Smokey Yunick R&D

We came, we saw, we . . . well, you hadda be there.

BY PATRICK BEDARD

• The Best Damn Garage in Town, town in this case being Daytona Beach, Florida, appears to keep itself in whitewash and garbage service by repairing Cummins, Caterpillar, Detroit Diesel, and whatever other oil burners clatter in under the cabs of heavy trucks. The place backs up to the Intracoastal Waterway like a squint-eyed poker player against a wall, showing nothing in front and nothing in back, either.

We are reconnoitering, scoping the layout before a scheduled 8:30 assault just a few moments from now. We are Don Sherman, technical director, and me, word guy, and we have come for the truth. Our reconnaissance vehicle is a Rabbit GTI, specially equipped with neck-wrecker tires and about 50 pounds of extra fiberglass spoilers, and we're slow-flying around the place, craning our necks for clues. You probably wouldn't need the fabled cunning of Smokey Yunick to spot such a pair of magazine yahoos, but it apparently doesn't hurt. A dinky Volvo 340DL, the size too small to sell here, pulls up alongside, driven by a guy in a gunfighter hat.

"I have to have breakfast first," he says.

We follow him to the side door of a coffee shop on the highway. You don't need CIA training to recognize Smokey Yunick, either, because half the plumbers and real-estate pushers inside greet him. He's broad-shouldered and sinewy and bowlegged. His uniform is finding it tougher every year to pass for white, never mind that its creases say it's fresh from the laundry no longer ago than yesterday. "Smokey" is embroidered over a pocket, and a blue oval on his back says, "Best Damn Garage in Town." All of this is crowned with the disreputable black hat. He looks like a guy trolling for an argument.

What's the one-time Merlin of NASCAR mechanics doing in a blueberry Volvo? Oh, the factory sent him that thing so he could demonstrate his new engine in a car they'd understand, but he took one look at the Daf-inspired variable-ratio transmission and decided that all the torque he was fixing to do to it would spit the belts out like French-cut string beans. So the project is on hold until Volvo can find something with better odds on life after the transplant.

Everybody has been down to have a look at his engine. "Ford, GM, Chrysler, the head knockers from Volkswagen, they've all been here," he says. "Hoglund [general manager of Pontiac] drove it. He got all excited. Alex Mair [an executive vice-president at GM] drove it. Said they could sell a million of them. But then they always make the same offer. They say they'll pay me to work with them for a year. Then if they like it, they'll negotiate. I know what they're trying to do. They just want time to figure it out so they can do it on their own."

This thing they're all trying to figure out is what Smokey calls his "phase-one adiabatic engine." Adiabatic is a term straight from thermodynamics, and nobody understands it. That's what makes this engine so intriguing: maybe Yunick has discovered what adiabatic means. That and the fact that it was rendered by an artist for the cover of *Popular Science* a year ago, looking very much like a nuclear reactor with a water-pump pulley on the front. The blurb said, "Smokey's amazing 150-hp two-cylinder auto engine uses heat energy others throw away." This was the clincher. Gas-station

PHOTOGRAPHY BY DON HUNTER

mechanics and corporate biggies alike know that car engines send more energy out the exhaust pipe than out the driveshaft. Radiator losses just compound the felony. There *has* to be a better way.

Everybody knows that, which has made the auto industry a plump target for charlatans pedaling a potpourri of schemes for extracting more bang from each beaker of gasoline. Most of them can be seen through with the naked eye. Not Smokey Yunick, however. He's busy recycling massive doses of heat back into the intake system, which kindergarten engineering says you can't do, and talking adiabatic as if he knows exactly what that means—moreover, talking adiabatic as if that gives him some special dispensation from the engineering laws that govern everybody else.

What if this guy in the creosote-finish cowboy hat is right? That possibility is what's drawn half of Detroit and twice as many private investors to the self-proclaimed Best Damn Garage in Town for a look-see. And that is what has inspired this fact-finding mission.

Now, I don't want to queer the verdict this early in the proceedings, but, just between you and me, I think pigs will fly before a couple of magazine guys like Sherman and me harvest the truth from Smokey Yunick. Yeah, we both spent time in adiabatic class back in engineering school, but Yunick didn't exactly fall off the turnip truck this morning, either. Starting in the early Fifties, his cars set the pace in NASCAR. Because they couldn't beat him, the carmakers finally had to join him; Hudson, Oldsmobile, Chevrolet, Pontiac, Buick, and Ford have all had his name on engine-development contracts at one time or another. Rarely over the past 30 years has he been without a Detroit deal, so he knows the technology and he knows the corporate do-si-do.

A lot of people would also say that he knows how to cook the pinochle deck. If there were a hall of fame for NASCAR cheaters, Smokey Yunick would be a first-round draft choice. Stories of engine high jinks and seven-eighths-scale bodywork are just warmups for the all-time favorite about the gas tank. It goes like this: Smokey was having trouble getting a car through Daytona inspection. The tech crew said the gas tank was too big. Smokey took the tank out and proved that it wasn't. So then they accused him of other infractions. When he decided the length of the list was getting ridiculous, he threw the tank into the back of his racer, cranked up the engine, and drove it out of the speedway and back to his shop. That's the kind of guy we're sitting across the breakfast table from.

