

# CAR *and* DRIVER

SEPTEMBER 1964 • 50 CENTS

**Porsche 904  
160 mph Can  
Be Beautiful**

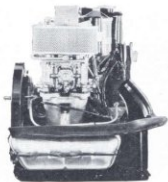


**Shelby-Cobra  
Academy For  
Race Drivers**

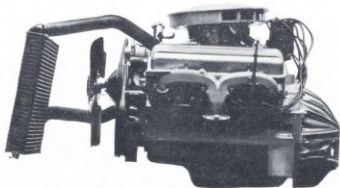


**5 RACES**

**SPECTACULAR 12-PAGE  
PHOTOGRAPHIC SALON**



**Why does Porsche offer you this little engine ...**



**when you can get this big one for about the same price?**

Casual readers of today's automobile advertising could easily assume that any engine producing less than 250 H.P. is for little old ladies. Why then a mere 88 or, at most, 107 H.P. in a competition car like Porsche?

No one can evaluate an automobile engine by itself. An engine can be judged only by its efficiency in running the automobile it was built to run.

Dr. Ferdinand Porsche developed the Porsche engine, not as a separate entity, but as an integral part of his unique automobile. Just as his concept determined the size and shape of the Porsche, so did it determine the nature, location and size of the engine.

Porsche's engine, refined over the years, is compact, air-cooled, easy on gas, and remarkably durable. It is made of aluminum alloy and assembled by hand. Since Porsche makes a mere 50 cars a day, engines can be checked, tested, and re-tested. Few automobile engines ever made have been so stringently inspected during and after manufacture.

The efficiency of this engine is best judged by Porsche's incomparable racing record: Thousands of vic-

tories against all types of competition in every corner of the world. Each year in Florida's 12-hour Sebring race, Porsche demonstrates its ability to run flat out hour after hour while more powerful engines quit under the strain.

No question about it—this responsive, economical, tough little engine is truly a giant-killer—just right for the car it was built to run. Is it right for you? Why not see for yourself?

Drive a Porsche and drive it a good long way. For name of nearest dealer, write Porsche of America Corp., 107 Wren Ave., Teaneck, New Jersey.

**PORSCHE**



## Road Research Report:

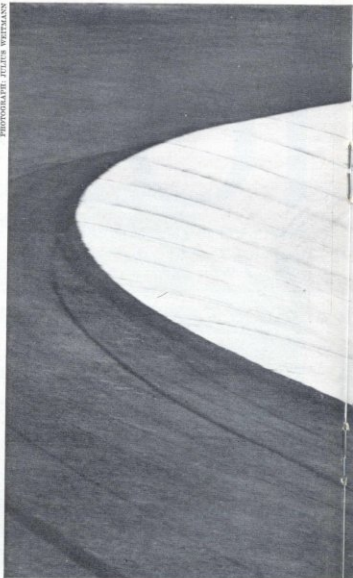
### PORSCHE 904

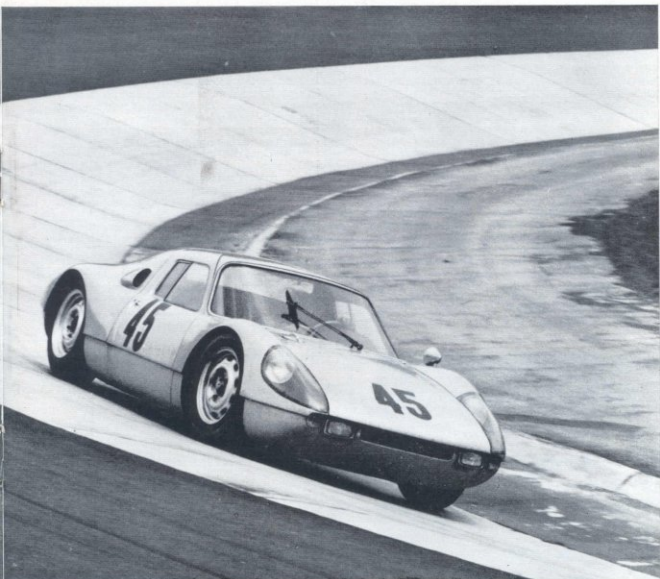
A two-liter dual-purpose Porsche with the handling of a Formula One car and the performance of a GTO.

