

PORSCHE 928

TECHNICAL ANALYSIS & DRIVING IMPRESSIONS

Tomorrow is here

BY JOE RUSZ

UNLIKE *Road & Track*, Porsche has yet to celebrate its 30th anniversary. For the record, that occasion is still two years away. But no matter, because the milestone in this prestigious firm's history was reached in March of this year. That's when Porsche introduced the 928, a car that should keep other automotive designers and engineers hopping for years to come. With the unveiling of the 928, Porsche suddenly plunges into the 21st century and quickly turns its back on nearly 30 years of tradition that began with Dr Ferdinand Porsche's rear-engine, air-cooled autos of the Thirties. Purists still may consider these to be the only true Porsches and may think of the late Doctor as the inventor of the sports car. But they had better restructure their thinking because from now on, the 928 will be the standard by which all future GT automobiles are judged. And the father figure, for those who must have one, will be Dr Ernst Fuhrmann, President of Porsche AG and Technical Director of the Weissach think tank that spawned this latest automotive upstart.

Compared to other cars, the 928 is an exception to current automotive thinking. Compared to existing Porsches, the front-engine, water-cooled V-8 coupe is an even more radical departure from traditional design. Not that there is anything unique about the concepts themselves. These principles have been in use for decades and with the introduction of the 924, two of them, water cooling and a front engine, have even found their ways into the Porsche camp. But it is the use of these concepts that makes the 928 so extraordinary.

We'll explore the mechanical details of the 928 later but for the moment let's examine its styling, the most obvious aspect of any automobile. The 928's Ferrari Daytona/Datsun Z-car styling is not unique to Weissach. Just who originated the shape we're not sure, but it's one that comes to mind when automotive designs are being kicked around. While one wag claims the 928 looks like a sportier AMC Pacer (an egg on wheels), we think the lines are somewhat reminiscent of the Cheetah racing cars of the mid-Sixties. That short stubby tail does it, although Porsche has punctuated what would otherwise be a large expanse of sheet metal, with two quarter windows and a rear hatch. Incidentally, that hatch is not all glass as in the 924. A meaty B-pillar which doubles as a built-in rollbar and 1-piece side windows without vent wings are also evident.

A flat, downward sloping hood with no deformations or protrusions dominates the forward half of the 928. Porsches have had their share of flat hoods before (the 914 and 924), but never have they been accented so enhancingly. How? By the headlights which fold down out of the airstream (like the late Lamborghini Miura's), yet remain exposed to the eye. At first it seems the lights should be covered, but after some consideration one realizes that the uncovered lights are used as a design element to set off that expansive front deck. (And keep the car from looking like a 924?)

Front and rear end pieces made of polyurethane are also an integral part of the 928's shape. The bumpers are shaped to blend perfectly with the bodywork (they're also covered with special "elastic" paint that won't chip because of light impacts) and serve to enclose the numerous accessory lights and the turn indicators on the 928. But most importantly, these synthetic nose and tail sections serve as safety bumpers and are capable of full recovery after even 14-mph front and rear collisions. Porsche showed us some slow-motion films of such crashes and the results were astounding: little or no damage to the 928. By using polyurethane, Porsche has done nothing new (Pontiac and Chevrolet

have relied on this technique for years). They have just done it more elaborately.

The 928's body is somewhat of a departure from current Porsche construction. Although the unitized shell, including the roof, floorpan and various inner panels, are steel, the front fenders, hood and doors are aluminum. It's Weissach's way of achieving perfect balance in this 3190-lb motorcar. Yet it's not a unique idea, even for Porsche which has used aluminum body components in previous limited production models. It's not that surprising, really, because the usual exotic car, such as the Ferrari Boxer, uses aluminum. In fact, even Detroit is using some aluminum these days and will certainly use even more by 1978. In addition to reducing the car's overall weight, aluminum offers another plus—its surface can be finished better than fiberglass. Needless to say, the 928's body carries Porsche's customary 6-year warranty against corrosion.

