



**Triumphant gearheads,
standing ovations for a hydrogen bus,
and a yuppie BMW that's actually good for the planet.
I've seen the future, and I like it.**

The Soul of **GREEN**

Alan Welch and his team of engineers and mechanics are building the car of the future. But on the day we meet last fall, the future isn't cooperating. Just a few miles from the finish of a three-day automotive competition and rally, their car poops out.

"We need another optical sensor," Welch pronounces from the backseat, where he's been hunched over his laptop running an engine diagnostic in the Mojave's desert heat. Wires are everywhere—some spilling from the glove box, snaking over the passenger side, then connecting to Welch's computer. "It's burned. We've lost RPM. Off, please." Welch is talking to driver Campbell McConnell, who receives the news, follows orders, and slumps down in his seat. The sensor that overheated is the size of a fingernail and available at most electrical-supply stores. But it's late afternoon along a desolate strip of Interstate 15 near Sheep Mountain, above which a pale half-moon is on the rise. The car will need a lift the last 28 miles into Las Vegas on a flatbed tow truck.

The team from Westport Innovations, a small, independent research and development firm in Canada, has been working for two and a half years to retrofit light-duty diesel engines to run on cleaner-burning natural gas. Now, not only has their prototype Ford Focus

come to an unscheduled stop, it looks like McConnell is going to spend the bulk of his 25th birthday in a parking lot.

Westport's prototype is one of 49 entries at the Challenge Bibendum, a kind of moving showcase for cleaner, greener vehicles sponsored by the Michelin Group. The event, named for the company's doughboy mascot, is the third for the French tire-maker. The first two took place in France, in 1998 and 2000. "Bibendum" derives from the Michelin family's original ad campaign, now more than 100 years old. In the ads, a marshmallowy creature holds aloft a champagne glass full of nails. (They're French, remember.) The Latin phrase *nunc est bibendum* or "time to drink" was used as inspiration for copy that read "Michelin tires drink obstacles." The fat guy became "Bibendum" and one of the most popular and recognizable corporate logos in the world, and so he stays. But his name is awkwardly out of step with modern attitudes about drinking and driving—as out of step, in fact, as the Challenge Bibendum itself is with oilman George W. Bush's vision of an unapologetically consumptive drill-and-drive America.

It is a stroke of genius to begin the U.S. Bibendum beneath the particulate haze of Los Angeles, a city whose car culture has contributed to some of the nation's most notorious air. L.A. artist Stephanie Sanchez has spent many years painting the atmo-

by Marilyn Berlin Snell



Honda's hybrid Insight competes with a gas/alcohol/hydrogen-powered Ford Explorer at the California Speedway; below, Westport's natural-gas Focus makes a pit stop in the Mojave.

MACHINES

spherics above her hometown. “When I paint a realistic Los Angeles sky,” Sanchez says during my visit prior to the event, “I use earth colors—usually raw umber and raw sienna.” High concentrations of nitrogen oxides, carbon monoxide, sulfur dioxides, and lead apparently often cancel the need for traditional blue.

As an ice sculpture of Bibendum melts in the parking lot of the Automobile Club of Southern California, I get a glimpse of the less-polluting vehicles on the horizon. It is estimated that by 2020 the number of cars on the world’s roads will have tripled, to nearly 1.5 billion. If technological innovations such as the ones being shown off here aren’t a significant part of that mix, the palette used to paint skylines will surely get darker.

Some of the Bibendum entries are bizarre, like the one-seater Solar Eagle III. The bright yellow vehicle is designed by students at California State University, Los Angeles, and propelled by photovoltaic panels that make it look like a computer punch card on wheels.

Others look out of place at a competition, like the stodgy

1994 Buick Regal station wagon retrofitted to run on a mix of hydrogen and corn alcohol, or ethanol.

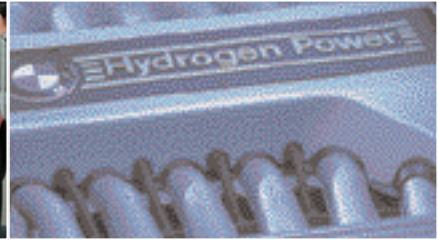
Still other entries will suit more conventional tastes, and—their builders and backers hope—mean big business down the road. Eight of the world’s top automakers are participating, including Ford, General Motors, and DaimlerChrysler, which all have relatively clean vehicles in prototype or production. In addition to natural gas and ethanol, there are autos run by electricity (think plug-in), and hybrids, which have a gas-powered engine that works in tandem with an electric motor to boost fuel economy. Electric vehicles have zero emissions, though the juice to move them comes from utilities, which now pump 25 percent of all CO₂ green-

house-gas emissions into the atmosphere. (Cars, sport-utility vehicles, minivans, and pickups are responsible for 17 percent.) Hybrids don’t need to plug in to power plants, since they generate electricity on board via the gas engine.