Our formal introduction to the Porsche 904 should have been a disappointment. We were given the third 904 ever built, an ancient factory prototype that had been a mechanical guinea pig for the engineering department. It was spottily painted a dull, military shade of khaki, with virgin (if sullied) fiberglass showing through in places. It looked like some kind of crazy, knee-high reconnaissance vehicle that had failed its tests at the Aberdeen proving grounds. What obviously should have been a museum piece was to be our test car.

Baron Huschke von Hanstein, Porsche's racing-, press-, and public relations-manager, was apologetic. Despite the fact that 904s were being turned out at the rate of almost one-a-day, eager customers were snapping them up at a pace production facilities couldn't match. We grandly waved aside his reservations; after all, if a lowly farm tractor had been good enough for von Hanstein's decampment from East Germany many years ago, Any 904 was better than no 904 at all.

Starting our check-out procedure, the good Baron popped easily into the low slung coupe and beckoned us to follow. He's a very lithe fellow for his 53 years.





The doors run the full height of the car—even curving into the roof—but opening them reveals a foot-high chassis side rail that blocks off about a third of the aperture. With practice, getting in and out can be done quickly but never gracefully.

By the time we were aboard, von Hanstein was ready to fire it up. The fuel pump was clicking, the dual ignition switches were pushed home and a touch of the key-operated starter was all that was needed to fill the tiny cockpit with noise. Even with street mufflers and air cleaners, the 904 comes on like the loudest part of a war movie sound track. That old Porsche trait, spitting back through the carburetors, is still there, as was a certain amount of lusty backfiring. We could swear we heard every bearing, shaft, gearset, tappet, and reciprocating part in the engine. Underway, these sounds meld into a furry-edged buzz—then a hollow, throaty growl—and finally reach a richly harmonic, high-pitched drone as the 7000 rpm red-line is approached. The loudest noise at 60 mph is your heart pounding in anticipation, and normal conversation is utterly impossible at 100 mph.

As we banged, popped and stuttered toward the fac-

tory's heavily guarded exit, we had a chance to mentally review our notes on the car.

Technically, there is little novelty in the 904. Except for the chassis and body it is basically an amalgam of everything the factory has learned from racing Spyderys, Carreras and single seaters.

The chassis, which merely ties all the bits together, is a simple rail job. No space frames, no unit-body or monocoque construction—just a pair of deep, more-or-less box section rails that might be straight out of Frank Kurtis' design book. There are a few stamped indentations and cross-braces, but to the Sunday-supplement engineer's eye, it looks remarkably limber.

The body was designed by chassis engineer Schroeder and Ferdinand Porsche, Jr. (grandson of the late Dr. Ferdinand). It appeals to one's baser instincts rather than to one's aesthetic sense. There have been dark rumors that its aerodynamics and top speed are improved by leaving the detachable rear body section at home, and as for originality, it shows the influence of Carlo Abarth's 1958 designs for Porsche.

The factory claims the body—which is bonded directly to the frame rails—lends structural strength to

the chassis. It is made of an ersatz fiberglass (called Pantal) by the BASF firm in Ludwigshafen and molded by the Heinkel works. It feels rough and heavy by comparison to its more sophisticated American and English counterparts and seems to shred easily in minor racing shunts. Difficulties in controlling wall thickness are blamed for the 904s' excessive weight at Sebring where the heaviest example weighed 1710 lbs; the factory now promises a delivered weight of under 1540 lbs. As far as the FIA is concerned, it could weigh as little as 1360 lbs before it would be under its homologated weight less the allowable 5%. Alternate bodies are permissible . . . anyone care to try an aluminum-bodied roadster?

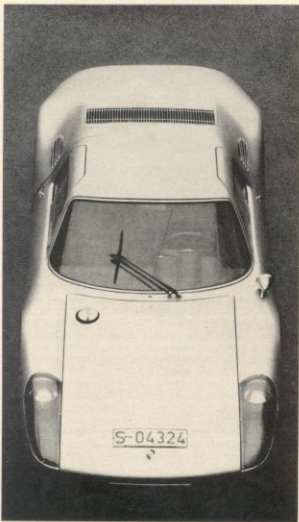
The exterior finish (silver—other colors on request) is good and our argument about chassis flexibility is shaken to pieces by one empirical spin around the block—it rides as solidly as a tree stump.