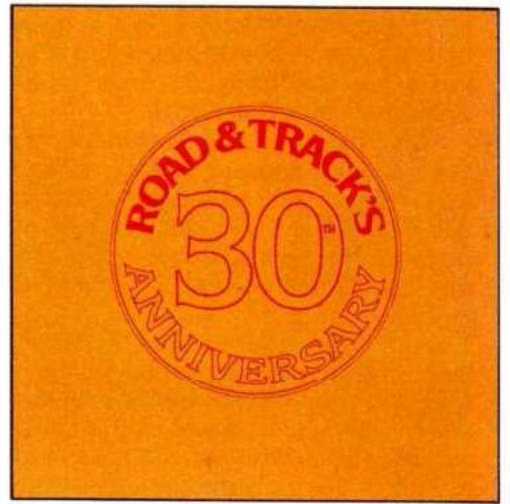
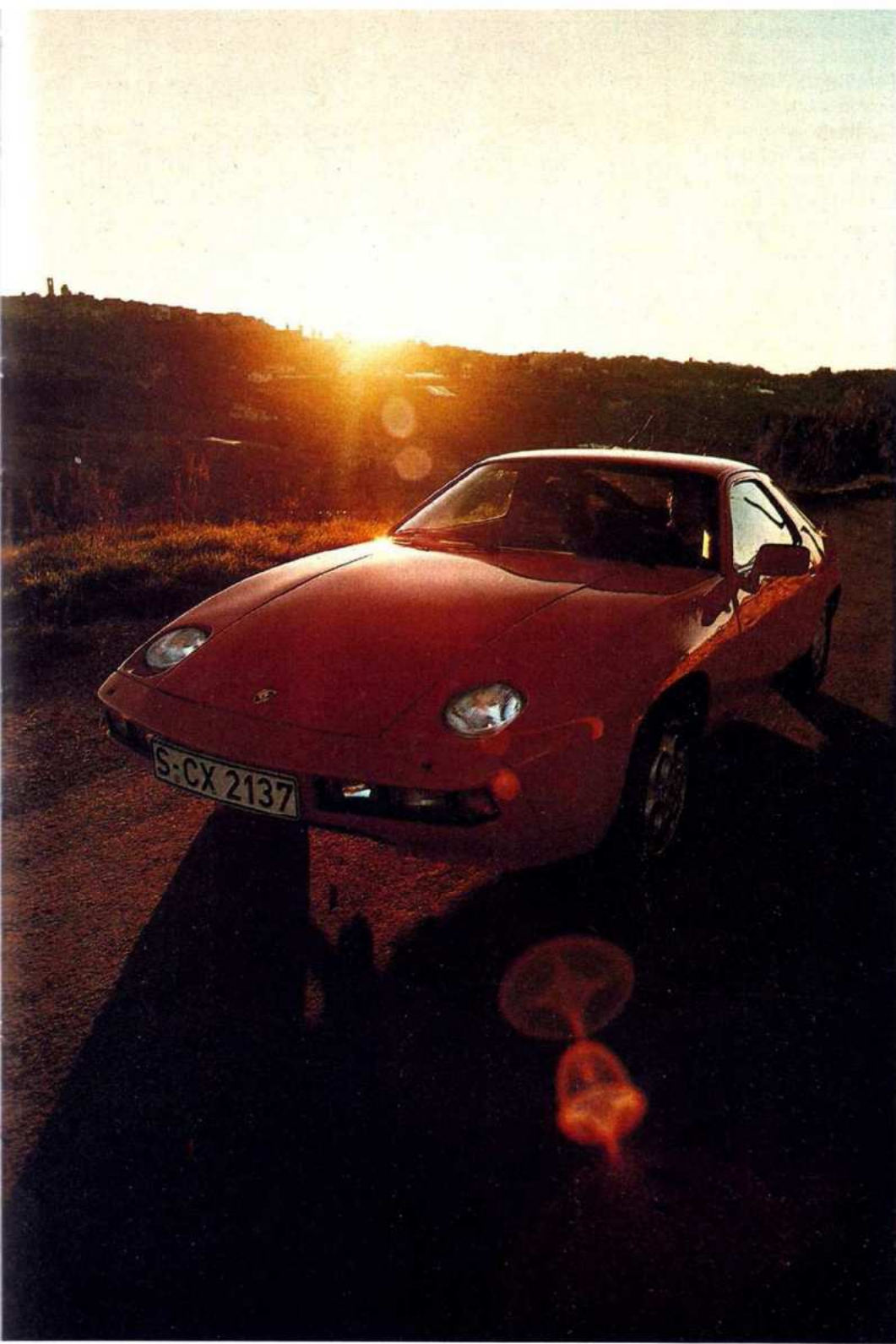
Viewed as a whole, the 928 is not a new design, just a different one. It's a shape that's so deceptively simple as to be dismissed at first sight. But upon reflection, the car's lines become more captivating, just as Porsche intended. In fact, Chief Stylist Toni Lapine says, "The 928 is a car that should grow on the public and become more appealing with age." This is what happened to the Type 901 (911 and 912), a design even factory personnel first



rejected. That shape survived to this day and could probably exist indefinitely.

