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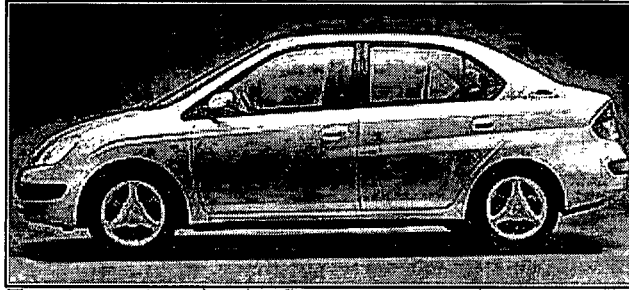
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NEWS



Toyota wants to be the first to mass market a gas-electric hybrid.

Toyota Prius hybrid car recharges its own batteries

Gas-electric combo will go global soon

September 10, 1998

BY RACHEL KONRAD

Detroit Free Press Automotive Writer

Forget the hype. The Toyota Prius is not the car of the future.

But the world's first mass-marketed hybrid vehicle, powered by a combination of batteries and gasoline, is a critical link between today's conventional cars and more futuristic personal transportation that the world will glimpse sometime in the 21st Century.

The Prius -- from the Latin word meaning "to go before" -- has been on sale in Japan since December. Demand for the Prius has been so overwhelming that Toyota President Hiroshi Okuda decided it was time to take the Prius global. It will debut in the United States and Europe in 2000, and possibly elsewhere after that.

The thing that makes the Prius different from other cars is its unique way of getting energy. The Prius sedan -- which is a bit roomier than its conventionally powered cousin, the Toyota Corolla, has a 1.5-liter gasoline engine and an electric motor. It operates on electricity from batteries at low speeds and switches automatically to the gas engine at higher speeds.

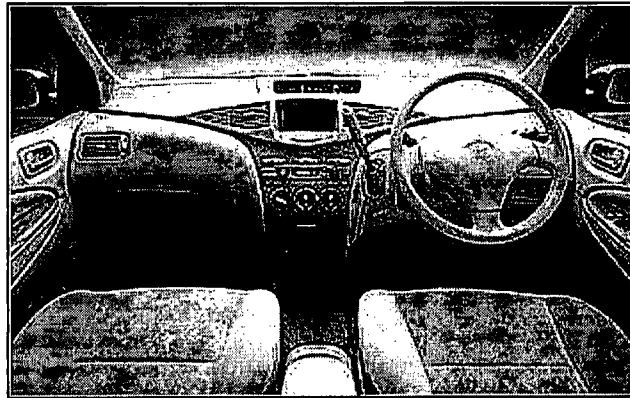
When you start the Prius, it's dead quiet, similar to fully electric vehicles, such as General Motors Corp.'s EV1. It doesn't make any noise or emit any pollutants from the tailpipe when you start

moving from a dead stop because at that moment the vehicle gets its power exclusively from the batteries.

When you hit 10 or 15 miles per hour, the gas engine quietly kicks in, and the Prius behaves and sounds like an ordinary vehicle. The Prius is capable of cruising at 88 m.p.h. on gasoline alone. It can accelerate up to 100 m.p.h. in short bursts using the engine and batteries together. Performance is expected to be improved before the vehicle's North American debut.

During deceleration or braking, the motor functions as a generator and recharges the batteries. When a battery's charge starts getting low, the electric generator routes power to charge the battery in a complicated mechanical ballet under the hood that the drivers and passengers never notice.

The batteries never need to be recharged from an external source, such as the giant garage adaptor needed to power electric vehicles.



The interior of the Toyota Prius, which is currently only on sale in Japan.

Since Toyota launched the Prius in December, it has slowly won over skeptical automotive critics.

The Prius isn't any faster or more exciting-looking than lower-priced vehicles such as the Honda Civic or Dodge Neon, they say. And in an era of record low prices for gasoline, critics note, there's not much incentive to buy a high-tech hybrid to increase fuel efficiency.

But it's vastly more convenient than fully electric vehicles, which cannot go much more than 100 miles without needing to be plugged into a power source for several hours.