The waitress appears. "Oatmeal," he says. The magazine guys opt for straight caffeine. He tells us that at one time or another he's made one-, two-, three-, and four-cylinder versions of his engine. Now he has five runners: a two-cylinder Rabbit, three-cylinders in a De Lorean and a Buick Skylark, and four-cylinders in a Horizon and a Fiero. The latter two are retrofits, kits adapted to existing engines. The internals are stock. Whatever testing we want to do will be on the 2.2-liter Horizon.

Sherman allows that we're not looking for numbers down to the third significant

Hot Vapor, or Just Hot Air?

CERO HOSCHEK

• Mr. Yunick wanted very much for us to believe in his engine. Once his idea was reasonably well protected by carefully written patents and a gaggle of well-heeled attorneys, he was prepared to disclose certain details. We could look at the hardware (at least what was visible under the hood of several test cars and on an engine stand), he would answer most of the questions we posed, and one prototype would be available for certain performance measurements. In short, Smokey was willing to reveal nearly everything about the engine except how it actually delivers on its remarkable claims.

In a nutshell, Yunick maintains that his hot-vapor engine makes 1.8 horsepower per cubic inch and substantially improves fuel efficiency. In the 2.2-liter Plymouth Horizon offered for testing, the assertion was 240 horsepower, a zero-to-sixty time of six seconds flat, and a highway fuel efficiency well over 50 mpg. This particular car had no emissions controls, but a modified De Lorean V-6 had passed EPA tests in the past.

The opportunities for checking Smokey's claims were limited in Daytona Beach, Florida, but we did the best we could under the circumstances. The *C/D* fifth wheel and a stretch of smooth, straight, and level road through the swamps would determine acceleration capability. We could compare the measured performance with previously tested automobiles to determine the actual power under the hood (using a simple power-to-weight-ratio analysis). To gauge fuel efficiency, we'd run Smokey's standard course: a two-hour, 101-mile round trip on Interstate 4 between Daytona Beach and Orlando, Florida.

It wasn't possible to bring a perfectly comparable baseline (an unmodified car with exactly the same specifications as the test Horizon's) to the party, but we came close: a renter with the same engine and body, but a TorqueFlite automatic instead of a five-speed like the Yunick-mobile's. Nevertheless, the Hertz machine would serve one purpose: as long as we wheeled it along the hot-vapor car's course, it would offer a reasonable check of how Smokey's route compared with an official EPA highway cycle.

All in all, the testing went smoothly, and it did deliver some fairly conclusive evidence. The TorqueFlite-equipped Horizon turned in 35 mpg over the road compared with its EPA highway rating of 36 mpg. (Therefore, Smokey's highway test is probably a bit *tougher* than the EPA's.) The hot-vapor-powered car delivered 51 mpg versus 47 mpg for an unmodified version of the same machine in (1983) EPA tests. Chalk up a fuel saving of 4 mpg, or nine percent for Smokey's team. In acceleration tests, we had less luck hitting the mark, but the hot-vapor-mobile did produce a zero-to-sixty time of 6.8 seconds and a quarter-mile elapsed time of 15.5 seconds at 91 mph. For comparison purposes, we offer you our road-test results for a standard 1984 Plymouth Horizon (*C/D*, December 1983): zero-to-sixty mph in 9.7 seconds and quarter-mile acceleration in 17.1 seconds at 80 mph. Obviously, the hot-vapor engine has a considerable horsepower advantage, but not as much as claimed, we feel.

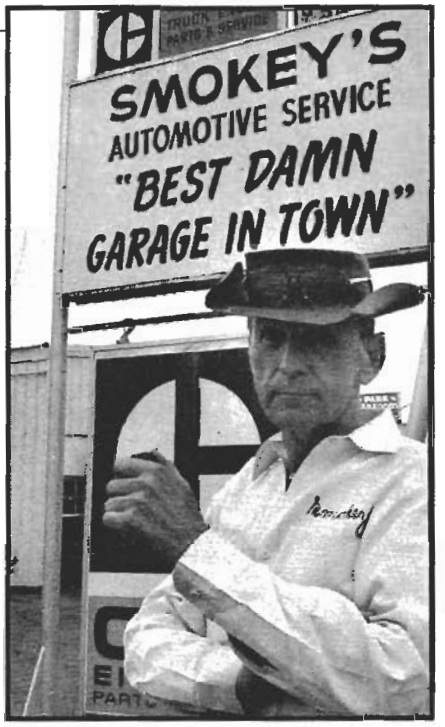
digit. We want to measure zero-to-sixty times. Yunick volunteers his fifth wheel. Sherman says we have our own. We also need a look at fuel economy. Sherman suggests a loop on public roads; he's made arrangements for a stock Horizon from a local dealer, so we'll drive Yunick's car and the stocker nose-to-tail around the loop and compare fuel consumption. Not exactly MIT-scientific but close enough for the truth to show. Yunick thinks that's fine. He even has a loop. Uses it for his own testing all the time—101 miles, eleven stops. In fact, the number he gets from it is exactly the same as what he gets on the official EPA highway test.

So far, so good. Yunick wonders what kind of fuel we're thinking about. Sherman says no-lead regular. Yunick doesn't like that. He wants to use Indolene, which is the standard fuel for EPA tests. Sherman doesn't want Indolene. Octane's too high, way above no-lead regular. If Yunick's grand adiabatic plan has a horsefly in the yogurt, it's detonation. Pumping all that heat into the intake stream should make it knock like hell. Indolene would tend to delay the onset of detonation.

Yunick doesn't dispute this point, but he still wants to use Indolene because that's the standard test fuel and all the Detroit tests are done with it; if we use something less advantageous, then his results are unfairly depreciated. He *could* calibrate his engine for no-lead regular. That's just not the way it is right now.