Like the body, the 928's engine is also a model of simplicity. A water-cooled, sohc, 90-degree V-8, its overhead-cam design and 4.5-liter displacement gave rise to early rumors that it was a Mercedes-Benz powerplant. Not so, as we now know. To begin with, the displacement is 4474 cc, compared to the Mercedes' 4520 cc. And the 928 has a 95.0-mm bore and a 78.9-mm stroke versus Mercedes' 92.0 x 85.0-mm combination.

Mechanically the Porsche engine appears to be simpler than its M-B counterpart. The single overhead cams (actuating hydraulically compensated valves) are pitched at an unusual angle so that the cam covers appear almost vertical. Thus the engine resembles its flat-6 predecessor, by chance or by choice. The Porsche's camshafts are belt driven (Mercedes uses chains) and with fiberglass shrouding in place, they give the V-8 the look of two 924 fours attached to a central crankcase. Porsche violently ➡



PHOTOS BY JOE RUSZ

protests at such an implication and informs us that this is a totally new design.

Internally, the 928 engine is built in the Porsche tradition—strong. The aluminum alloy block houses a forged steel crankshaft with five main bearings. Connecting rods, also forged, are paired on a common crankshaft journal. Forged pistons with an 8.5:1 compression ratio enable the engine to run on regular 91 RON octane fuel. Bosch K-Jetronic fuel injection, fed by two electric fuel pumps, supplies the fuel-air mixture to the engine. This simple continuous-flow injection system is standard Porsche fare these days. It's reliable yet potent enough to allow the European engine to develop 240 bhp (DIN) at 5250 rpm. The same unit will be used on the 50-state U.S. version which will be equipped with catalytic converters and will develop about 225 bhp (DIN).

The question that inevitably comes to mind is, "Why did Porsche build a rather simple sohc engine and not an exotic powerplant befitting such an unusual car?" Because, "A Porsche is not a toy," according to Press Chief Manfred Jantke. The factory's Finance Director, Heinz Branitzki, elaborates by explaining that the 928 engine was designed "with growth potential." We agree, especially after examining the cutaway drawings and seeing how easily a second pair of camshafts could be adapted to the cylinder heads.

At this point we could conclude our report by saying that the 928 is a rather stunning looking, strong running GT coupe—a better Porsche and an exceptional exotic car. But earlier we said that the 928 was a step into the 21st century and to justify this statement we must elaborate on the car's suspension, running gear and drivetrain. After all, those are what make the 928 unique.

Like the 924 which preceded the 928 in the market place, even though it was designed afterward, the 928 uses a forward-mounted engine and a rear transaxle. The new 5-speed gearbox is also totally Porsche, though the optional 3-speed automatic is not. The automatic is a Mercedes-Benz component and perhaps that's what started the rumors about the 928 using a Mercedes engine. The transaxle is attached to a cast aluminum cross member that's part of the "Weissach axle" which I will explain

PORSCHE 928 SPECIFICATIONS

GENERAL

Curb weight, lb	3190
Wheelbase, in.	98.42
Track, front/rear	60.8/59.6
Length	175.1
Width	72.3
Height	51.7
Fuel capacity, U.S. gal.	22.7

ENGINE

Type	sohc V-8
Bore x stroke, mm	95.0 x 78.9
Displacement, cc/cu in.	4474/273
Compression ratio	8.5:1
Bhp @ rpm	240 DIN @ 5250
Torque @ rpm, lb-ft	250 @ 3600
Fuel injection	Bosch K-Jetronic

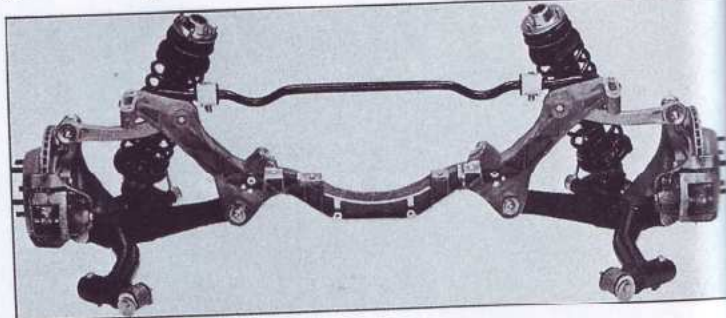
CHASSIS & BODY

Body/frame	unit steel with aluminum doors, hood, front fenders
Brake system	vented discs
Wheels	cast alloy, 16 x 7J
Tires	225/50VR16
Steering type	rack & pinion power assisted
Overall ratio	17.8:1
Turns, lock-to-lock	na
Front suspension	upper A-arm, lower trailing arm, coil springs, tube shocks, anti roll bar.
Rear suspension	upper trailing links, lower trailing arm, coil springs, tubular shocks, a-r bar.

