Inside: Bruce Phillips' Awesome Farnbacher Racing GT3

Roadrunner Ramblings

ROADRUNNER REGION PORSCHE CLUB OF AMERICA
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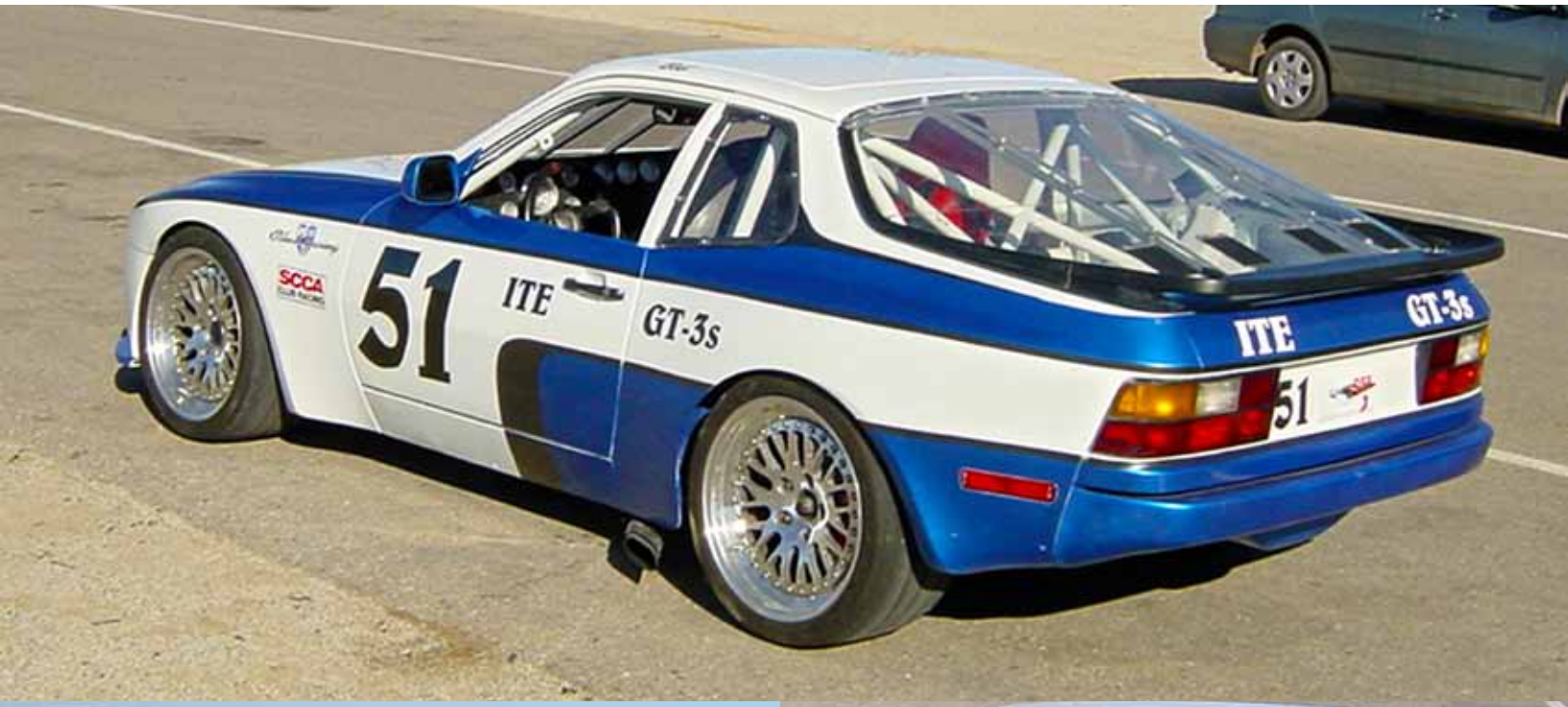
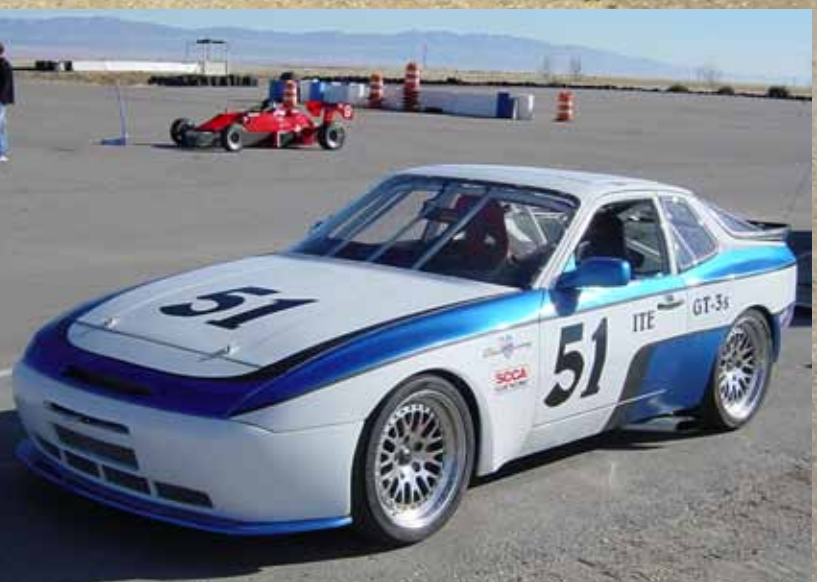
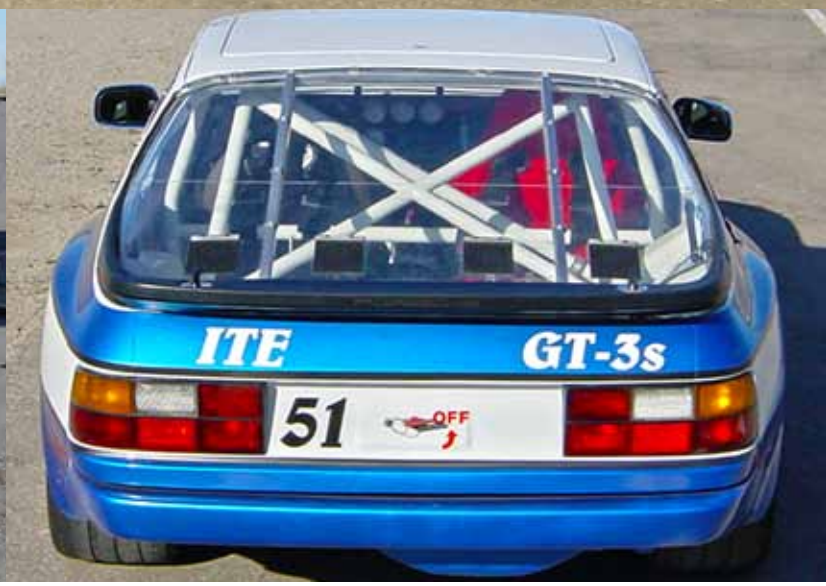