There are also fuel cells (which can be powered by a variety of fuels—see “Are You Ready to Drive Green Today?” page 44), and hy-



TOP LEFT: JOE WILSENI/ACHIEVE. TOP RIGHT: VELLOW DOG PRODUCTIONS/GETTY IMAGES/REUTERS. BOTTOM: MARRILYN BERLIN/SHELL



Clockwise from top: a hydrogen bus; Honda's hybrid on the Baker grade; a hydrogen internal combustion engine; a 1965 hydrogen-powered Cobra; a hydrogen pump.

drogen-powered internal combustion engines. The latter combine hydrogen with oxygen from the air to run the motor. Though the only thing coming out of a hydrogen car's tailpipe is water vapor—a very good thing—there is a bit of a fuel-storage problem that still must be overcome: It currently takes 11.6 gallons of hydrogen to create the energy equivalent of a gallon of gasoline. Engineers on Ford's H2 ICE team (cool mechanic-speak for "hydrogen internal combustion engine") say they are working to improve hydrogen storage technologies.

I try to keep pace with car talk about ICE, torque, and horse-

power, but later, in need of remedial education, I call Harry Quinsler, who's been a professional mechanic for more than 18 years. "Torque is the ability of a vehicle to pull or haul weight," my friend tells me. "Horsepower makes you go fast." As cars become more fuel efficient, torque and horsepower tend to be compromised—which is why engineers at the event were so eager to talk about how new technology has eliminated, or at least significantly reduced, this problem.

Some Bibendum entries are bizarre; some look out of place. Still others

with traffic flow. As my passengers speak knowingly about performance features and NOx traps (nitrogen oxides are a nasty component of most fuel exhaust), I am fixated on the hydrogen sensors. Who cares about performance, I wonder nervously, when we are encased in a vehicular Hindenburg? I am assured that Ford's engineers have installed more than enough safety equipment: The dome light doubles as an H₂ detector; there are four fans in the back of the car—two for circulation and two for extracting escaped hydrogen; and a sunroof automatically opens if sensors detect a leak. Natkin points rearward and says proudly, "That's not an antenna; it's a fuel-storage-system high-pressure vent." All very impressive, I say, but has anybody fixed the flammability problem? They have, Natkin says, noting that the P2000 hydrogen-sensor technology is currently being upgraded to the kind used in the space shuttle program.

The deal-breaker with hydrogen isn't safety or technology. According to Natkin, clean, green hydrogen cars could be in mass production in a relatively short period of time. "It's more of a fuel availability and cost question at this point," he says. The holdup is the lack of political will, and therefore government aid, to build a fuel infrastructure that would support a hydrogen economy. While the Ford Focus prototype I rode in had been able to fill up in Barstow (there are more than 1,200 U.S. stations that sell natural gas), fuel for the Bibendum's hydrogen vehicles must be provided by

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Then comes the chance to drive or ride in some of the vehicles during the 225-mile rally to Vegas. This is a journey for nerds and gearheads, with no junk-food stops or brushes with the law. But it offers the possibility of a future in which the Great American Road Trip—that fine art of the serial escape and symbol of freedom and independence—could be done without smutting up the skies.

First, I drive a hydrogen car built by Ford. Bob Natkin, a

senior technical specialist and team leader on Ford's hydrogen internal combustion engine project, sits next to me in the compact but comfortable P2000. I am also chauffeuring a journalist from London's *Daily Telegraph*—one of more than 150 reporters from 23 countries covering the Bibendum. "What am I hearing?" asks the Brit as our hydrogen car clanks a little going up a 4,700-foot incline outside L.A. called the Baker grade. "It's the fuel injection system," says Natkin. "Right now, this car is really just a rolling laboratory." The P2000 has the knock-around sounds and anemic pickup of a Ford Fiesta, but I am still capable of keeping up

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CLOCKWISE FROM LEFT: STEPHEN MARKS/INCF; GETTY IMAGES; THE IMAGE BANK; MARILYN BERLIN/STELL; JOE WILKES/INCF; MICHAEL SHAW/INCF; JOE WILKES/INCF; MICHAEL SHAW/INCF



Clockwise from left: BMW's 12-cylinder hydrogen car; CEO Edouard Michelin backed by Bibendum; a hydrogen SUV; a Nissan Hypermini electric subcompact.

a tanker truck that trails the rally participants.

