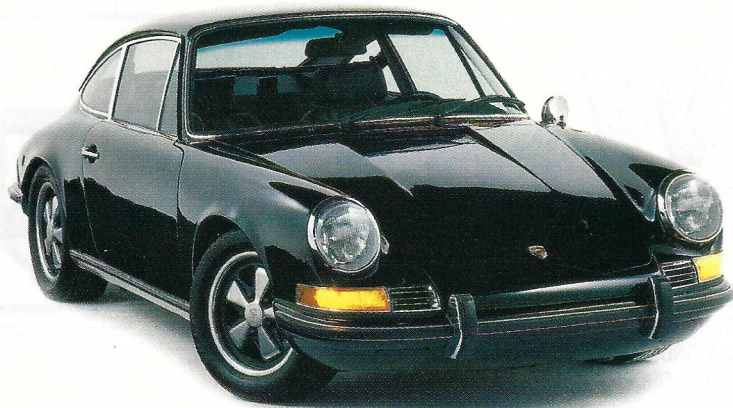


Project 911S

Part 4: Rear Suspension

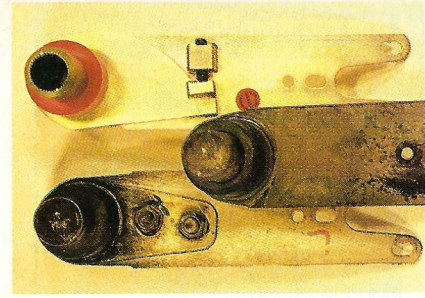
by Mitchell Sam Rossi

PHOTOS BY LES BIDRAWN



If there is one thing that has "glorified" the Porsche 911 throughout its existence, it is the car's remarkable ability to pirouette about its own front wheels at the most inopportune moment—say, in the midst of a high-speed turn.

And the tighter the radius, the quicker the back end can impose its will, carrying its occupants to the outskirts of the road and beyond. The same effect can be elicited on long sweepers, but here passengers are given time to enjoy the changing landscape. In both cases, the driver is left to wonder how and when he/she lost command of the sports car.



1. Tweeks polyurethane bushing and stock worn rubber bushing. **2.** Tweeks polyurethane bushing and stock worn rubber bushing on stock spring plate. **3.** Late adjustable spring plate, early spring plate, Performance Product's adjustable Sway-A-Way spring plate.

Dashing around a corner, the 911 seems to glide in perfect harmony, its center of gravity actually centered, its bond to the road knowing no limits. It entices the driver to the edge of reason and dares him/her further. Then, a spiteful god puts his/her thumb and forefinger together and flicks him/her off the pavement for having a sinful amount of fun.

More often than not, it is actually the driver who disturbs the Porsche's stride by easing his/her foot from the accelerator at the very moment the suspension is working its magic on the car's weight, tire adhesion and velocity. This unfortunate transfer of mass, as many 911 pilots know, can have catastrophic results.

Equipped with multi-link rear suspension systems, the 993 and the new 996 are far more predictable than the early cars. At the very brink of disaster, these Porsches use the miracles of engineering to save their overzealous drivers. That is, to a point.

No matter what wizardry comes out of Weissach, the physics of placing a large amount of mass aft of the rear wheels is simply tempting fate. There are several modifications that can be done to the suspension of the early 911 to ease this burden, but none will completely eliminate the car's tendency to swap ends.

While you may think there is only evil in the rear-engine design, in fact,

the opposite is true. While the 911's habitual oversteer has plagued the car, with a bit of fine tuning, a little practice behind the wheel, and the employment of titanium nerves, one can hardly find a production car that manages any curve as well or as fast.