"An electric vehicle is too troublesome for most consumers," said David Champion, director of automotive testing at Consumer Reports in East

Haddam, Conn. "This is a little more friendly."

Some of Toyota's investors have been the only ones to complain about the money-losing vehicle. According to estimates from automotive analysts, Toyota loses as much as \$20,000 on each Prius -- more than what it costs to buy one.

The Prius' sticker price in Japan is about \$16,000, although that's artificially low because of the diminishing value of the Japanese yen. The Prius debuted in Japan costing about \$17,000 when measured in U.S. dollars. In the United States, the Prius is expected to cost somewhere between a Corolla (about \$15,500) and a Camry (about \$21,000).

Toyota is willing to lose the money on the Prius because it wants to be the first automaker to mass market a gas-electric hybrid.

Toyota's research has shown that most people -- especially Americans -- refuse to pay more money for a car that's environmentally responsible. It wouldn't make sense for Toyota to market a high-tech vehicle that no one could afford.

If the Prius catches on, Toyota stands to reap a fortune.

Chris Cedergren, president of Nextrend Inc. of Thousand Oaks, Calif., estimates that up to 25 percent of vehicles worldwide could be powered by alternative methods by around 2020. If Toyota is the first to the market with hybrids, and if the program doesn't suddenly turn disastrous, consumers will likely think of the Prius as the most reputable choice, Cedergren said.

"You have to give credit to Toyota for doing this," he said. "If the Prius works, they'll put it (the technology) into other vehicles. Then, watch out."

PRIUS SPECS

In Japan, the 1998 Prius gets 66 miles per gallon of gasoline. It can go 850 miles per tank. Fuel efficiency will be less impressive in the United States, however, where the Prius will get about 50 m.p.g.

Unlike conventional gas-powered cars, which getter better mileage in highway driving, the

Prius performs better in stop-and-go traffic, when it is either idling or moving slowly. At those times, the Prius is powered by a battery and hardly uses any gas. At high speeds, the Prius mostly uses gas.

In Japan, the narrow streets and congested highways require lots of stop-and-go maneuvers. Wide-open highways are rare. By contrast, many parts of the United States are covered by empty highways.

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NEWS

Power without pollution

Electric batteries. Fuel cells. High-tech diesel engines. The cars of the near future could be powered by any or all of these.

November 6, 1997

BY TED EVANOFF

Detroit Free Press Automotive Writer

What will be powering our cars and trucks 10 or 20 years from now?

Well, the boss' Mercedes could have a fuel cell under the hood. Airport taxis might run on exotic electric batteries *and* use small gasoline engines to get rolling. Cross-country freight trucks could be driven by high-tech diesel engines.

An array of cleaner, more fuel-efficient automotive power plants are being developed, and every one of them could one day be on the road.

Or, we could continue to rely on the standard gasoline engine that's been around since Henry Ford's time.

Even the experts don't know for sure, because a lot depends on what the automakers might develop, what the nation's lawmakers might demand, and what the American consumer might buy.

"I think it's not clear which engine will go forward," said Pandit Patil, director of the U.S. Department of Energy's office of advanced automotive technologies.

Certainly there's technical innovation under way. Automotive engineers and scientists worldwide are scrambling to develop an environmentally friendly supercar -- one that would get 80 m.p.g.

That's a must if the nation is to reduce the creation of so-called greenhouse gases, which have been blamed for trapping heat in the atmosphere and making the Earth warmer and warmer. Carbon dioxide, for example, is an unavoidable by-product of burning coal and oil, and the only way to make less is to burn less.

To avoid cataclysmic changes to the world's climate, President Bill Clinton wants to reduce the amount of greenhouse gasses the U.S. produces to 1990 levels by the year 2012.

Detroit's Big Three automakers have joined with federal scientists to create the Partnership for a New Generation of Vehicles, or PNGV. PNGV intends to come out with a fuel miser concept car by 2000 and a production prototype by 2004.

Hurdles remain, however, in developing an environmentally friendly engine that sips fuel.

"There is really a lot of innovative engineering that is going to be required," said Chris Sloane, PNGV technical director at General Motors Corp.