Sherman is digging in on the low-octane issue. Yunick allows that maybe we can do accelerations on the bad gas but we'd better do a few on Indolene first. The engine is about done for anyway. "It's got eight, nine thousand miles on it," he says. "Everybody drove it at the SEMA show, wheels spinning and smoking, tearing the shit out of it. If it explodes, I won't be surprised."

The Best Damn Garage in Town is half open-air truck repair of the style you see only in the South and half cinder-block bunker with signs on the doors warning off anyone who's not a blood relative. Inside are enough machine tools to make another



A six-second-flat zero-to-sixty time is the realm of a Porsche 928S; factoring through equivalent power-to-weight ratios, the 2300-pound hot-vapor car would need 165 horsepower to deliver such acceleration figures. It might actually be capable of producing that much horsepower on a good day, but it didn't during our test session. (Drivability was mediocre, and there was a crippling sag at the high end of first gear that no doubt hurt acceleration performance.) The 6.8-second zero-to-sixty time we did record drops the Yunick machine to a somewhat lower plateau; figuring through power-to-weight ratios again, we'd say that the car was producing a power peak of about 145 horsepower, a net increase of 51 percent over the stock engine's output.

Are a nine-percent gain in fuel economy and a 51-percent gain in power output in the same engine plausible? To find out, we discussed all the evidence we had with a number of experts to see if they could either shoot the hot-vapor theory full of thermodynamic holes or give it their blessing. In the end, they could do neither. They did, however, help us formulate an explanation about what is actually going on inside the engine.

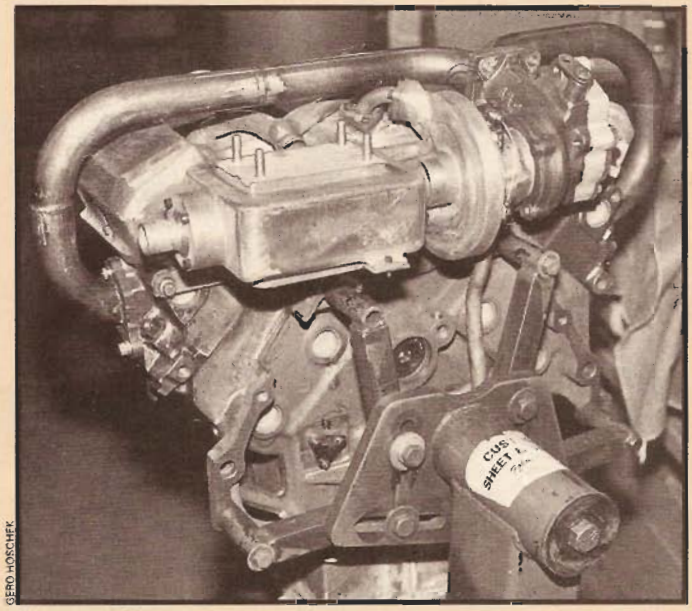
Dr. John C. Hilliard of Combustion and Fuel Research, Inc., in Ann Arbor, Michigan, and other Detroit-area contacts agree that the hot-vapor design could do what is claimed during part-throttle engine operation. Exhaust energy normally wasted out the tailpipe is effectively recycled to drive an exhaust turbine, which in turn spins a compressor wheel that prepares the intake charge for combustion. There are several potential benefits in such a system. First of all, the heat and the stirring action outside the engine completely vaporize the fuel and mix it evenly with the intake air. Second, since the charge is so nicely "homogenized," it will burn rapidly and completely inside the combustion chamber, even with a lean fuel-air ratio; the usual lean-misfire problems don't apply. And third, pumping losses will be reduced for two reasons: (1) with lean mixtures, the throttle plate will be open wider for a given power output; and (2) because of the slightly positive intake-stream pressure produced by the heated manifolding and the compressor wheel, the piston doesn't have to expend any work drawing in a full charge during the intake stroke.

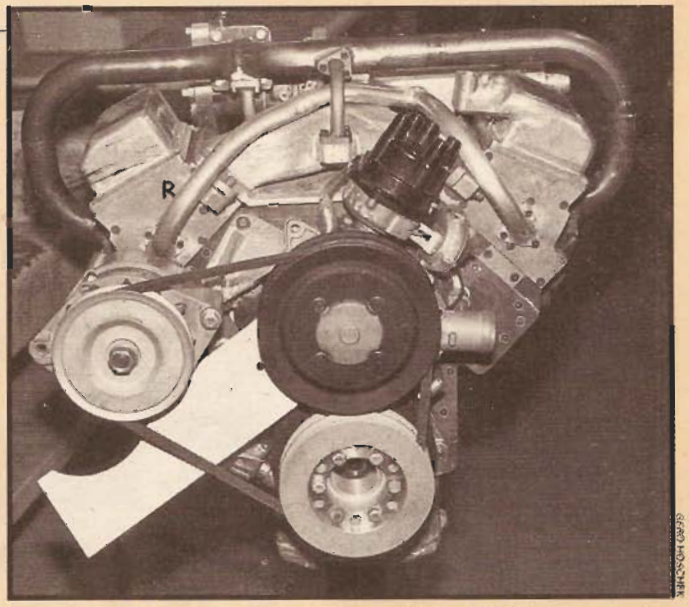
Dr. Hilliard likens the arrangement to two other highly successful designs: the diesel cycle and the Michael May Fireball combustion process. If his (and our) theories about the hot-vapor engine are correct, Smokey's invention uses quality (instead of quantity) charge metering, lean burning, and rapid combustion rates, just like the two aforementioned engines.