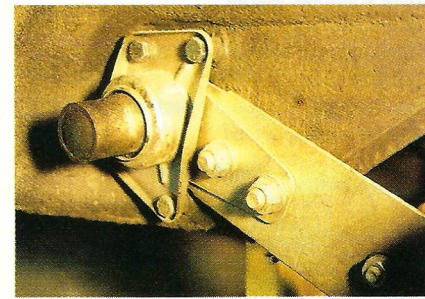
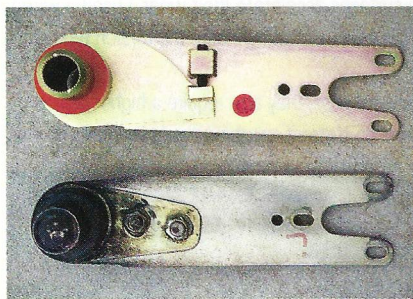
Tackling the Rear Suspension

As with the front suspension, the project car's rear torsion bars were changed to heftier rods, replacing the stock 23mm units with 30mm bars. The rubber bushings were also exchanged for the more precise polyurethane bushings from Tweeks, an aftermarket and performance parts supplier. Another important upgrade was with the early spring plates or radius arms.

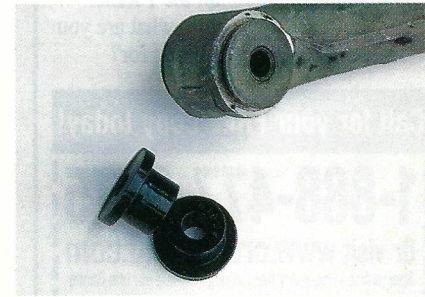
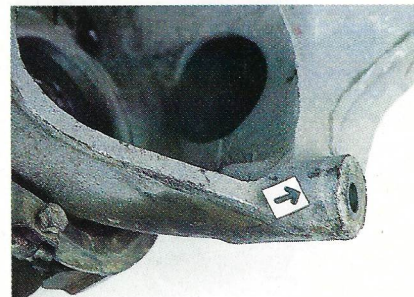
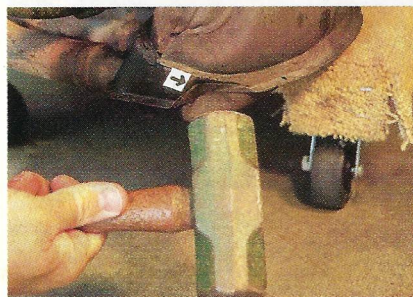
"If you want to get the ultimate corner balance, you have to have the adjustable spring plates," said Steve Alarcon of Johnson's Alignment, a suspension tuner specializing in Porsche cars. Corner balancing with the early plates will improve the car's handling, but the adjustable units afford the tuner a higher degree of precision. "With the newer style spring plates," Alarcon said, "we can set the car's balance to the nearest pound."

For the 911S, I was able to find a pair of spring plates from a later 911, (1977-86) at Best Deal, a local Porsche dismantling shop in Stanton, Calif.

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4. Late adjustable spring plate, Performance Product's adjustable Sway-A-Way spring plate. **5.** Original early spring plate in place on car. **6.** Late upgraded adjustable spring plate in place on car.



7. Modification of engine heat exchanger. Arrow indicates area of bend. **8.** Late aluminum control arm. Arrow shows lower shock absorber attachment point to be machined to fit early car geometry. (Note: this arm has not been modified.) **9.** Late aluminum control arm with upper pivot point and Tweeks replacement polyurethane bushings.

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Unlike my original plates, these are designed in two halves, one slipping over the outer end of the torsion bar while the other attaches directly to the control arm. Large eccentric bolts joining the two give the plates their adaptability.

There are also aftermarket pieces such as the Sway-A-Way adjustable spring plates offered by Performance Products, a restoration and performance parts distributor in Van Nuys, Calif. These are far easier to adjust, incorporating a single screw to help fine-tune the car's weight distribution.

To access the entire rear suspension, raise the car and place the jack stands under the transverse torsion tube just outside of the control arm pivot brackets. Remove the wheels. Position a floor jack under the bottom of the control arm and raise it to take the tension off the torsion bar and shock absorber.

Unbolt the lower shock mount from the trailing arm. The spring plate is attached to the steel control arm in four places by two eccentric-type bolts on the inside of the arm and two retaining bolts on the outside. Once these are removed, take off the four-bolt cover which secures the spring plate over the torsion bar.

If luck runs your way, the spring plate will slip off and the torsion bar will slide smoothly out of the torsion tube. After years of sitting in the side yard, this was not the case with the S. While I know the car is an inanimate object, I had suspicions it was still bitter about being deserted and was making every effort to be difficult.