DRIVETRAIN

Transmission	5-sp manual, 3-sp auto
Gear ratios: 5th (1.00)	2.75:1
4th (1.34)	3.69:1
3rd (1.82)	5.01:1
2nd (2.47)	6.79:1
1st (3.60)	9.90:1
Final drive ratio	2.75:1

Weissach axle uses articulated trailing arms pivoting in an arc about forward locating point. Lower links flex under loading.



Porsche: Cars of the Future Built Today

IN NOVEMBER OF 1952, *Road & Track* tested its first Porsche, a 356 Super coupe that so impressed then co-editor Robert Dearborn that he wrote, "This is The Car of Tomorrow." At the time it probably was. The car had an aerodynamic shape few other automobiles of that era could match. That, plus an air-cooled, 1488-cc engine with 65 bhp made the 356 a model of mechanical efficiency. Just how efficient that design's efficiency was, was borne out at the race track where the small displacement Porsches developed a reputation as giant killers, at least until the giants got a bigger hammer. So the Porsche was a success on the track and in the market place. But was it The Car of Tomorrow?

Only if Tomorrow meant the mid-Sixties. That's when other, more contemporary autos came along and turned the 356 into an enthusiast's car—a car whose idiosyncrasies only a lover of the marque could accept. But I am being too harsh because in the mid-Sixties, the 356 was

already an old car. In fact, its basic design dated back to 1938 and a prototype called the Type 114. That was Dr Ferdinand Porsche's first Porsche but not his first car, because in his illustrious career he had designed autos for Audi, NSU, Mercedes-Benz and several other European manufacturers. And Volkswagen, for whom he designed not just the Beetle, but the entire VW works in Wolfsburg, Germany. It was not surprising then to find so much of the Volkswagen present in the early Porsche. The twin trailing-arm front suspension with its parallel upper and lower torsion bars, the single trailing-arm rear suspension with torsion bars and those notorious swing axles, were concepts borrowed directly from the Beetle. So was the engine, an air-cooled, pushrod-actuated, overhead-valve flat four cylinder. In both the 114 and the 356 prototypes, it was mounted in front of the rear axle. But by the time the first production 356s rolled out of the Gmünd, Austria assembly facility in

1948, the engine was in the back, just as in the VWs.

Those early 356s were simple machines that belied their Volkswagen heritage, as I discovered upon driving R&T Art Director Bill Motta's 1955 Continental. A push of the starter button quickly brought the dual Solex carbureted engine to life and a blip of the throttle cleared it for use. Though the sound is throatier than that of an early VW engine, I feel that aside from a few mechanical refinements, the Porsche and the VW are remarkably similar.

Setting the Continental into motion takes a bit of doing, because at low speeds the engine does not have an abundance of torque. But once underway, the acceleration is brisk for a car of this vintage. The Porsche shifter, well worn after 22 years of use, is smooth. Its long throws make gear selection easy—I mean, what other gear would you expect to find in the upper right-hand corner? A baulky 2nd-gear synchro, quite common on

later. The transaxle faces forward so that the gearbox section rests ahead of the rear axle, just under the rear seats. Tying the transaxle and the engine-mounted clutch together is a torque tube which encloses the driveshaft. Besides protection for the driveshaft, the torque tube also serves as a strengthening member.

By mounting the engine and transaxle at opposite ends of the car, Porsche has achieved 50/50 weight distribution. This perfect balance is one of the reasons for the car's incredibly good handling. The other reason for the 928's responsiveness is the suspension which embodies many of the best concepts (remember, we said *use* made the 928 unique). To begin with, coil springs at all four wheels is a change of pace for Porsche, where torsion bars or torsion bars and coil springs have been the norm. Except for the racing models, the last production Porsche to use all-coil spring suspension was the 904GTS, built in 1963 and 1964. With the 928, Porsche has come full circle and with good reason—coils give more freedom to chassis, suspension and body designers than do torsion bars.