These theories fit the evidence we've been able to uncover at light loads (say, up to 60-mph cruising on the highway), but they fall apart during full-power, wide-open-throttle operation. Here, we suspect that conventional high-performance-tuning techniques apply and that the hot-vapor intake scheme is switched off to whatever extent possible. To make horsepower without detonation, engine tuners seek a dense (cold, high-pressure) intake stream and minimal exhaust back pressure. Our guesses are that the orifices in Smokey's exhaust-fed charge-heating passages don't really allow enough flow to hurt wide-open-throttle volumetric efficiency and that high-rpm water-flow rates also move the coolant through the vapor generator quickly enough that there really isn't much fuel vaporization during full-power running. Detonation could be avoided with a combination of a richer mixture and retarded ignition timing, both common practices in turbocharged engines. Our suspicion is that this engine's abundant power output has nothing to do with hot vapor but instead comes from standard race-tuning practices that are second nature to the astute Mr. Yunick.

We don't mean to imply that his engine is a sham. Although we feel that no new ground has been broken at the high end, the hot-vapor approach at the low end and the fact that both the high end and the low end are working together in one engine are significant accomplishments. Engine manufacturers around the world are working feverishly at improving part-throttle efficiency, and Smokey Yunick has demonstrated a viable approach to substantial gains.

There is more work to be done. Smokey hasn't as yet done much development with emissions controls in place, and both durability and drivability were far from commercial in the car we tested. Furthermore, it's important to realize that the hot-vapor engine is only the first step in a four-step program. Once Yunick gets around to phase four—ceramic engine materials, special lubricants, and minimal thermal losses—he'll likely call us in to verify some truly phenomenal gas-mileage claims. In the words of the man with the black hat, "Two hundred miles per gallon won't be any harder to achieve than 50 mpg was." —*Don Sherman*





One-third of a Buick V-6 was used to make the V-2 hot-vapor engine.

Germany, though you might have to settle for a Liechtenstein, given the lack of elbow-room. Over by the bench is an engine stand draped with a shop towel. Yunick eases back the cover, revealing an object halfway between modern sculpture and nothing you've ever seen before. It's a V-2, the back two cylinders of a Buick V-6, complete with the original bell-housing flange. The scars where the front four cylinders were amputated have been healed over with aluminum plate, and the original water pump and accessory drive have been affixed to the front of that. Most everything on top is hand-hewed aluminum: pipes, plumbing, ducting, and stubby little rocker covers exactly one cylinder long. We're looking at a nice piece of metal work.

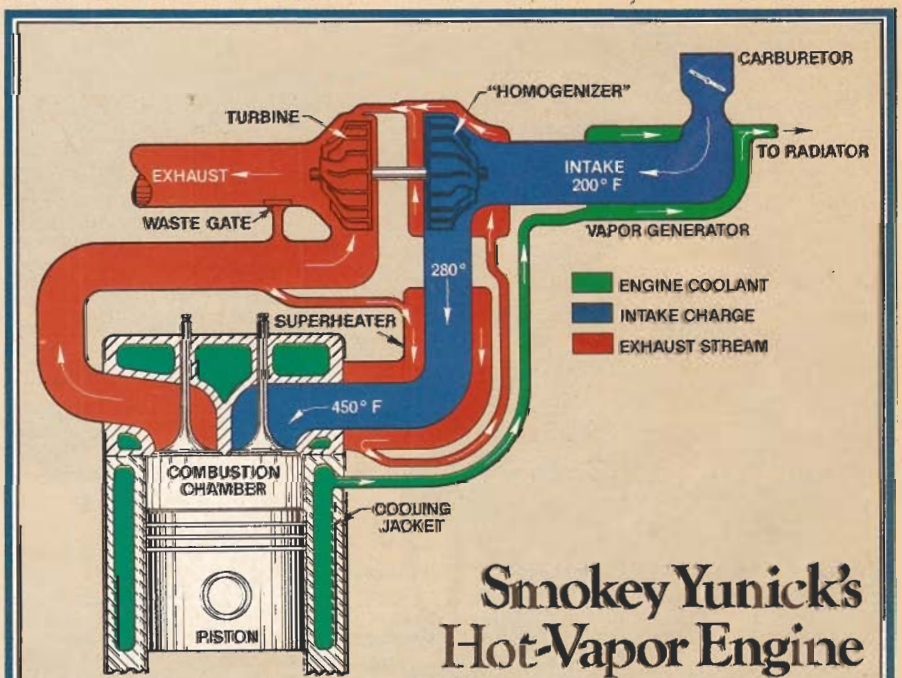
Yunick points to an aluminum box under the carburetor. "That's the vapor generator," he says. "All the cooling water goes through the vapor generator, then to the radiator."

That's the first stage of the intake-heating process. The second stage happens in the "homogenizer," where the air-fuel mixture goes immediately after leaving the vapor generator. The homogenizer looks like a tiny turbocharger. In fact, it's made from a turbocharger, a cute little Japanese IHI. But Yunick insists that it's not a turbocharger. It's there to whip up the air-fuel mixture. "A turbine is a turbine. They're all about the same. I say this is a homogenizer, but you can take a look at it and call it whatever you want." This statement is Smokey Yunick at his finest. Insisting that a turbocharger is not a turbocharger is a direct assault on logic, but he deftly defuses the point by saying we can decide for ourselves. That option, however, is offered in a tone that suggests, if the listener doesn't have enough imagination to see beyond the obvious, we might just as well spend the rest of the day at the beach.