The Bush administration is suddenly hot for hydrogen, announcing a program called Freedom Cooperative Automotive Research, or FreedomCAR, and with it \$150 million in subsidies for hydrogen-fuel-cell research. But Bush has remained mum about outlays for infrastructure, which is required to make his green talk amount to anything more than a delaying tactic that lets automakers off the hook in the short term.

Germany, on the other hand, takes hydrogen seriously. According to Thomas Dietsch, director of the clean-energy

gets 24 miles per gallon. Both it and the A2, which gets an astounding 78 miles per gallon, are available in Europe, but not in the United States.

Stuart Johnson, a spokesperson for Audi, acknowledges that because the U.S. government isn't demanding higher fuel-economy standards, Audi isn't inclined to bring its fuel-efficient models stateside. "Most Americans aren't that concerned with fuel economy," notes Johnson. "And unless gas prices go up or CAFE standards are raised," he says, referring to corporate average fuel economy rules, "Americans probably won't get interested." Diesel engines are 20 to 25

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program at BMW's engineering center in Oxnard, California, in 1998 the German government formed a roundtable with Shell Oil and car companies, including BMW and DaimlerChrysler, to work out a strategy to bring on the hydrogen future. The state of Bavaria has already helped fund and build a hydrogen station in Munich, for example. And in September, Berlin will open its first hydrogen station. (Private companies are unlikely to make the move alone. According to the California Fuel Cell Partnership, it will cost a U.S. station almost \$450,000 to put in just one hydrogen pump.)

BMW has announced that by 2020 it aims to have 25 percent of its cars worldwide running on hydrogen fuel cells. I am only allowed to sit shotgun in the hydrogen BMW at the Bibendum, but the ride is smooth and quiet, like a regular-old, obscenely expensive Beemer. "The power," says researcher and driver Erich Gruber in a charming German accent, "is only slightly less than the conventional twelve-cylinder model." Gruber and his colleagues break speed limits on a regular basis, gunning their hydrogen cars across Death Valley during summer endurance tests.

The Germans also enter several Audis, whose A8 and A2 turbo diesels both receive Bibendum awards for interior and exterior design. With a radio, CD player, TV, and computer on the dashboard, the A8 is better-appointed than my living room, and almost as spacious. I don't want to give up my seat when rally participants stop to change vehicles at the Bun Boy in Baker, California. With all-wheel drive, the A8

percent more fuel-efficient than conventional gas engines, but they emit higher levels of nitrogen oxides and particulates, a known carcinogen. Audi has worked to reduce these emissions, and its A8 and A2 models both meet new European emissions standards (though Europe's rules are not as strong as those in the United States).

It's a little hard to figure out the Jekyll and Hyde personality of Ford, General Motors, and DaimlerChrysler—Detroit's Big Three automakers. Ford alone has ten entries at the Bibendum. All are forging ahead with alternative fuel technologies. At the same time, however, Detroit's alter ego has been systematically killing off every major legislative effort to increase fuel economy.

Among the most impressive of the U.S. entries is a Ford hybrid-electric Escape SUV. With a V-4 engine, the Escape reportedly can travel nearly 500 miles on a single tank of gas and gets 40 miles per gallon, making it the most fuel-efficient sport-utility vehicle in the world. The hybrid Escape will be available to consumers in 2003.

General Motors comes to the Bibendum a little skittish. In 1996, after spending nearly a billion dollars in research and development on a two-seater electric vehicle, GM rolled out America's first plug-in car, the EV1. With faulty batteries and a range of only 100 miles, the big idea was a flop and only 700 were sold or leased. At the Bibendum, the company went in the opposite direction, touting a new technology for its gargantuan GMC Sierra pickup truck. According

CLOCKWISE FROM LEFT: ©BMW AG; JOE WILSENS; MICHELIN; STEPHEN WARKS INC./GETTY IMAGES; THE IMAGE BANK; MARLIN IN BERLIN; SHELL; JOE WILSENS; MICHELIN



ARE YOU READY TO DRIVE GREEN TODAY?