For example, fuel cells still need some kind of heating system to protect water in the cells from freezing. And the circuits that carry powerful electrical currents are still too heavy for everyday use in battery-powered vehicles.

Only big breakthroughs can smooth out the technology to the point at which it will be affordable, reliable and durable enough for an ordinary automobile intended to operate in hot and cold climates.

If the breakthroughs happen in the next several years, and it's possible they may, new engines will reach market. If not, good old internal combustion will remain the mainstay.

Some engineers suggest gas engines will remain popular along with a smattering of new engines made especially for certain tasks, such as powering freight trucks or fleets of taxis.

"You're very likely to see cars with hybrid engines, standard gasoline engines or fuel cells," said Bradford Bates, manager of Ford Motor Co.'s alternative power source technology department.

The fuel cell

Detroit's carmakers are all trying to make strides with fuel cells. Last month, Ford and partner International Fuel Cell announced they had developed an experimental power plant that could run on electricity derived from a fuel cell.

Ford's disclosure came on the heels of a widely heralded announcement a week earlier from the

consulting firm Arthur D. Little. The Boston firm said its new fuel cell could use hydrogen extracted from gasoline to produce electricity in sufficient quantities to power a car.

Other experimental fuel cells used another fuel such as methane. But for methane fuel cells to be successful for ordinary driving, the nation would need a system to make it easy for motorists to get. Gas stations already abound.

But auto technology analyst Ralph Colello doubts the near future will include fuel cells of any sort.

"I don't think they'll have much of an impact between now and 2012," said Colello, vice president of the consulting firm A.T. Kearny & Co. in Cambridge, Mass. "I think it's a very, very expensive technology. It looks to me like we're at the very early stages of showing technical feasibility."

If a gasoline-powered fuel cell costs at least \$30,000 to put in a car today, he said, researchers will take years -- if not decades -- to bring the cost down to an affordable \$3,000 for a family car.

For the same reason, he shrugs off hybrid cars that use electric and gasoline engines. Putting two power plants under the hood can't be cheaper than one, at least not in the near term, he said.

What's more likely to become common on U.S. highways in the next few years are high-tech diesel engines, he said.

Diesel decisions

American drivers came to disdain diesels. But gone are the smoky and cumbersome diesels common during the oil shocks of the 1970s and 1980s, Colello said.

BMW, Caterpillar, Cummins, Detroit Diesel, Isuzu, Volkswagen and a host of other engine makers are all fine-tuning diesel technology for trucks, he said, and he bets diesels gradually will migrate to cars.

That's because diesels, long useful for pulling heavy loads, also can get 50-percent better fuel economy than gas engines, cutting down on greenhouse gas emissions. And the refinements in the new direct-injection diesels could regain the confidence of everyday drivers.

Turbochargers give the new diesels zip. The new engines make less noise. And they aren't troublesome to start in the cold.

Truck drivers still must go through a series of gear shifts to get the vehicle up to speed, but the technology could soon make the engines run faster, eliminating the need for frequent gear shifting in cars, Colello said.

Diesel technology has become so advanced, he asserts, that it's "going to create a new standard" for fuel efficiency at a cost below the price of hybrids and fuel cells.

Automakers are going ahead with the experiments anyway. Ford, for example, plans to bring out a 63-m.p.g. hybrid concept car next year.

It would have a small diesel engine and an electric motor linked to a five-speed automatic transmission turning the front wheels. The electric motor would run in tandem with the diesel or provide exclusive power for the car, whichever is most efficient at any given moment.

