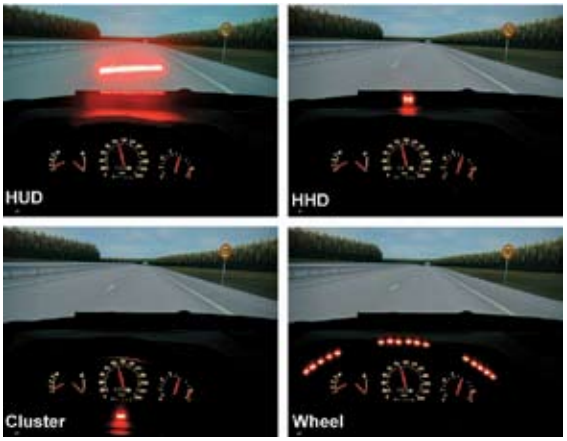
Paul Weissler

Head-up display best for collision warning

Although visual warnings are an essential component of single-stage FCW (forward collision warning) systems, which provide alerts to assist drivers in avoiding or mitigating rear-end crashes, there is much uncertainty about how and where this warning should appear. Visual warnings must elicit a fast and appropriate response from drivers when they are critically close to impact situations.

NHTSA guidelines recommend that visual warnings be placed within 15° of the driver's normal sight line, which is usually on the forward road scene. The FCW system should also serve to direct a distracted driver's sight to the forward road scene.

In addition to line-of-sight considerations, the visual warning should also have high contrast against a uniform background and be bright and colorful. Unfortunately, it is not that simple, particularly for the line-of-sight issue. And the visual display cannot be overly conspicuous or it will capture attention rather than direct the eye to a hazard ahead.



Volvo investigated four visual displays for the collision-warning system of the all-new S80: a head-up display (HUD), a high head-down display (HHD), a cluster display (cluster), and a steering wheel display (wheel).

At the **SAE** 2007 World Congress in Detroit, Henrik Lind of **Volvo** presented results of his company's investigations of four different visual warning displays for the FCW system in the new S80. To evaluate the displays—a collision-warning head-up display (CWHUD), a steering wheel warning display, a high head-down display (HHD), and a cluster display—warnings were randomly presented to drivers while they were visually distracted by a traffic-sign discrimination task. Brake reaction times to the different warnings were recorded.

CWHUD provided the best performance—a 200-microsecond quicker reaction time and a small amount of missed warnings. The display's greater size and brightness, combined with the similarity and position of a red brake light, provided drivers with an intuitive understanding of the situation.

Interestingly, there were no gender differences in reaction time. Most participants preferred the CWHUD warning light overall, followed closely by the steering wheel light. The HHD was third choice and cluster warning was the least-preferred option.

Volvo notes that the study did not consider the problem of driver annoyance. Frequent false alarms or nuisance warnings may cause the drivers to become irritated; this risk increases for more intrusive warnings. Ultimately, an FCW system could incorporate less-intrusive visual warning signals, such as the HHD, steering wheel display, or cluster display used together with an audible warning. A combined system would also help to address the potential for reduced visibility in low-sunlight conditions.

Darlene Fritz

Conti shows tire-integrated pressure sensor

Continental has developed a tire-pressure-monitoring sensor integrated directly into a tire rather than mounted on the wheel rim. With a mass of only 9 g (0.3 oz), the tire-integrated sensor is part of its Intelligent Tire System (ITS) for monitoring tire pressures. Some of the advantages of tire mounting include storing of tire information with the tire, avoiding thermal separation from the rim, and reducing the chances of damaging the sensor.

Continental's tire-integrated pressure-monitoring sensor is small and light at 9 g (0.3 oz).

"An integrated sensor can carry with it information and history about the tire," noted Peter Rieth, who heads Advanced Engineering for the Automotive Systems division of Continental AG. Stored data could include the tire type (summer or winter), the date of manufacture, recommended tire pressures, the speed index, and the maximum load.

"Another major benefit is the robustness of the system, which is an issue with today's systems," said Rieth. "When you mount and dismount a tire, it is very often the case that you have problems with damaging the sensor on the rim, along with leakage of the modules."

An optional wheel-load sensor installed in the intelligent tire-pressure-monitoring-system module makes it possible to identify a displacement of the cargo in a light van or in a fully loaded luggage compartment of a passenger car. The module can transmit data into the vehicle together with the actual tire pressure.

"The load information helps calculate the center of gravity of the car," explained Rieth, "which can influence our control strategy and stability control." Knowing if summer or winter tires are mounted is alone enough to shorten the stopping distance from 100 km/h (62 mph) by as much as 1 m (3 ft), according to Continental.

Series production may start as early as the end of 2009 or early 2010, according to Continental. Continental's ITS is offered in one of three versions. ITS A is offered primarily for the European and U.S. market, ITS B fulfills legal requirements in Japan and Korea, and a simpler system called System TPMS is specially designed for vehicles with front-wheel drive.

Bruce Morey