Up front, an upper A-arm and lower trailing arm are used in conjunction with the aforementioned coil springs and also with tubular shock absorbers. An interesting aspect of the lower arm is that it's a large aluminum casting and provides not only location of the wheel but also fore and aft compliance. A 26-mm anti-roll bar adds the necessary roll stiffness to the 928's front end.

At the rear is Porsche's *piece de résistance*, a suspension module Porsche calls the Weissach axle. It's a large, cast aluminum cross member to which are attached lower articulated diagonal trailing arms and upper transverse links. Once again, coil springs and tubular shocks make up the rest of the suspension package that achieves some stiffness through the use of a 21-mm anti-roll bar. In reaction to braking and cornering forces, the flat transverse arms bend, acting as leaf springs, and the diagonal trailing arms pivot in a 1-in. arc. This movement of the trailing arms compensates for the natural tendency of the wheels to toe-in during deceleration, especially when slowing down in a curve.

Realizing that toe-in causes a car to tighten its line and turn into the curve, possibly into an opposing lane, the factory came up with this unusual rear suspension package. Besides toe-in

compensation, the Weissach axle also has built-in anti-squat and anti-dive controls serving to make the car even more surefooted. Power assisted disc brakes and power steering make driving the 928 even easier.

The 928's cockpit exhibits more of the same inventiveness that is found outside and underneath. The speedometer and tachometer are prominently displayed as they have been in every other Porsche. But in the 928, the primary instruments and gauges are supplemented by warning lights grouped into two categories—vital (loss of engine oil, brake fluid, etc), and important (low washer fluid, brake lining wear). Switches and knobs mounted on the dash, the center console or beside the driver's seat actuate driving lights, fog lamps and headlight washers. Others control power windows, rear windshield wiper and washer, power seats (optional) and an electrically operated sunroof. A futuristic touch is a driver actuated rheostat that aims the headlights to adjust for changes in ride height or vehicle attitude. Unfortunately, this feature probably won't be included in the U.S. version.

The 928's steering wheel offers height adjustment and moves the instrument pod along with it. So the primary gauges are always in line with the driver's vision. But the steering column does not adjust in and out. To compensate, the pedals, foot rest and shift lever may be adjusted to suit the driver, but only by a capable mechanic.

Engine in front, gearbox in rear, results in ideal balance.

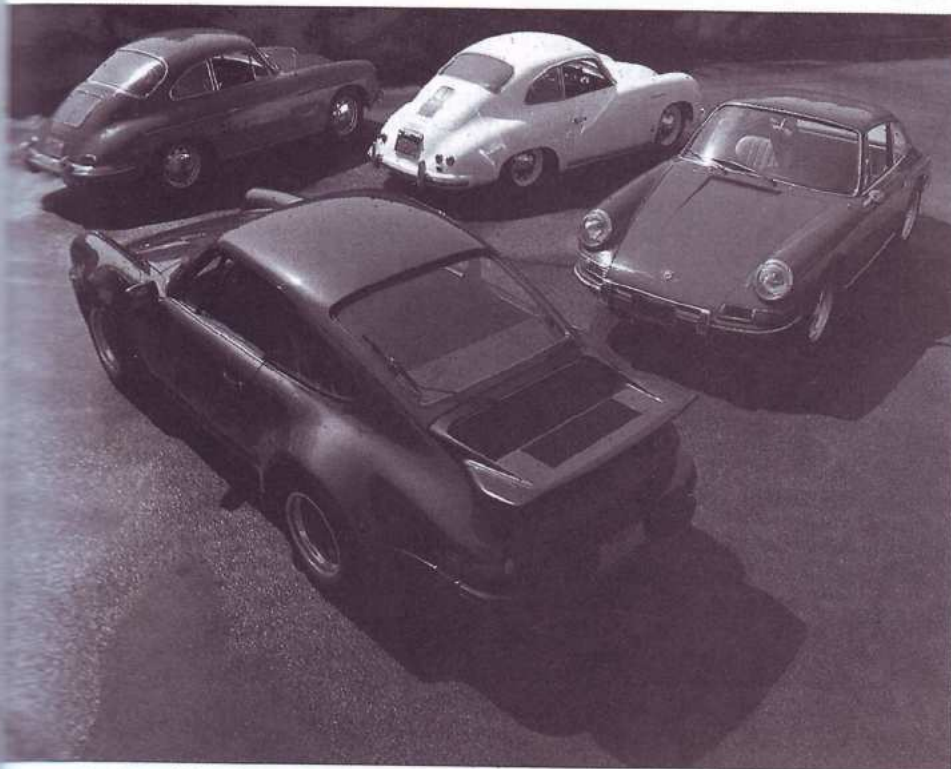
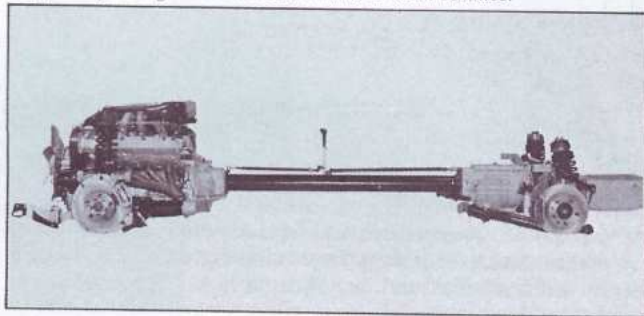