For sure, his homogenizer differs from every other turbocharger in the world in that it has an exhaust-heated jacket welded around the outside of the compressor snail. That—and presumably its normal compression function—is what makes it the second-stage heater.

From there the twice-heated intake charge is directed into an exhaust-heated intake manifold, which he calls the "superheater." The air-fuel mixture leaves the superheater at 450 degrees Fahrenheit, according to Smokey.

He might just as well say the earth is flat. It would be as credible. Everybody knows the next thing you do to a turbocharged engine to make it run better: you add an intercooler. Yunick has done the opposite: the "superheater" is effectively an interheater, an item you've never heard of be-



Smokey Yunick's Hot-Vapor Engine

Smokey Yunick's phase-one hot-vapor engine uses four stages of heating to prepare the intake charge for combustion. A vapor generator near the base of the carburetor starts the process by warming the fuel-air mixture to 200 degrees Fahrenheit. Next, the stirring action of the homogenizer wheel and the heat transfer from an exhaust jacket around the homogenizer's housing raise the intake stream to 280 degrees Fahrenheit. A second exhaust jacket surrounding the intake manifold acts as a superheater, boosting the charge temperature all the way to 450 degrees Fahrenheit. The waste heat of combustion drives the exhaust turbine and provides most of the energy that's used to raise the temperature and the pressure of the intake stream. A smaller than normal radiator limits the heat rejection from the cooling system.

cause there's no word for a scheme as contrary as this one.

Yunick speaks in a low voice, confidently, like a teacher revealing the mysteries of chemistry. "Detroit says that 235 degrees Fahrenheit for the air-fuel mixture in the chamber is the absolute limit. Beyond that they lose control of combustion. And they're absolutely right for the Otto cycle [the thermodynamic textbook name for what happens in a spark-ignition engine]. I don't have that problem."

The claims for this engine are as extraordinary as the idea behind it. He says power output is 1.8 hp per cubic inch. The Chrysler four-cylinder we'll drive makes 240 hp. And it'll do over 50 mpg in the highway test; it did 54.6 yesterday morning, as a matter of fact. Does it meet emissions regulations? This particular car hasn't been tested, he says, but he has met the standards with other engines, so it's just a matter of working out the details.

How can this be? Engine experts say that vaporized gasoline, which Yunick surely achieves with all his intake heating, may result in as much as a ten-percent improvement in fuel economy at light loads, such as the EPA highway cycle, but it's a big loss at full power. Plus it encourages detonation. Heating the air-fuel mixture at full power—and turbocharging on top of that—you might just as well put a .357 Magnum up to the cylinder head. It's engine-cide.

"For what they're trying to do, yes," Yunick says. "I'm using the Otto cycle and the expansion cycle in tandem. The expansion cycle is what happens in a steam engine. Pressure from the steam doesn't blow the piston down. It's heat that does the work. The piston expands the steam."

He again insists the homogenizer is not a turbocharger. "It's a check valve. With all the heat going into the superheater, the air-fuel tries to expand and back out of the carburetor. The homogenizer won't let it back out. It turns all the time, 4000 to 6000 rpm even at idle. It's set to hold about thirteen pounds of pressure. But it's not making the pressure like a turbocharger. The heat makes the pressure."

This is a balanced heat loop: "I'm using more heat from the fuel. To get more power, use more heat. Never was any reason to cool engines if we had materials to stand up. Alpha and beta silicon carbides, they're okay up to 2700 degrees Fahrenheit. My phase four, it's a box with two holes, air in and exhaust out. No cooling."

Your fact finders are being led into the uncharted regions of the thermodynamic map. Nobody ventures into this forest, possibly because they think they know better. Yunick speaks with unswerving conviction, but his blue-green eyes wander around the shop, as if he knows that piling this tangle of theory on somebody and peering through his bifocals at them at the same time would blow all their fuses. My eyes are

GERO HOSCHEK

Smokey's faithful sidekick, Ralph Johnson, explains highway-mileage test procedures.

drawn to the hat. It has aluminum chips from some forgotten machining operation embedded in the oily ring where a band should be. Kuh-*rist!* Would a guy in a hat like that dare lie to us? Or does he wear the hat as a subterfuge so he can lie?

Sherman looks very skeptical. He wants to see inside the homogenizer. Yunick indicates that wouldn't prove anything, so Sherman excuses himself to go pick up the stock Horizon. I decide to probe Yunick about more conventional theories, just to see where he stands. Where he stands is not behind diplomacy: "Lean burn is ridiculous. You have to burn at stoichiometric [the chemically ideal ratio of fuel to air] to get the most out of the fuel. Anything less, you're going to lose economy. Lean burn is just horseshit."

I wonder if he met with Iacocca when Chrysler was dickering on his engine. "No," he says. "Last meeting with Lee, I called him a loudmouthed dago, so I wouldn't have thought we'd get too far if we did."

He's wary of Detroit trying to steal his engine. He claims to have invented variable-ratio power steering and a few other developments in common use today, without ever benefiting financially. The engine is somewhere in the patent process now. "The patent office says this may be the biggest automotive invention in 40 years. On a one-to-ten, the patent is about a nine or a ten, but what does that mean? Guy who starts first and runs fastest, that's the only protection an inventor has."