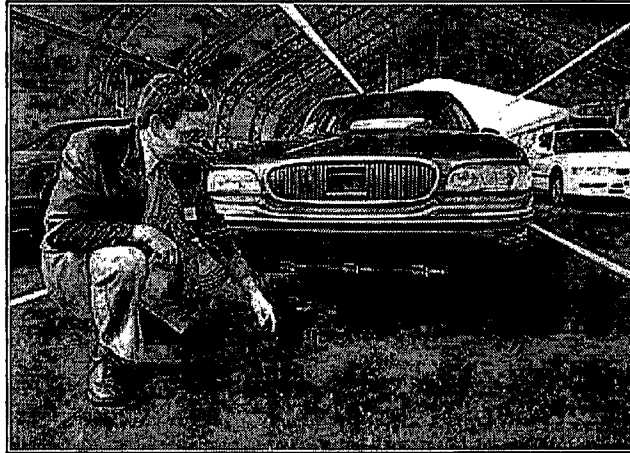
Ford already has developed a lightweight aluminum concept car, the P2000, to accommodate the new power plant. The 2,000-pound car is built on a stretched-out Ford Contour platform that's almost as big inside as a Ford Taurus.

The lighter the car, the less fuel it will burn. So using new materials is another way to boost mileage and reduce the production of greenhouse gasses.

Although the P2000's lighter weight can push fuel economy up 25 percent compared to a Taurus, building the car in aluminum soon for the mass market remains a challenge.

Steel costs about 35 cents a pound, compared to \$1.35 a pound for aluminum. Steel is much easier to shape into body panels, too. But while breakthroughs are needed to make aluminum cheaper and easier to work with, the effort is under way.

"We're beginning to pull the pieces together with the goal in mind of having a concept car by 2000," said Ross Witschonke, Ford PNV technical affairs director.



Steven Shladover, Director of California PATH, points out the magnetic sensors installed on the front of a Buick LeSabre at a demonstration of the automated highway system in San Diego. (AP photo by Denis Poroy)

Look Ma, no hands: First experimental automated highway debuts

July 23, 1997

BY DANA CALVO

Associated Press

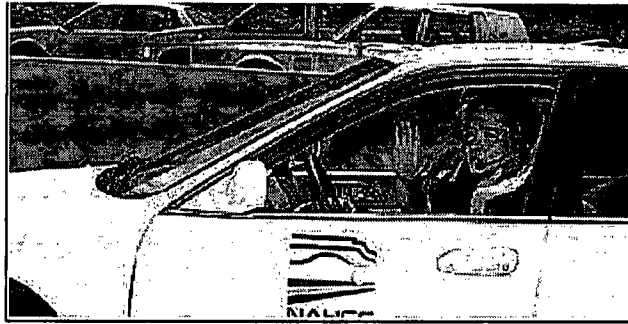
SAN DIEGO -- The nation's first stretch of automated highway that enables computers to do the driving for you made its debut Tuesday and was proudly declared by its creators to be "really dull."

Once the computer takes over, drivers can take their hands off the steering wheel, their feet off the pedals and their eyes off the road.

"It's really exciting for about the first 15 seconds, then it gets really dull," said Jim Rillings of the National Automated Highway System Consortium. "It's like driving with a chauffeur. You just sit back and let your mind wander."

Tuesday's test was purely a demonstration, a glimpse of the future. The specially equipped cars necessary are not even available to the public. The prototype highway should be running by 2002, but the location has not yet been selected.





Hung Pham, of Honda USA, shows off his hands-free driving technique on Interstate 15 in San Diego while driving at 55 mph during a demonstration of the automated highway system. (AP photo by Denis Poroy)

Test vehicles equipped with video cameras, magnets and radar navigated down the nation's first 7.6 miles of experimental automated highway on Interstate 15.

Tiny magnets embedded in the asphalt on either side of traffic lanes at four-foot intervals enable the magnetized vehicle to constantly orient itself within the lane's boundaries.

The dozen cars and buses in the demonstration project are equipped with one-inch video cameras on their rearview mirrors or windshields that follow visual aids along the road. Those could be cement barriers or even deep tracks in a snowy road.

There is no price tag for the project, but its supporters insist it will save millions of federal dollars because it relies on existing infrastructure and eliminates the need for building more freeway lanes.

Among the partners working to develop the technology as members of the National Automated Highway System Consortium are General Motors, Lockheed Martin and Carnegie Mellon University.

Its genesis was a 1991 federal law that empowered the Transportation Department to develop "fully automated, intelligent vehicle-highway systems."