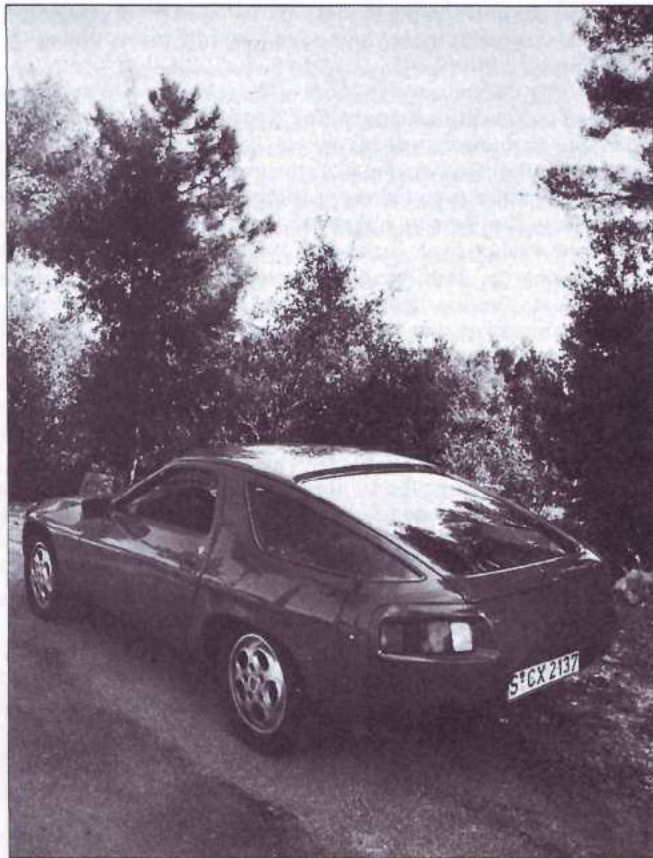
PHOTO BY THE AUTHOR

Traditional Porsches: 356C (rear), 356 Continental (center), 911, Turbo Carrera.

some of these cars, was a bit of an inconvenience though.

Yet it is cruising and handling and not its less-than-lustrous acceleration that make the 356 a spirited road car. In spite of its age the car is very tight, perhaps even more than some of its successors like the 911 and 914. Engine noise, which I thought would be oppressive, is actually quite subdued with the 1488-cc four cylinder growling away softly behind you. Handling is certainly not as sophisticated as on my own 911 (the 356s used swing-axle rear suspension). But it is commendable for a car of the Fifties. In fact, there are a few Speedster owners who would say the handling is remarkable. They're the chaps who race these vintage Porsches in Sports Car Club of America events. And make it all the way to the runoffs.

Porsche made do with this archaic design until the mid-Sixties. In a progression of models ranging from 356 A to C (1955 through 1965), they improved the brakes which finally became 4-wheel discs with the 1964 model year. And they updated the engines, increasing displacement, improving cylinder heads and induction systems and gradually boosting




Driving Impressions

TO LOVE the 928 is to drive it, as I quickly discovered. Not quite accustomed to its styling, I was immediately enamored of its hearty exhaust note and its discernible but not unpleasant gearbox whine. It was all quite reminiscent of the Chevrolet

Corvette. But pulling smartly out of the driveway of the Mas D'Artigny Hotel in St Paul de Vence, France, quickly dispelled any suggestions that this was a German Corvette. As the tachometer needle rushed toward its 6500-rpm redline, the car's speed rose commensurately. With the speedometer hovering at 130 kph (80 mph), it was the relative absence of mechanical and wind noise that made driving the 928 a startling experience. In the past I always considered the Turbo Carrera to be exemplary in this respect. But the 928 changed all that. Here was a car that was not only quiet but even more civilized than the Turbo.