This is the racer mentality showing through. Since we'll have to confront his reputation for rules evasion sooner or later, I try to ease the conversation in that direction.

"The only real defense in racing," he says, "if somebody else is cheating, you gotta, too. Doesn't do any good to bitch.

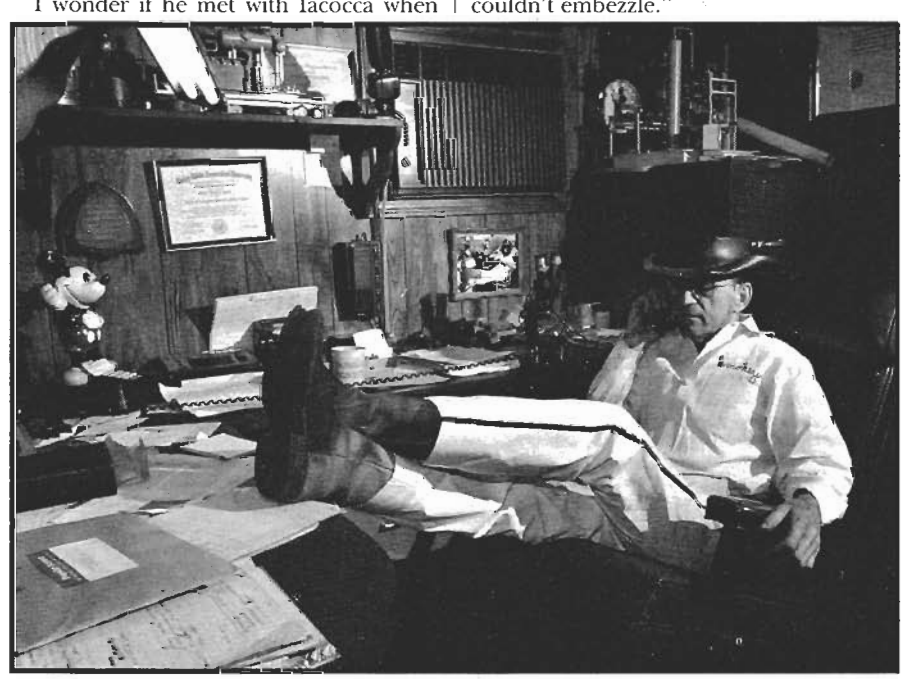
"If there was a cubic-inch limit, I would never screw with that. To me, a big engine is cheating.

"Another thing I didn't like was big gas tanks. But everybody was doing it.

"Used to be you could use additives in NASCAR. We used nitrous. The bottle is over there," he says, inclining his hat toward the far side of the shop. "But when they said you couldn't use additives, we didn't use nitrous after that.

"Nobody said you couldn't do certain things—lips, belly pans, move the crank. So I did."

Yunick has been consistent over the years in using this defense, but it seems disingenuous, like an accountant proclaiming his innocence on Judgment Day by saying, "But the Ten Commandments never said I couldn't embezzle."



I ask him about the legend: did he really drive off without the gas tank? "No, never happened."

"Somehow, your reputation has you more of an offender than the others."

"Probably I was," he concedes. "I worked that rule book over real good."

"Don't you think that hurts your credibility now that you're trying to sell a mysterious engine to an industry?"

"No, not at all," he says without hesitation.

This seems an amazing response to me, but I suppose a fox never sees himself as a menace, either. You have to ask the chickens about that. Bernard Robertson, director of powertrain engineering at Chrysler, was one of Detroit's visitors to the Best Damn Garage in Town.

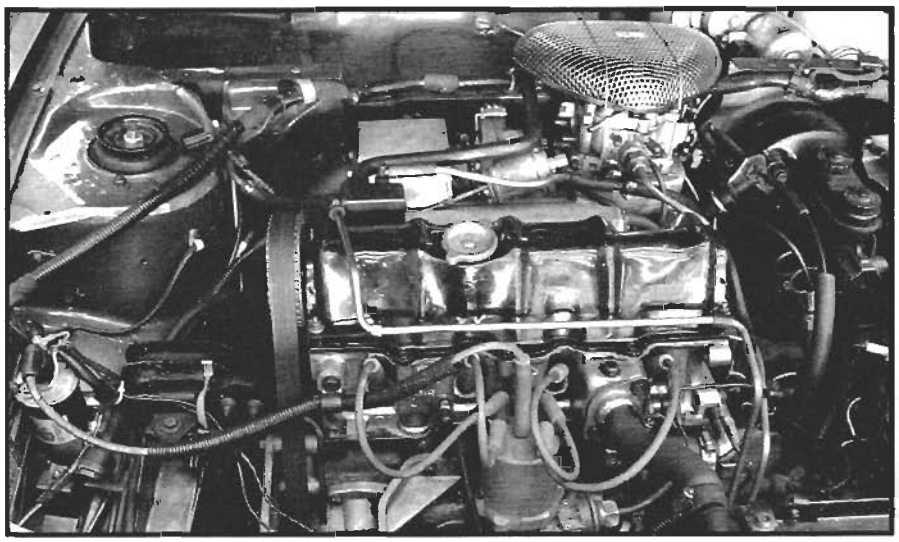
"I always had the feeling," Robertson says, "that with his background in NASCAR it would be easy to put one over on us, hide fuel tanks and hide radiators.