Scan beyond the hoods of all the 15-mile-per-gallon sport-utility vehicles on the market and the environmentally concerned car buyer will find several good choices. Here's what's in showrooms today and what you should be seeing in the not-so-distant future.

Buy It Today Among HYBRID CARS—vehicles propelled by a small gasoline engine and an electric motor—you can choose from a pair of four-door sedans: the **Honda Civic Hybrid**, which attains 46 miles per gallon in city driving (and 51 mpg highway) according to EPA tests, and the **Toyota Prius** (52 city, 45 highway, with automatic transmission standard). Another option is the futuristic two-seat **Honda Insight** (61 mpg city, 68 highway).

Fans of ELECTRIC VEHICLES can choose from the **Toyota RAV4 EV** (range: 125 miles between chargings) and the **Ford Ranger EV** (range: up to 89 miles). (Alas, the Toyota is available only in California, and the Ford only from one of 46 dealers nationwide.) The latest wave is the “neighborhood electric vehicle,” including **Ford's THINK city** and the **Lido** (from auto-industry icon Lee Iacocca, father of the minivan).

Among GASOLINE-POWERED VEHICLES, your best bet is the **Honda Civic HX**. With its “lean burn” engine, this subcompact attains 36 mpg in city driving (44 highway). Another top choice is the subcompact **Toyota Echo** (34 city, 41 highway).

Several major manufacturers offer vehicles that run on (relatively) clean-burning COMPRESSED NATURAL GAS, but there are only about 1,200 CNG stations around the United States. **Volkswagen** offers several DIESEL models that get laudable mileage, but their particulate exhaust is carcinogenic and they emit more smog-forming pollution than conventional cars.

Down the Road Ford plans to sell a 40-mpg hybrid version of its **Escape SUV** in December 2003 and a sedan the following year. GM says it will introduce hybrid versions of its large pickups and SUVs in 2004, but with a meager fuel savings of

about 12 percent.

In 2004, GM will offer “DISPLACEMENT ON DEMAND” technology in its largest trucks and SUVs. It automatically switches off unneeded cylinders when less power is required, generating an average fuel savings of 8 percent. **HYDRAULIC**

LAUNCH ASSIST, which captures energy normally lost from braking to give the vehicle a “free” boost when it takes off from a stop, may be an option on **Ford** trucks as early as 2006.

FUEL-CELL CARS are on their way but won't be readily available until the end of the decade. **Honda** and **Toyota** have announced that they will sell fuel-cell-powered cars in Japan in 2003; **Daimler-Chrysler** claims its offering will be on sale in the United States in 2004. The first models to arrive

will be expensive, and refueling will be difficult because the United States does not yet have a hydrogen-fuel infrastructure. —**Reed McManus**



The fuel-sipping Civic Hybrid looks like a regular Honda? That's the point.

Would you like to walk into a car dealership and know that every vehicle on the floor is as green as it can be? The Sierra Club's Campaign for Responsible Auto Companies aims to reduce global warming by encouraging automakers to reduce the amount of oil burned by cars, SUVs, minivans, and pickup trucks. The Club is calling on auto companies to incorporate the “Freedom Package” in their vehicles, technologies already used in some cars today that, when combined, could significantly improve the fuel economy of every new vehicle on the road.

Key elements of the Freedom Package include a continuously variable automatic transmission, which helps boost fuel economy by providing an infinite number of gears; a variable-valve-control engine, which controls the mix of fuel and air in an engine more precisely; and an integrated starter-generator, which shuts off the vehicle when it is idling at stoplights or in stopped traffic. (Cars burn as much as 15 percent of their gasoline while idling.) For more information, go to www.sierraclub.org/freedompackage. To encourage public officials and automakers to do their part, send in the postcards opposite this page.

to GM engineers, its “displacement on demand” engine saves fuel by using only half of its eight cylinders during normal driving conditions. All cylinders kick in when the driver needs extra power. Under the best of circumstances this technology can bump up fuel economy by 3 miles per gallon, to 17 mpg. (That's not much, but if this increase were adopted by all SUVs and pickups in the United States, it would save 49 million gallons of oil a day—7 million gallons a day more than the Bush administration says it could get from drilling the Arctic National Wildlife Refuge.) Displacement on demand will be standard on all 2004 Sierras and Chevy Silverados—a good thing, since they both made the **ACEEE's Green Book** list of the 12 “meanest vehicles for the environment” in 2002.