The engine is the tried-and-true Porsche two-liter, air-cooled flat-four with four overhead cams. (Incidentally, they've dropped all that mystique about chrome-plated bores and roller bearings in favor of sprayed-steel liners in aluminum cylinders and plain bearings for con-rods and mains, like the Super 90 and 356SC.) For the first time since the original series of

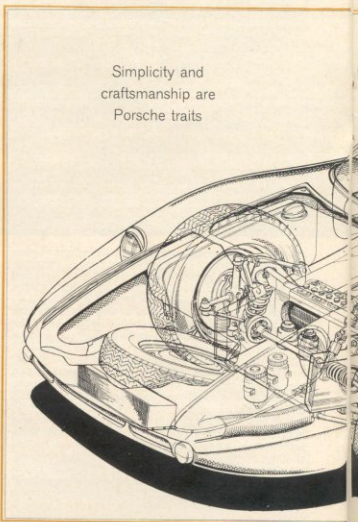
50 Porsches were built in Austria, the engine is ahead of the axle in a Porsche production car. Basically the same powerplant as the late-model Spyder and Carrera 2 engines, it is rated at 180 bhp at 7200 rpm with 144.5 lbs/ft of torque at 5000 rpm by the conservative DIN system. This engine differs from previous Porsche two-liters in having wilder cams, bigger valves and more fin area. Detuned for street use (with air cleaners and muffler) it produces 155 DIN bhp at 6900 rpm and 124 lbs/ft of torque, again at 5000 rpm.

There just happens to be room in the 904's engine bay for anything up to an aluminum 377 Chevy V-8, though experimentation thus far has been confined to a two-liter version of the Formula One car's flat-eight. Word around the back room is that the flat-eight is falling from favor, and that eventually the 901's flat-six—tuned to over 190 bhp—will be available in the 904.

The suspension is nearly identical in geometry and dynamics to the last (1962) Porsche Grand Prix cars, though some changes have been dictated by the sports car's different characteristics, and for easier "mass" production. It consists of a conventional double wishbone system front suspension and a complicated four-link rear suspension—both with telescopic shocks and coil springs. There's not a torsion bar in sight, save for the front and rear anti-rollbars. All the struts are



Simplicity and  
craftsmanship are  
Porsche traits



tubular steel fabrications, while the front uprights are forged and the rear hub carriers are cast in light alloy. The rear suspension employs two long trailing arms, a reversed upper wishbone and a slightly-trailing lower link. Light alloy trailing arms are optional.

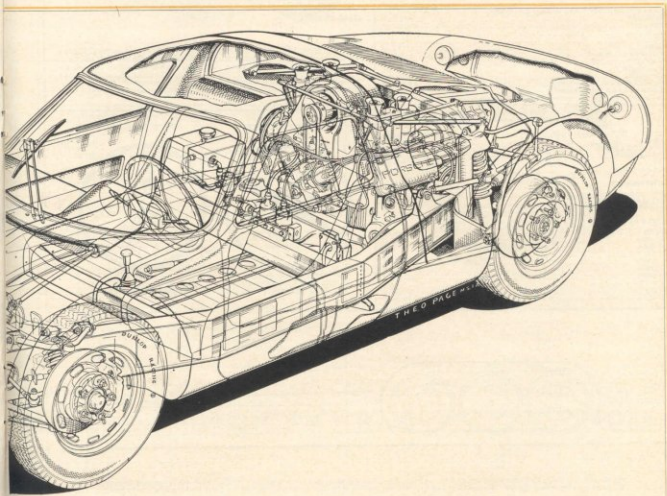
Single universal joints are used as the outboard ends of the open halfshafts; the inboard ends have two sets of U-joints that give a "double knee action" to accommodate small changes in track. This ingenious and positive system does what sliding splines and Metalastik joints do for other cars (though it would not be suitable for anything as powerful as a Cobra, for example). Unlike the 356C Porsches, the 904's suspension system is lubricated-for-life except for the leading ends (Heim joints) of the rear trailing arms.

The steering is a new-to-Porsche rack-and-pinion design from ZF (prefiguring the 901's steering) while the brakes are Dunlop-Ate four-wheel discs, mounted outboard. Like the 356C, the rear brakes have a small drum within the disc hub, to be used as an emergency or parking brake.