"One other thing. He does beautiful work. Yet when we went down for a test drive, there were really obvious flaws, things like heat shields hitting the floor. There's nothing fundamentally wrong with that, but he's a much better car preparer. It reminds me of going to the used-car lot, and the salesman says, 'Here's a real nice one. Just got it in yesterday. Haven't had a chance to go over it.' Go back a month later and he says the same thing. He leaves it up to you to figure out what's wrong. Smokey's like that. He'd say he just had the engine out yesterday and hadn't had time to work out the details. But I never believed that. I got the distinct feeling the noises were there to cover up something else, like spark knock."

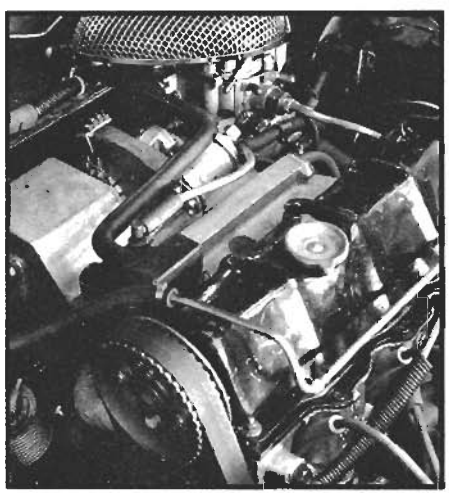
Yunick decides we've talked long enough. It's time for action. Sherman isn't back yet, so we'll take a ride without him.

The Horizon has a console studded with odd gauges. Yunick eases into the side street, coasting toward the Beach Street intersection where the light is threatening to go red on us. Cross traffic is bearing down. At the last possible second he gasses the poor little Plymouth. The front end lurches up, lifted by the amazing acceleration. Something judders against the floor. The tires squeal bloody murder. I'm concentrating on needles sweeping their gauges. He catches second gear halfway around the turn, and the front tires lose their composure entirely, screaming for mercy. Out of the corner of my eye I see the hat swivel toward me, back to the road, then to me again. He wants to see what I think. He loves this part. Smokey Yunick doesn't dazzle you with computer printouts. Gas it and go. This is his style. Here's where the science meets the road.

Within a half-mile he pulls over so I can drive. The engine has three bags full of power. Not 240 hp, maybe not even 200 hp, but a crazy amount for a 50-mpg car.



A Rochester two-barrel carburetor meters fuel to the hot-vapor engine in the test Horizon.



The gearing was obviously chosen for economy. I try the usual ploys to make it detonate. Full power through the lower gears. Lug down in fifth, down to 1200 rpm, then squeeze on full throttle. It sags momentarily, like any carbureted Datsun you ever drove. But it also moves smartly forward. And it detonates. There are all kinds of noises from things hitting the floor, as Robertson warned, but I'm convinced I hear ping—no worse than your neighbor's Granada, but ping nonetheless.

Yunick doesn't hear it. "There are some other noises," he says.

Sherman finally returns with a Horizon from Hertz. The dealer didn't come through, as dealers usually don't. The renter is an automatic, which will fuzz up the comparison with Yunick's five-speed, but the economy run is already on hold because of the wind. Gusts have come up as we approach midday. Yunick thinks we ought to wait.

Instead, we'll do the acceleration tests. Smokey's longtime assistant, Ralph Johnson, will drive, at least for the first few runs. I get the idea Yunick thinks the magazine guys might balloon-foot on him in the face of all that horsepower, might not bring home the good numbers. He obviously doesn't know Sherman.

We return with good news and bad news. The hot-vapor Horizon is quick, zero to sixty in 6.8 seconds. That's the good news. It also lost a cylinder on the fifth pass. Ralph Johnson was driving. The magazine guys figure they came out fine on that deal.

While Johnson and Yunick diagnose the engine, we sniff around the roofed-over area behind the bunker. The place is chockablock with remnants of past experiments. A white tower, now rusting, pokes through the roof 90 feet into the Florida sunshine; the windmill is off and grounded in the back lot. "I was doing alternative energy before it was fashionable," Yunick says. "But there's not enough wind and sun here in Florida to make it efficient. So much of what is taught, said to be gospel, is bullshit."

Certainly he tried to make alternatives work. Off to one side is a stripped truck chassis. On one end is a conventional liquid-in-tubes solar collector angled toward the roof. Similarly positioned on the other end is an eight-foot concave mirror. The accumulated dust says this rig hasn't chased the sun in a dog's age.

Some of the stuff around is recognizable: a scale-model wind tunnel maybe twenty feet long is situated in a loft overhead, apparently ready to go; race engines, no two alike, rest in racks; parts of his old Indy Eagle hang on the wall; a twin-turbo Chevy waits on one of the dynos. And some of the creations defy the imagination. A network of corroded plumbing and castings and gauges has been constructed on a wheeled steel framework. It may be the geothermal expander he mentioned earlier, or, who knows, maybe an atomic truck motor. If any more contrasts are necessary, right in the middle of the compound, shaded by the roof, is a shiny Bell JetRanger II. It's black and gold, his old racing colors. He flies charter with it when he has time. It's been useful for experiments, too. He found out some things about ground effects with it right in the back lot.

All of this stuff took a while to accumulate. Yunick is 60 years old, been here since just after World War II. He's used the years to figure things out for himself. Nobody could ever say he hid from his curiosity, and nobody could say he was afraid to go it alone. In fact, I'm sure he would have it no other way.

The number-one cylinder on the phase-one adiabatic engine is a gross leaker. At first Yunick and Johnson thought it had tuliped a valve, but now the failure has been traced to the piston. It looks as if the aluminum weevils have been chewing on a corner of the crown.