At GM's press conference, Chief Environment Officer

Dennis Minano announces that his company “wants to remove the auto from the energy-environment-fuel debate.” I ask Minano whether he couldn't make this happen more expeditiously by actively supporting (or at least not fighting) higher mileage standards for cars and trucks. “The next transportation revolution won't be aided by government mandate,” he says a little curtly. I think he prefers talking torque. “GM does not support a legislated increase in [fuel economy] standards.”

That, it turns out, is an understatement. While GM's Dr. Jekylls show off eco-friendly autos—they have hydrogen and natural-gas concept cars as well as pickups at the event—the Mr. Hyde contingent is challenging California's zero-emissions-vehicle mandate in court. The rule GM is fighting requires that by 2003 a certain percentage of new vehicles sold

in California have zero, or at least very low, emissions. Car companies—particularly American automakers enamored of SUVs—would need to start rolling out highly fuel-efficient cars in big numbers to offset their sales of gas guzzlers in California—a state that accounts for 10 percent of all auto purchases in the United States.

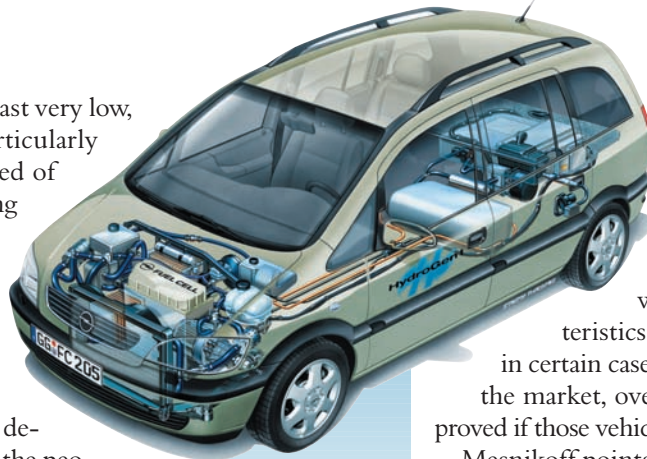
At first, other car companies declined to join GM's suit against the people of California, afraid perhaps of bad PR (though DaimlerChrysler has since signed on). But the likelihood is high that Ford is cheering on its American competitor. (Last March, for instance, Ford CEO William Clay Ford Jr. traveled to Washington to personally lobby Republican John McCain of Arizona to back off a proposal that the senator and Democrat John Kerry of Massachusetts had introduced to increase fuel economy. McCain demurred, but the auto industry managed to keep the proposal from ever being brought to a vote.)

"The Big Three make most of their money on Chevy Suburbans, Ford Expeditions, and the like," says longtime Detroit-watcher Richard Truett, an engineering reporter for *Automotive News*. "And they are going to protect those nest eggs as best they can." In other words, Detroit is hedging its bets. It's banking on strong SUV and truck sales to keep competitive so it can invest in future technology. GM, for example, already spends \$100 million a year on fuel-cell research and development. "GM and other carmakers would be the first to agree that they need to do a better job making cars cleaner and more fuel efficient," says Truett. "What they won't agree with is government entities arbitrarily telling them what to do." (Yet the Big Three don't mind getting hefty government subsidies to innovate.)

Both industry executives and politicians say they have to respond to the world as it is—to consumer demands, corporate bottom lines, job-security issues, and voting habits. The future, on the other hand, has no constituency; it barely has a language, but it gets the point across. The most graphic recent example was the 12,000-year-old ice shelf the size of Rhode Island that broke away from Antarctica—disintegrating, said scientists for the British Antarctic Survey, at an astounding speed under the impact of global warming.

To justify its humongous vehicles, Detroit has recently resorted to scare tactics. Shortly before the debate in the Senate on increasing fuel economy, for instance, ominous commercials began appearing on TV suggesting that soccer moms would lose their SUVs and that farmers would lose the pickups they need for work.