The gearbox is really the newest—and one of the best—features of the car (and, again, prefigures the 901's almost-identical transmission). It is a five-speed all-synchromesh unit, using the justly-famous Porsche synchro system, in a new casing with a host of improvements over the Spydery's five-speed. (The old

five-speed, never used in a production car, was basically the 356's four-speed with first in place of reverse and reverse hung off the nose piece in an auxiliary case.) A ZF cam-type limited slip differential is standard equipment on the 904, as is a 4.428-to-one ring and pinion. Sixteen gears are available with ratios ranging from 2.83:1 to .760:1 (six to 22 mph per thousand rpm with the standard 165-15 Dunlop SP tires). The gearbox selector pattern is artfully arranged with a normal four-speed H-pattern at center right; starting and reverse gears are to the left, beyond a spring-loaded detent. Reverse (forward) has an additional detent (down), so it takes the novice some time to get moving astern.

The dashboard (in black wrinkle-finish fiberglass) is unusually complete with instruments and controls. Centered in the nacelle is a 9000 rpm tach flanked by a 280 kmh (190 mph) speedometer on the right and a combination oil pressure/oil temperature/fuel gauge on the left. Various warning lights tell the driver if the heater is off, the generator is kaputt, the high beams are on, the parking lights are on, or if the turn-indicator blinkers are on. Two stalks on either side of the steering column control the horn, headlight dimmers, directional lights and auxiliary driving lights. There's a push-button windshield washer and an absolutely (Text continued on page 68; specifications overleaf)



## Road Research Report: Porsche 904

Importer: Porsche of America Corp.  
107 Wren Avenue  
Teaneck, New Jersey

### PRICES

Price as tested: \$7425 F.O.B. Stuttgart

### ENGINE

Air-cooled flat-four, light alloy block, 5 main bearings	
Bore x Stroke	3.62 x 2.91 in, 92 x 74 mm
Displacement	120 cu in, 1966 cc
Compression ratio	9.8 to one
Carburetion	Two Weber dual-throat 46 IDM
Valve gear	Four overhead camshafts
Valve diameter	Intake 1.935 in, exhaust 1.69 in
Valve lift	Intake 0.484 in, exhaust 0.508 in
Valve timing:	
Intake opens	79° BTC
Intake closes	93° ABC
Exhaust opens	85° BDC
Exhaust closes	60° ATC
Power (SAE)	196 bhp @ 7200 rpm
Torque	148.3 lbs ft @ 5000 rpm
Specific power output	1.65 bhp per cu in, 100.4 bhp per liter
Usable range of engine speeds	2000-7500 rpm
Electrical system	12-Volt, 45 amp-hr battery, 300 W generator
Fuel recommended	Super premium
Mileage	15-20 mpg
Range on 29-gallon tank	435-580 miles

### DRIVE TRAIN

Clutch	7.9-inch single dry plate		
Transmission	5-speed all-synchro		
		mph/1000	Max mph
Gear	Ratio	Over-all rpm	
Rev	2.610	11.58	50.0
1st	2.643	11.66	49.5
2nd	1.510	6.87	84.0
3rd	1.125	4.99	115.8
4th	0.889	3.94	147.0
5th	0.759	3.36	160.0
Final drive ratio			4.428 to one

### CHASSIS

Double rail frame bonded to fiberglass body.	
Wheelbase	90.6 in
Track	F 51.7, R 51.6 in
Length	161 in
Width	60.6 in
Height	42 in
Ground clearance	5.0 in
Dry weight	1435 lbs
Curb weight	1540 lbs
Test weight	1800 lbs
Weight distribution front/rear	42/58 %
Pounds per bhp (test weight)	9.10
Suspension: F: Ind., unequal-length wishbones and coil springs, stabilizer bar.	
R: Ind., four-link with radius arms (reversed upper wishbone and single lower arm) and coil springs, stabilizer bar.	

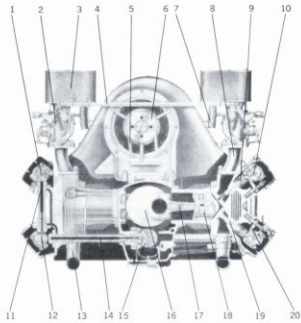
Brakes	10.8-in discs front, 11.3-in discs rear, 376 sq in swept area
Steering	Rack and pinion
Turns, lock to lock	2.0
Turning circle	44 ft
Tires	Dunlop SP 165 x 15
Revs per mile	820

### MAINTENANCE

Crankcase capacity	10.5 qts (dry sump)
Oil change interval	3000 miles
Grease fittings	4

### ACCELERATION

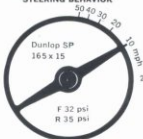
Zero to	Seconds
30 mph	2.0
40 mph	2.8
50 mph	4.2
60 mph	5.3
70 mph	6.5
80 mph	8.1
90 mph	10.2
100 mph	12.2
Standing 1/4 mile	108.5 mph in 14.2