Because of its 50/50 weight distribution and its 225/50VR-16 tires (mounted on 7 x 16-in. cast alloy wheels), the 928 exhibited a neutral attitude that its predecessors seldom achieved. The handling was like that of a finely balanced racing car—responsive, flat, positive. A flick of the steering wheel put the car exactly where I desired. In tight hairpins, the car could be driven around properly, or (for fun) flat tracked by just letting the rear end come out a bit. But at all times it was the driver, not the car that made the decisions.

Acceleration proved to be one of the 928's strong points. The engine is flexible and pulls smoothly in 5th gear, even when lugged down to 2000 rpm. Though there is sufficient torque to provide ample pulling power in almost any gear, optimum performance is achieved by using the gearbox properly. Unfortunately, our route through the Maritime Alps did not provide a stretch of road long enough for a top-speed run, but I did find that at nearly 200 kph (120 mph) the engine still pulls strongly. So I reckon it would have little trouble achieving the 140 top speed quoted in factory specs. I also don't doubt that the 928 should be able to accelerate from 0 to 60 mph in just 6.8 sec, as the factory also stated.

After spending a half day in the 928 (trading off driving stints with the Feature Editor), I felt as refreshed as when I'd begun. It had been an effortless few hours in this car that seemed the epitome of a marriage between man and machine. No mere coincidence, but rather another example of Porsche's plan for the 928. As Heinz Brantzki had said, "The times of the old English sports car have changed. The concept of sports cars has changed. Nowadays comfort is just as important as sportiness." 

the 4-cylinder's output to a peak of 95 bhp (DIN) in 1964.

The factory also offered the race-bred, double-overhead-cam Carrera in limited production coupes, convertibles and Speedsters built from 1950 to 1964. But Tomorrow was already here and the 356 was showing its age.

With Ferdinand Porsche's son, Ferry, at the helm, the factory again moved into the future. This time the car was called the Type 901 and it debuted at the Frankfurt Auto Show of 1963 where it was called the 911. Yes, it was still a Porsche with the slippery lines and rear-engine design associated with the marque. But the VW-type front suspension had given way to MacPherson struts with transverse torsion bars, while the rear had semi-trailing arms, torsion bars and fully articulated axles (half shafts). The engine was also quite a departure from its VW-based predecessor. It had six cylinders instead of four, single-overhead camshafts and dry sump lubrication and was coupled to an all-synchromesh 5-speed gearbox. Its output, 130 bhp (DIN), took up where the four cylinder's left off. So did performance. Where the best 356, a 1600 Super Speedster tested in our April 1958 issue,

accelerated from 0 to 60 mph in 10.5 sec and reached a top speed of 105 mph, the lowliest 911, an early European production model tested in March 1965, had a 0-to-60 time of 9.0 sec and a top speed of 132.

At the time no mention was made of the 911 or its 4-cyl variant, the 912, as being the car(s) of tomorrow. Yet history has shown that the 901 was as much a car of tomorrow as the 356 had been. In the dozen years since its introduction (the first production models were 1965s), the car has been continuously improved and has reached almost total perfection (for a car of its type) in the Turbo Carrera. But even so the early 911 is still an impressive automobile, especially when one considers that it's a 14-year-old design.

My own 1967 911 with its 130-bhp DIN engine still excites me, even after I've driven the latest European GT or sedan. First, one notices the free-revving powerplant. Coupled to a gearbox with very low numerical ratios, the 1991-cc solic six will flat pull away from all but the healthiest of new sport cars.

Handling is as one would expect—very good in the hands of an average driver, exceptional in the hands of an experi-

enced Porsche pilot. With its rear-engine design, the 911, like the 356, is noted for its trailing-throttle oversteer, and it takes discipline to drive the car through a corner. Through the years, Porsche has subdued this trait quite successfully so that in the Turbo Carrera it's less noticeable.

Like the 356, the early 911 is built for touring and in all my 10 years of ownership I can find no cross-country trip that was not made more enjoyable by my Porsche. But as the first of a new design, my car, as well as all other early 911s, is mechanically very noisy. Those early engines are quite highly stressed (they have at least a 6800-rpm redline) and like to run above 3500 rpm. The result is lots of clatter from the valve train.