It would cost less than \$10,000 to equip one mile of freeway with the new technology, compared with anywhere from \$1 million to \$100 million to build one mile of new highway, said Dick Bishop, a Transportation Department spokesman.

But will car-dependent Americans be willing to hand over control to a computer?

"We talked to older drivers, and they said it's because they've seen so many technological changes in their life, they're used to it," Rillings said. "I don't know, maybe younger people still think driving's fun."

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NEWS

Satellites to guide average drivers

Pricey device soon could be common

May 7, 1998

BY JEFF GERRITT
Detroit Free Press Staff Writer

In a few years, motorists with advanced navigation systems could avert potholes, get traffic reports and turn-by-turn directions for alternative routes -- and even make some cars repairs while driving.

It's all down the high-tech highway that transportation officials hope will lead to quicker rides, eased congestion, relaxed road rage and smaller highway budgets.

More than 4,000 transportation industry executives, consultants and researchers glimpsed the future at a national Intelligent Transportation Systems conference in Detroit. The four-day exposition ends today.

Gary Naeyaert, a spokesman for the Michigan Department of Transportation, said advanced navigation systems will ease congestion on Michigan roads, which carry 30-percent more traffic than they did 10 years ago. Michigan also has the nation's highest share of cars carrying one person.

"We can't build our way out of congestion anymore," Naeyaert said. "What we need is smarter roads, smarter cars, smarter drivers."

About 40,000 U.S. vehicles -- about a third of them rentals -- have advanced navigation systems, which use information from global-positioning satellites.

The first U.S. cars started carrying the systems about 1 1/2 years ago. The navigation screens are about 4 inches by 4 inches, mounted near the dashboard and provide maps, icons and audible and printed words.

For now, the cost of the units -- \$2,000 to \$3,500 each -- is too high and their use too limited for many consumers. Industry experts compare

advanced navigation devices in the late 1990s to cellular phones in the early 1980s -- an expensive oddity that soon will become an everyday commodity.

"U.S. automotive companies are very conservative," said Roger Stevens, vice president of driver information systems for **Magellan Systems Corp.** in Rochester Hills. "They typically wait for something to be proven before they adopt it."

The U.S. market trails Japan, where 1 million navigation units were sold last year, Stevens said.

Advanced navigation systems can guide drivers to almost any destination. After the driver programs a destination, a voice guides the driver. The devices are especially attractive to business people who drive often in unfamiliar territory, said David Ladd, a spokesman for **Siemens Automotive** in Auburn Hills.

Within two or three years, the navigation systems will include road service, traffic information and suggested routes.

In metro Detroit, the Michigan Intelligent Transportation System Center in downtown Detroit will provide drivers with traffic information, said Kunwar Rajendra, an MDOT engineer.

Adding real-time traffic information will broaden the devices' appeal, Ladd said. "It opens a much broader market," he said. "You have the father who wants to make sure his daughter or wife has the security of roadside assistance or people like me who missed a flight the other day because I didn't know that I-94 was shut down."

Bob Drury, a development manager for Siemens, said drivers will get traffic information before they leave home. "A lot of the information you now get on these overhead signs in Detroit you'll get early," he said. "You'll be able to make a decision prior to committing to the freeway."

Big Three automakers will offer such multifunction systems by 2001, industry executives say. By 2000, Stevens expects U.S. sales to total 2 million and climb to 13 million by 2004. "It's going to be a multibillion-dollar market."

Robert Allan, a product specialist for **Mercedes-Benz North America** in Montvale, N.J., said the

Siemens devices have been offered as \$2,495 options on three models since October 1997. He said customers find them easy to use, so he expects sales to grow.

Industry executives say they'll get the price well below \$1,000 within three years, and soon below \$500. "The target is \$500 to really penetrate the mass market," Drury said. "If we can hit that \$500 mark, it's really going to take off."

Jeff Gerritt can be reached at 1-313-223-4461.

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NEWS

Automakers work on a port that will let you plug your hand-held computer into your car

October 24, 1998

BY HEATHER NEWMAN
Detroit Free Press Staff Writer

Every day, your car carries on conversations with dozens of tiny computers that run virtually every one of its systems.