1/10 SCALE

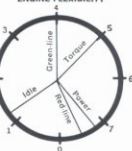
Street engine: 155 DIN bhp, 175 SAE bhp. (1, 10) Intake cams, (2) Solex 44 PII-4 carburetor, (3) Air filter, (4) Throttle rod, (5) Fanbelt, (6) Generator, (7) Carburetor heating tube, (8) Intake manifold, (9) Intake valve, (11) Short jackshaft, (12) Exhaust cam, (13) Exhaust manifold, (14) Long jackshaft, (15) Jackshaft drive gear, (16) Crankshaft, (17) Connecting rod, (18) Piston, (19) Exhaust valve, (20) Cam follower/finger.

### STEERING BEHAVIOR

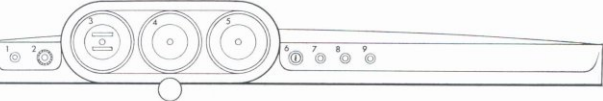


Wheel position to maintain 400-foot circle at speeds indicated.

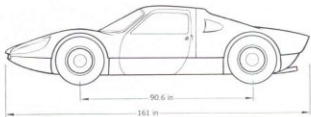
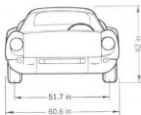
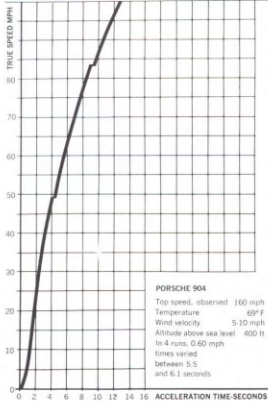
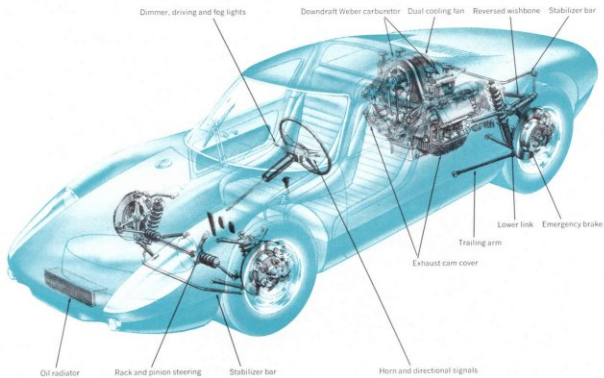
### ENGINE FLEXIBILITY



RPM in thousands



(1) Heater control, (2) Windshield wiper and washer, (3) Speedometer and odometer, (4) Tachometer, (5) Oil temperature, oil pressure and fuel gauge, (6) Ignition key and starter switch, (7) Headlight switch, (8) and (9) Dual ignition switches.





enormous truck-type single-blade windshield wiper with a "pantograph" strut to keep the blade vertical as it sweeps through its wide swath.

The molded foam rubber seats are stationary while the pedals and steering column are adjustable, like Ford's original (rear-engined) Mustang. With the pedals in their forward-most of the three positions, von Hanstein could neither fully de-clutch nor achieve maximum braking, as we found out to our horror at the first turn outside the factory gate. This has long since been corrected on the production 904s—we obtained one of the 105 examples that have been built as of this writing, to ascertain this and to better our acceleration figures—but heel-and-toeing in the old prototype was difficult for a six-foot-two driver.

A variety of optional-sized seats are available for production 904s to suit drivers of various girths and give enough headroom for up-to-six-footers. The seats, covered in blue felt, simply "plug in" to the recesses molded in the back of the cockpit. The interior, as drab as a Populist meeting hall, is surprisingly comfortable (for the driver; the passenger's right foot loses out to a battery box) even liveable for a trip of, say, six hours. There's even a shelf to brace the left foot while whistling around corners.

Ze engine, I was told, is just chust an oldt Carrerra mohtorr, vis only 130 horress. Ist much betterr vis too-litah 180 horresspowerrr rrracing engine. Oh sure, only 130 bhp. It didn't seem hardly enough to do any more than pool all our blood along our jellied spine, break our glasses across the bridge of our nose and leave the impression of our belt buckle on our stomach.