"The auto industry and front groups such as the Coalition for Vehicle Choice try to scare people into thinking that fuel economy will mean that folks can't buy the vehicle they want, and that the cars they *can* buy will be unsafe," says Ann Mesnikoff of the Sierra Club's Global Warming and Energy



Hydrogen storage is a challenge, even in this fuel-cell compact van from Germany's Opel.

Program. Research from the National Academy of Sciences shows, however, that technology currently exists to improve fuel economy without changing weight or other vehicle characteristics. The research also shows that in certain cases, such as the biggest SUVs on the market, overall safety could even be improved if those vehicles lose some weight.

Mesnikoff points out that the duplicity of Detroit's refusal to upgrade their fleets is shortchanging consumers. "The American people deserve better safety *and* fuel economy. Detroit should spend more time putting in better engines, transmissions, and aerodynamics and less time putting

out lies," she says.

Dan Becker, who works with Mesnikoff in Washington, is troubled by the spring shenanigans that kept Congress from voting to increase CAFE standards: "The Big Three ignored their technologies with a vote that increases our oil dependence and pollution. Their ads were dishonest and dishonorable at a time when the American people are looking to Congress to reduce our consumption of oil."

As Detroit stalls, Japanese automakers are zooming ahead. Honda, for example, is well represented at the Bibendum. Its Insight zipped around the Fontana track, clocking 57 mpg. The first hybrid in the U.S. market (Toyota followed shortly with the roomier Prius), 5,000 Insights were sold last year. Honda also displayed its Civic GX, a natural-gas car named by the EPA the cleanest-burning internal combustion engine in the world. Ahead of the pack once again, the GX is already available for \$22,900.

"Fuel economy is all about technology," says Becker. "The Bibendum demonstrates not only the technologies of tomorrow that will give consumers better fuel economy, but the technologies already on the market. Honda and Toyota, for example, have shown technological leadership by beating the American automakers to the market with fuel-saving and clean hybrid vehicles, while the Big Three have shown their ability as leaders against change."

*In a spring episode of the NBC series **The West Wing** (sponsored in part by Volkswagen, Mercedes, Buick, and Saturn),* Jed Bartlet was on a rant about the need to free the country from foreign-oil dependence. "We must control our destiny through innovation," the fictive head of state proclaimed. It was a dramatic moment, one that left me a little melancholic about the absence of a real leader with the courage of such convictions. In the void, there is TV, and the Bibendum.

At the Las Vegas Hilton on the last night of the event, journalists, corporate executives, mechanics, and engineers gather for an awards ceremony. The only standing ovation of the evening comes for a workhorse bus. For three days,

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the zero-emissions hydrogen-fuel-cell ZEBus, built by Ballard Power Systems of Vancouver, British Columbia, tootled around, giving journalists joyrides in parking lots and on the road trip to Vegas. On the Baker grade, the ZEBus was a little sluggish—like 100 percent of the other public-transit buses on the road—but its exhaust pipe spewed only water vapor and it got up to 70 mph on the flatlands. It doesn't win an award, but it is applauded for congeniality.

As the room quiets, someone dressed as the Michelin Man—apparently unable to see through the eye holes in his marshmallow suit—runs into a waiter carrying a tray stocked with glasses of cabernet. The goblets smash on the floor as red wine makes little rivulets down the front of the white rubber suit. Time to Drink, Bibendum!

My buddies from the Westport team win three awards for their natural-gas Ford Focus: two gold medals—one for handling and one for quietness—and a silver for fuel efficiency. The team, sunburned and exhausted from the day spent stranded in the Mojave Desert, sits together at a table, relaxing and drinking beer. A new optical sensor has been located, and the team will install it tomorrow. Then they'll get back in their natural-gas-powered Focus, which is still at least two years from production, and spend four days driving to Detroit. Out of 20 refueling stops on the cross-country drive, 16 will be made at stations selling natural gas (otherwise they'll refuel from a team pickup carrying storage tanks). They will have a flat tire along the way, but nothing more dramatic. They will deliver their prototype for evaluation to enthusiastic engineers and executives at Ford, who will then air-freight it to Ford's diesel lab in London. They will return to Westport Innovations in Vancouver and get back to work on the car of the future. All this is to come. They'll deal with it later, after a little gambling and a belated birthday celebration on the Las Vegas Strip. ■

MARILYN BERLIN SNELL is Sierra's *writer/editor*.