With the passing of each year, Porsche began tuning out the peakiness and noise of the early engines. They increased displacement (and with it, torque) from 1991 cc to 2195, then 2341 and finally 2687 cc in the latest U.S. 911s, and 2993 cc in the Turbo Carrera. In the process, the factory also improved driveability (something the early 911 was lacking in) by reducing cam timing and adding fuel injection. And in the case of the Turbo



Carrera, the factory reached into its bag of racing tricks and added a turbocharger to produce an automobile that is one of today's most sensational GTs.

The Turbo is simply unlike any other present-day GT. Its most outstanding trait is its acceleration which comes on with a rush when the boost kicks in at about 4000 rpm. In a flash, the engine reaches its redline and now, suitably warmed to the task, continues charging on upward toward the car's 155-mph top speed. Yet it does so with so little mechanical protestation and noise that it's eerie.

Porsche 911 handling reaches its zenith in the Turbo. Most of the idiosyncrasies of the 901's rear-engine location and semi-trailing-arm rear suspension are kept in check, so the Turbo acts less like a Porsche than its predecessors. There is still some oversteer, brought about by lifting off the throttle while cornering. But it's nothing the race-bred suspension and large wheels and tires can't handle. Actually there are moments when it seems like Porsche overcompensated for the car's inherent oversteer. For instance, when the boost comes on, halfway through a turn, the sudden surge of

power makes the Turbo understeer strongly and only careful juggling of the throttle keeps the car on its proper line. No wonder Al Holbert says the Turbo Carrera is a car one drives with three feet.

In 1965, Porsche introduced an economy version of the 901 for the less affluent buyer. That was the 912, a car that shared most of the 911's features except the engine. In place of the sohc six, the 912 used a 1582-cc, pushrod-actuated four cylinder that gave 90 bhp. This Porsche-built (and not VW) powerplant made the 912 a popular model, at least until the end of the 1969 model year, when it was dropped from the lineup.

The following model year the factory introduced the 914 to the economy-conscious buyer. In its most common form the car used a slightly modified Volkswagen Type 4 engine fitted into a Karmann Ghia-built body. Purists grudgingly admitted this car into the Porsche fold, but were a little more approving of the 914/6, a limited production 914 introduced in 1970. Porsche built just over 3000 6-cyl 914s between 1970 and 1971, and fitted each one with the 911T's 2-liter, sohc engine and the 901's 5-speed gearbox, brakes and running gear. Per-

formance of these 110-bhp (DIN) cars was admirable, but a \$6099 price tag that too closely approached the 911T's \$6600 base price stifled sales. Two years after its inception, the 6-cyl was dropped. The 4-cyl 914, still equipped with the VW-based engine (now more powerful), survived until January 1976 when production was discontinued. Shortly thereafter, this mid-engine design was replaced by Porsche's second-generation sports car, the front-engine, water-cooled 924.

After almost three decades, Porsche had become a formidable competitor in the automotive market place. The factory enjoyed sales of around 15,000 911s in 1976, their best year. Chances are Porsche could enjoy the same sales success with the 924. But Porsche does not live on past success and even as the Type 901 was settling into middle age, the factory's Weissach research and design facility was developing the latest car of tomorrow. That was design number 928 (all Porsche projects since the founding of the firm in 1931 have been consecutively numbered, with a few exceptions), a very non-traditional Porsche begun in 1971. Here was a car on which the German firm was staking its future. It was a car that would have to meet the more stringent emissions and safety laws that had come into being in the early Seventies. It was also a car that would have to compete against the designs of other manufacturers who had not exactly been asleep at their drawing boards. It was also the ultimate replacement for the 911, the last throwback to traditional Porsche design. But the world and Porsche were not yet ready for an expensive, V-8 engine GT car (the energy crisis had seen to that), so in the meantime Porsche looked across Germany to its VW-Audi family members for a more economical auto to replace the 914 and prime the market for the 928. They chose the EA425, a car designed by Porsche for VW-Audi which had relegated it to lesser priority. The 425 was conceived in mid-1972, but Porsche did not release it until early 1976. The coupe was very much like the 928 upon which it was based. Its water-cooled engine was in the front and it carried a rear-mounted transaxle. It even looked a bit like the 928. Porsche called this surrogate the 924 and while it became the basic Porsche of the future, it was still strongly rooted in its VW-Audi heritage. It was, after all, built around Audi and Volkswagen components in an Audi assembly plant.

Satisfied that the world would not crumble around us all, Porsche released the 928 to an anxious motoring public in March of this year. That car epitomizes the latest in the state of the art of technology and in Dearborn's words (and ours) is the car of tomorrow. It is also (as Dearborn said), "an entirely new driving experience." —Joe Rusz