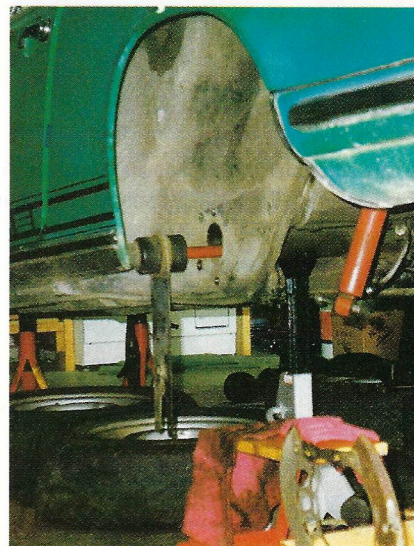
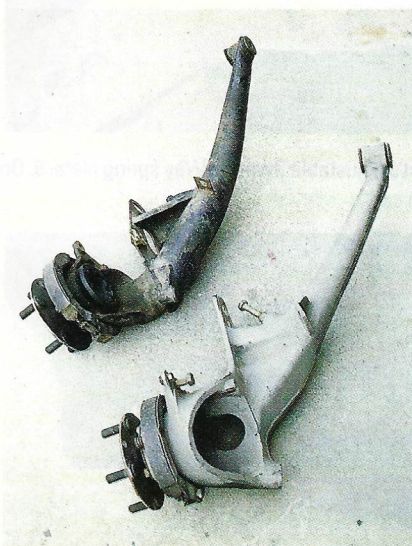
The splines of the left torsion bar were rusted into the spring plate. It took a large amount of WD40™, a pair of vice-grip pliers and a rubber mallet to finally liberate the plate. Thankfully, the right side of the assembly surrendered more readily.

Although I was utilizing the later spring plates, their rubber bushings were also vulcanized in place. Evicting the worn bushings requires heating the plates with a small propane torch. Be sure to heat the plate evenly. Once the rubber finally begins to bubble, twist it free with a pair of channel-lock pliers.

An important piece of advice: If you are doing this work at home, it should be done outdoors since the burning grease and rubber emit a pungent odor. As my garage is connected to the house, the smell seeped inside where it lingered for 3 days. My wife's scowl stayed for a few days longer.

Once the bushings are removed, clean the plates thoroughly. The solid, polyurethane bushings are not as forgiving as their rubber counterparts, and rough surfaces accelerate their wear. I used a wired wheel and a high-speed drill to clean and polish the critical areas, including inside the torsion tube. The spring plates and hardware were then gold-zinc plated.

While the polyurethane bushings enhance the car's responsiveness, they also require a higher degree of care. Alarcon warned that when the solid bushings are used on a street car, they should be removed and



10. Early steel control arm and late aluminum control arm. 11. Removal of spring plate from torsion bar.

inspected for wear every couple of years.

The S received another upgrade which might be beyond the need of most early 911 enthusiasts, even those planning to slalom their car. This involved switching the car's steel control arms for the later, 1974-89, cast-aluminum arms.

This can be a painstaking operation as the 911's rear suspension geometry differs between the '69-71 and '72-73 cars but, as my car was destined for the track, it was a change Alarcon highly recommended. "If the rules allow it, it is a must for a competition car," he stressed.

For a 1972 or 1973 911, this is a straightforward bolt-on procedure, as these models employed the same geometry as the 911s that carried these alloy arms from the factory. In the case of my 1970 car, alterations had to be made to the new Bilstein shock absorbers and the engine's heat exchangers.

The aluminum control arms offer several advantages over the steel units. Not only do they use a larger wheel bearing, which can bear the side loads of track excursions, but they are substantially lighter and stronger.

"Generally, the problem in handling is unsprung weight," said Randy Aase, of Aasco Performance, a premiere manufacturer of competition and prototype automobiles. "That's because it is weight that cannot be transferred by the suspension during cornering. It is not anything that we can compensate for as it is fixed by design." Alleviating unsprung weight, such as lightening the suspension components, brake system, wheels and tires or anything else not carried by the chassis gains huge benefits for handling.