Someday soon, it will be talking to one additional computer: yours.

The Dodge Intrepid ESX2, a \$2-million concept car built this year to show off a hybrid electric-gasoline power train, also contains a tiny accessory that has gone almost unnoticed: an infrared port.

That port, hidden inside a fold-down panel in the dash, lets the car talk to any one of a dozen tiny palmtop computers that can transfer information using light. Plop down your palmtop and you can control the radio and sound settings, change your climate control and even get engine diagnostics. Video clips can show you how to change a tire or change your oil.

A consortium of automakers this week announced they'll cooperate in developing a universal design for such computer ports so car owners of the future will be able to move with their electronic equipment from one car model to another. Whether the universal design turns out to be hard-wired or infrared, the standard is scheduled to be agreed upon in the next year to 18 months.

Chrysler Corp.'s infrared port and the software could be a \$50-\$100 option, company electronics specialist Steve Buckley said. It would be compatible with most of the palmtop computers on the market that run Windows CE. That price makes it an attractive bet to get onto the accessory list for the Chryslers and Dodges of the future.

"All we've really added to the car is an infrared

interface for our computer bus system," he said. "There are groups at Chrysler looking at incorporating this kind of technology. Part of the goal of this car is to assess customer desire for the feature."

Jon Harmon, technology public affairs manager for Ford Motor Co., said he expects the technology to hit the market quickly. Lincoln is showing off its version, a hard-wired, direct-cable connection to Windows 95 laptops, in its Lifestyle Demonstration Vehicle.

"It won't be long at all before that's a real production feature," he said. "This kind of technology is not going to be pricey or exclusive."

At General Motors Corp., the automaker's Delphi parts subsidiary has turned a sport-utility vehicle into a rolling technology showcase it calls the Network Vehicle. A satellite antenna embedded in the roof brings in television programs and full access to the Internet, including a Yellow Pages function, navigation aids, E-mail, voice mail and a pager. A voice recognition system enables the driver to engage the system by talking to it.

Early elements of the system, including a personal computer, should begin appearing in luxury vehicles as early as 2001, said David Wohleen, general manager of Delphi Delco Electronics Systems in Kokomo, Ind.

Allowing customers to attach their own computers to their cars makes more sense than the automakers building them in, Chrysler's Buckley said. Upgrades will be easier, and customers can pick the brand they like.

Windows CE machines run stripped-down versions of Windows 95 and 98 software and usually cost \$500-\$1,000. Buckley pointed out that with a cellular modem, a palmtop could be wirelessly on the Web while the customer was driving.

That could give drivers access to live Web-based traffic reports, such as AAA Michigan's report at www.aaamich.com/control/traffic/index.html or the Michigan Department of Transportation's live traffic conditions site at campus.merit.net/mdot

Automotive writer Ted Evanoff contributed to this report.

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Automotive writer Ted Evanoff contributed to this report.

NEWS

Chatty cars are the wave of the future

They'll talk to themselves and you, exec says

October 9, 1998

BY MIKE BRENNAN
Detroit Free Press Business Writer

Cars and trucks a decade from now will be environmentally friendlier and wired to the Internet, predicts William Powers, vice president of research for Ford Motor Co.

Powers, in a recent interview, said he foresees cars and trucks becoming even more computer-laden, with various subsystems, like brakes and power trains, talking to one another to give drivers new features like adaptive cruise control.

Adaptive cruise control uses a radar-like device to tell the brakes when the car is closing in on a vehicle or an object and the engine needs to throttle back.

Such systems are in the early stages of development now.

"Interactive vehicle dynamics will couple existing functions to create new functions like these," Powers said. "What we've done in the '90s is start combining subsystems to create new functions like traction control. That will accelerate in the next century."

Interactivity will extend beyond connecting mechanical subsystems. It also will connect drivers and passengers with the world outside through the Internet, Powers said.

"You go to your office, your home, your car and you have all these information devices collecting data for you," Powers said. "When you're driving, you'll be able to interact with every passing restaurant, every store, every entertainment venue. Each will send information to you in your car, telling you what today's special is or what time the next show starts.