Sherman thinks that looks like a detonation failure. Yunick says it isn't. He says Chrysler admits this is a weak piston: they don't use it on the '84 models, and they don't use it on their turbos.

It's a hard call. The top of the piston shows no distress, just the corner, which is conspicuously notched, as if somebody had taken a hatchet to it. Sherman presses the detonation possibility. It's common knowledge that high manifold pressure and temperature, even with Indolene, will detonate.

"Yes, with normal fueling," Yunick says, "but not with hot vapor. Do you know about hot vapor?"

He's in his territory. Experiments have been done in the industry, but he probably knows as much about vaporized fuel as anybody. Sherman is stymied here. Besides, there turns out to be a crack in the piston, down through the ring lands and into the skirt. The rings are locked up tight. It looks like a structural failure, attributable to high loading for sure, but probably not detonation.

Sherman isn't impressed by the acceleration times. He says we've recently tested a stock Chrysler 2.2 turbo in a car at least 500 pounds heavier and it was only a second slower to 60. So that doesn't sound like 240 hp to him.

"But it didn't have the same gearing," Yunick says. "This has a 2.20. What did the other car have?"

Sherman admits the other car was geared shorter, about 3.60, as he recalls. Yunick still has an out.

He does not, however, have a spare piston, short of disassembling another engine, which is his only choice if the car is to be on the road again for fuel-economy testing in the morning. As he works, Sherman approaches again, this time from the economy side. If the hot-vapor Horizon does just over 50 mpg in the highway cycle, that's only about ten percent better than the stock '84 model. A long gear and a turbo on a stock 2.2 might do just as well.

Yunick rejects that. Wouldn't have the same performance then. It couldn't have. The standard gasoline engine simply doesn't use as much of the energy in the fuel as his engine does.

"When you look at that superheater, you don't know what's in it. I'm not trying to make a mystery of it. I can only take you so far. I'm just trying to tell you the sequence of it like you would in a patent."

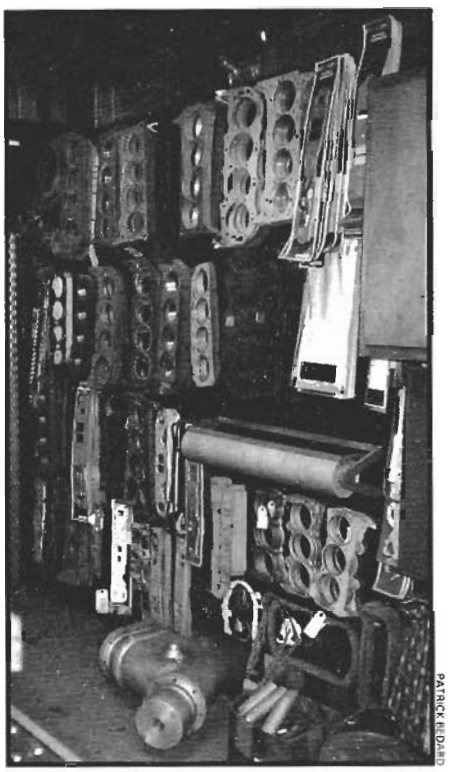
Sherman wants to know why we shouldn't think of this as a typical turbocharged engine.

"The homogenizer acts like a check valve," Yunick says, an edge showing in his voice. "The work isn't put back in with a pump. It's heat, 1800 to 1400 degrees, that part of the expansion cycle. That's what I work on." This is a seductive concept, like a cancer cure from apricot pits. Laetrile thermodynamics. The conventional texts never even allude to the possibility. Still, steam engines really do operate on the expansion cycle, as he says. There's no way we can stand here and say he's wrong.

I'm reminded of something else that Bernard Robertson said about Yunick: "He has a way of making you go back and challenge all the things you thought you knew, interrogate the standard truths you work with every day. Some of them aren't all that well founded when you scratch at them." Chrysler ultimately didn't believe that his thermodynamics added up but was very interested in a consulting relationship, just because it found Yunick to be a rare catalyst for original thinking.

Herb Fishel heads up Chevrolet's "race engineering" department now, but when he was at Buick a few years back, he coordinated a number of projects with Yunick. "You give him a set of parameters, he'll get to the bottom line, and you're not going to know a helluva lot about how he got there. You won't get answers to your questions, but what you get will work."

Yunick is preparing a replacement piston. Within five paces in any direction he has every tool and machine necessary to assemble a perfect engine: a hydraulic press, a Shadograph balancer, an Optron. We are surrounded, as well, by parts. A row of fifteen V-8 intake manifolds hangs over one set of benches. Dozens of carburetors line



PATRICK REDARD

shelves on one wall. A ton of oiled crankshafts are stacked beneath a row of worktables. Boxes upon boxes of bearings and spark plugs are neatly stacked along one wall, countless special oil pans rise along another, about a million head gaskets of various sizes and descriptions hang on yet another.

Doctors and dentists hang their sheepskins. Yunick hangs his experience.

Sherman the prosecutor eases over and says in a low voice, "I'm going out to pack up the fifth wheel. Why don't *you* ask him some hard questions?"

Yunick is bent over the parts washer, hat down. Above the rush of solvent, I can make out, off in the distance, the determined flapping of wings. It sounds like pigs warming up on the runway.

Smokey Yunick told the magazine guys all he's going to about his phase-one adiabatic engine. ●