Another design difference with the newer arms is the attachment point for the rear swaybar. The '74-77 aluminum arms retain the ball-and-socket connection similar to those of the early cars. The '78-89 arms, however, use a threaded insert and bolt which is compatible with a wide variety of aftermarket performance swaybars.

Removing the control arms is not a simple task. With the spring plates and shocks unattached, remove brake lines, emergency brake cables, calipers and the swaybar. You also need to remove the rear axle half shafts from the outer half shaft flanges.

The last bolt holding the control arm to the car is through the pivot bracket located on the torsion tube. Nine out of ten times, this bolt has been inserted outwardly and its extraction is blocked by the transmission. This leaves two options, the simplest being to slip the bolt until the head can be cut off and the remaining

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shaft withdrawn.

The second option is to remove the entire engine-transmission assembly. This is a time-consuming operation, but, remembering the S was in dire need of a new clutch, it was the option I chose.

Modifying the Upgrade

Again, if you are adding the alloy control arms to a '72-73 car, their suspension geometry is nearly identical to the originals. The harrowing work begins when fitting the alloy arms to an earlier car.

Because of the angle of the upper shock mount and the conflicting angle on the alloy arm, the shock absorber comes in contact with the edge of the heat exchangers. Discarding the dust shields gains a better angle and allows the shock absorbers to be attached to the arm, but the heat exchangers and shock bodies still come into contact.

A "modification" to the corner of the boxes can be achieved with a sturdy sledge hammer. Before anyone cringes, understand the steel exchangers are constructed in two pieces and it is only the joining seam that needs to be urged out of the way.

While this primitive approach of slamming the heat exchangers works well enough, a better method for the upgrade is to remove the excess material from the control arm's lower attachment point. This moves the shock absorber away from the heater box and allows for the correct suspension angle.

"What we do is take about an inch off the shock mount and blend the cut into the arm," Aase said—Aasco Performance has often tackled this operation. "There is a steel insert. We cut just down to that," he said, noting there is no strength loss at the attachment point.

Once the new polyurethane bushings were fitted into the alloy control arms and properly greased, I was sure to install the pivot bolts inward, thus giving myself the option of removing them without extracting the transmission.

Bilstein sport shock absorbers superseded the original rear Koni units. The new shocks were hung in the upper towers by using a large washer in place of the dust shield to act as backing for the mounting hardware. The shock piston was then compressed with a floor jack until it lined up with the control arm. The bolt slipped easily into the attachment point and was tightened to the

proper torque rating. It was then a matter of re-attaching the brake lines and cables and the half shafts.

With the spring plates clean and ready for installation, the torsion bars were inserted into the torsion tube. They can only be fitted to the car in one direction, as the inner portion carries 40 splines while the outer has 44. Also note that if you are using your original bars, they were marked at the factory as left and right, designated by letters stamped on the end, and must be reinserted into the correct side of the car.

For brand new bars, however, side designation does not matter and, in fact, most aftermarket bars are not labeled. It is only after the bars have been employed on the car that they gain a "memory" of their torque direction.

Be sure to coat the entire length of the bar, especially the splines, with a molybdenum-based lubricant. This will prevent them from rusting. If you opt for gun-drilled torsion bars, a good bit of insurance is to fill the inside with the same grease.

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There is more to setting a Porsche's rear suspension system than simply sliding the spring plates over the torsion bars and reattaching them to the control arm. By turning the bar inside the tube one spline at a time and rotating the spring plate the same amount in the opposite direction, the car's height can be adjusted in 1/4-in. increments.

One doesn't need to be a mechanical engineer to understand how this works, but adjusting the suspension is so vital to the car's handling characteristics that I suggest it be left to the experts. With the spring plates reattached, I adjusted the car's height only enough so it didn't sit like a three-legged table.

Short of tucking the engine and gearbox under the deck, the S was now ready for the suspension shop. But before that step, there was much to repair and improve. The next hurdle put to the wrenches was the brake system.

Neglecting the brakes for so long left me with only one choice—a complete overhaul, including rebuilding the cherished aluminum S calipers, one of the defining assets of the 911S. And as my father used to tell me, "I don't care how fast you go, just be sure you can stop."

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