"But I don't want you to take your eyes off the

road, so I won't give it to you in a heads-up display or on the dash; rather you'll be able to hear it and talk to it."

Some cars and trucks of the future will use hybrid engines that combine electric motors with internal combustion engines, Powers said.

A big electric motor will get the car up to speed, then hand off the acceleration work to a smaller internal combustion engine -- perhaps powered by a clean-burning fuel such as methanol.

When the car slows down, the power demands will transfer back to the electric motor. Tailpipe emissions with such a hybrid system would be close to zero, Powers said.

Several automakers are working on the hybrid engine concept, with Toyota believed to be the closest to marketing a product in the United States.

Toyota's Prius, which features a battery and gasoline engine combo, went on sale in Japan late last year and is scheduled to hit U.S. shores in 2000.

Testing on the Prius by the Environmental Protection agency so far shows lower emissions than expected and mileage of about 50 miles per gallon.

Because of all the additional on-board computers and electric motors coming, vehicles soon will shift from 12-volt electrical systems to 42-volt systems, Powers said.

Cars and trucks might even have two batteries instead of one, to make sure there's plenty of power to keep things running, Powers said.

At Convergence '98, a technology conference set for Oct. 19-21 at the Hyatt Regency Hotel in Dearborn, engineers and scientists will detail this and other evolutionary developments, he said. Powers is chairman of this year's annual conference.

The 42-volt electrical system "is an area where everyone in the auto industry is working together," Powers said.

The Big Three automakers also are working together in noncompetitive areas such as new gasoline formulations that contain less smog-producing carbon, Powers said. Lean-burn catalytic converters are another area where

everyone could cooperate, he said.

"We all buy catalysts from the same suppliers anyway," he said. "So we go get a federal alliance to help us with the problem. We need to ...make it a worldwide dialogue."

Burning natural gas would solve most emissions problems, Powers said. But there's been some reluctance by automakers to get behind natural gas vehicles because of refueling problems.

But Powers says solutions can be found for that problem.

"Do you have natural gas in your home?" he asked. "Then you've got a hell of a distribution system already in place."

Mike Brennan writes about computers and the Internet. He can be reached through E-mail at brennan@freepress.com or at 1-313-223-4410.

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NEWS

The computer commuter

Cars of the future will respond to voice commands, send E-mail and make safe-driving decisions for you

December 24, 1998

BY TED EVANOFF

Detroit Free Press Automotive Writer

KOKOMO, Ind. -- Put a powerful engine in a car with sweet lines and a great cabin and it's bound to be popular.

As the automobile becomes a rolling computer, though, it could be smart cars that excite buyers.

A new wave of intelligent technology has begun to appear in luxury models, and by the middle of the next decade could reach mid-priced lines.

Radar peers into snow and fog, satellite navigation pinpoints the car on an electronic map, side sensors alert a driver when another car is in his or her blind spot.

There are skid-control systems, sensors that detect objects behind a backing vehicle, tires that signal low air pressure, switches that soften or firm the ride.

There's a computer that recognizes simple voice commands to turn on the windshield wipers or turn off the radio. And there's a personal computer mounted in the dashboard. The in-car PC could deliver electronic mail, send faxes or list every Spanish tapas bar within 10 miles, with maps tracing the route to each restaurant.

General Motors Corp. executive David Wohleen, president of Kokomo-based Delphi Delco Electronic Systems, said part makers will probably start supplying such features as early as 2001.

Upcoming attractions

Three trends are under way:

The car as an office. This depends on personal computers hooked to the Internet being installed in cars.

The emergence of technology that helps motorists make decisions. This includes electronic maps and satellite navigation systems. It also covers improved engine diagnostics, as well as data collection by automakers.

For example, if an engine component is running hot, the car could convey that information via the Internet to a computer at the dealership where the car was purchased. The dealer's computer could file the information for the car's next check-up. Or, if the problem seemed serious, it could send the driver an electronic message and set up an appointment with a mechanic.

Then there are the smart cars, which take on specific driving tasks that had been in the driver's domain.