Von Hanstein was winding it out so quickly in each of the ultra-close ratio gears that we hardly noticed that we were doing 100 mph only three blocks from the factory. By the time we had taken that in, we were already turning 7000 in fifth and well out of town.

"You're sure President Johnson does this?" we croaked weakly.

"Ja, shoorr—look!" He took both hands off the small, wood-rim steering wheel. The 904 tracked along as steadily at 120 mph as a Yankee Clipper. The steering, however, is very sensitive (with only two turns, lock-to-lock): to change lanes he twitched the rim about half-an-inch. As a matter of fact, the 904 can snap from lane to lane at any speed with absolutely no wallowing, yawing or

fishtailing . . . and the factory drivers love to demonstrate this to unsuspecting Timid Souls. Lean, needless to say, is imperceptible.

After scaring the living hubris out of us, v. H. gave us the wheel. Fully expecting to stall it dead on the first try, we revved the engine wildly and cautiously eased out the clutch. Just when we thought it wasn't in gear after all, the clutch bit like a steam catapult, the revs dropped to near-zero and we were off in a series of jerks and chirps from the Dunlops. The so-called flywheel is about as thick as the ham in a drug store sandwich, so the revs fall off sharply between shifts—and the tires squeak again. It was only when we got driving the little monster like a full-house competition Corvette—slamming the shift through the gate as fast as our palsied hand could move—that things simmered down and smoothed out. But not even a drag Corvette would run out of revs so quickly in each gear. Although the



**CAR AND DRIVER CANDIDATE**

**DAN GURNEY  
FOR PRESIDENT**

**DAN'S OUR MAN**



904 is not comparable to Pontiac's GTO, it's noteworthy that the Porsche with its long "Le Mans" gearing is only 4/10-second slower to 100 mph than the Pontiac geared to turn 115-mph quarters.

Our wooly exuberance evidently got the better of von Hanstein so we dropped him off at the factory and set out alone for the open reaches of the Solitude circuit, which—the GP boys lap at something over 100 mph. It's a lovely and dangerous circuit lined with trees, a couple of hotels and restaurants, ditches, some fencing, poles and Germans. On public roads, its only closed to traffic on race days. The rest of the time, all kinds of native traffic is tearing around in both directions trying to prove something—skill, masculinity, lack of guilt in starting the last war or lack of responsibility in having lost every one since 1870.

At any rate, in the hairpin turns we discovered the expected: the cornering power is fantastic. The tires

just lock into the road surface and push the car against seemingly infinite amounts of centrifugal force. In the faster turns we were initially over-cautious. When at last we gave the beast its head, we learned what all those theoretical discussions about a "low polar moment of inertia" added up to—when you lose it, you lose it faster than the reflexes can follow. The factory test drivers later told us you can't hang the tail out on a fast bend; you track it around like a GP car or you are too slow . . . or you spin. With almost all the weight of the car within the wheelbase, it breaks loose as quickly as a broom balanced on your palm . . . with the straw end down. Not that it can't be done; the correction must be quick, sure, and metered out in exact amounts at the right time.

The rearward visibility is excellent—much better than one would expect, and better than a pre-1957 Volkswagen, for instance. It suffers only in the left rear quarter where a triangular piece of fiberglass fairing cuts off the view of who's passing you. Not bloody likely. Side and forward vision are as good as, or better than, the late lamented Speedster.

The big question in our mind, and perhaps in those of our readers, was: could this untamed beast find happiness as a pampered street car? (We were ready to start signing over all our travelers' checks . . . as a down payment.) The answer is yes—a highly qualified yes. It could be used for boulevard transportation, but the owner/driver would have to be slightly out of his mind.

There are those among us who are going to go out and buy 904s anyway, detuned as little as possible, and tear around the countryside like maniacs. They won't be dissuaded by the awkwardness of getting in and out, by the expense of setting up and maintaining the four-cam engine, by the harsh ride, nor by the insufficient steering lock (several tries are needed to make a U-turn on a narrow street). No sir, they're utter fools, and we wish we were among them.

On the other hand, as a competition car, it's an eminently practical and satisfactory choice. The SCCA recently classified the 904 as a class A Production car on the basis of its potential performance. By that standard it competes with the mighty Cobra. By the FIA's international classification it's an under-two-liter car where its closest rival is the very fast, very fragile Abarth Duc Mille ("2000"). The 904 is quick and strong enough to acquit itself well in any long distance event, and at \$7425 (ex-works) it's a pretty cheap way to get into the Big Time. **clp**