Today's \$40,000 Lincoln Navigator sport-utility vehicle has computer-processing capability to rival the Apollo moon capsule. Much of this computer firepower is found in separate engine, antilock brake, traction and safety controls. Engineers are beginning to link these systems in a way that would put computers in control under certain conditions.

"Right now I'm the captain of my ship. I drive it. If somebody brakes in front of me, I decide when to brake. Now some of those tasks are going to migrate away from the driver," said Chelsea White III, director of Intelligent Transportation Systems at the University of Michigan.

This migration was apparent recently when GM demonstrated a Jaguar XK8 test car equipped with an advanced Delco cruise control.

Riding on U.S.-31 in central Indiana, the luxury car was moments away from crashing into the back of a freight truck lumbering ahead in the same lane.

Although the Jaguar driver never touched the brake pedal, the car suddenly slowed to the truck's speed and stayed exactly 100 feet behind it. What prevented the smash-up? Adaptive cruise control.

Cars on auto pilot

Vehicles long have had cruise control, which lets the driver electronically set the speed at a desired level. Under this system, a driver must slow the

car if he or she finds the car too close to the vehicle in front.

With *adaptive* cruise control, the car adjusts automatically to traffic. The driver sets the desired speed limit as before, and by simply tapping a steering wheel button, tells the in-car computer how far to stay behind the vehicle ahead of it. The car slows or accelerates to maintain the distance without surpassing the pre-set top speed.

In Indiana, the Jag driver had set the cruise control at 60 m.p.h. and instructed the radar-guided computer to keep the car 100 feet behind whatever was in front. As the truck slowed to less than 40 m.p.h., radar placed behind the front grille of the Jag detected the truck and alerted a microprocessor under the hood. The computer smoothly throttled down the engine and applied just enough braking power to adjust the Jaguar's speed to match the truck's speed at 40 m.p.h. and to maintain the 100-foot separation.

When the truck turned into a gas station, the Jaguar's radar sensed clear road ahead and the car accelerated back to 60 m.p.h.

Whether lots of people want adaptive cruise control -- or any other form of intelligent technology -- in their vehicles remains to be seen.

"One of the biggest things we face is customer acceptance," said Delco engineer William Bauson.

In the high-tech car of the near future, the information streaming into the cabin could overwhelm the driver. Engineers are trying to figure out how much is too much. They also want to avoid lulling the driver into complacency.

For instance, Delco's adaptive cruise control will slow the car to about 25 m.p.h. (An experimental version will bring it to a stop.) And it will react only to big objects, such as cars and trucks. It will ignore, say, an orange construction barrel in the road. So the driver still must stay alert for road hazards.

Price also will determine customer acceptance. Smart technologies now appear chiefly in high-end autos. For example, Lexus, Jaguar and Mercedes-Benz are offering adaptive cruise control on some 1999 models.

There's no doubt economies of scale will drive down costs to an affordable level for mid-price vehicles. Eaton Corp. of Cleveland expects its \$3,000 adaptive cruise control for commercial trucks will drop to \$300 for cars.

Costs also are falling as engineers design more efficient electronic systems, cutting the cost of technology and enabling the automakers to install the high technology.

With the costs coming down, automakers are trying to use technology to differentiate their brands.

For example, the 1999 Buick Century and Ford Contour midsize sedans offer traction-control systems, a feature now found mainly in more expensive cars and trucks.

In the realm of entertainment, the 1999 Oldsmobile Silhouette Premiere minivan deploys a 5.6-inch television screen in the headliner for TV viewing by rear-seat passengers.

Safety first

In hand with the information and entertainment flowing into the vehicle will be skill enhancers for drivers.

Most intelligent technology, at least initially, is aimed at safety. Cadillac's NightVision, available first in the 2000 DeVille, peers about 500 feet ahead. It can detect a child in the road who would be invisible in the glare of oncoming headlights and make an image of the child appear on a transparent strip of material on the bottom of the DeVille windshield.

"These systems are going to be desirable because they'll help the driver avoid problems and control the vehicle better," said White, the U-M researcher. "They improve on the skill of the driver."

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