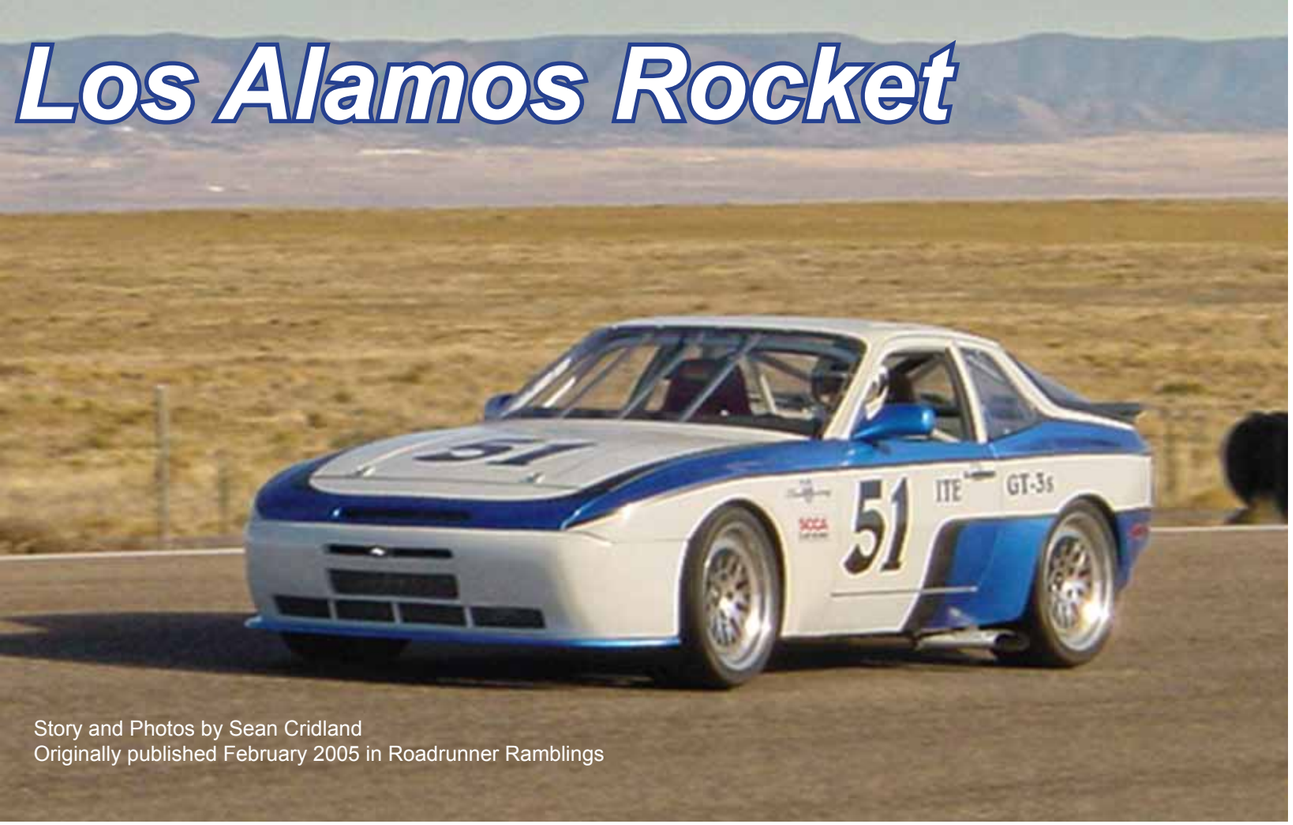




One for the show with plenty of go. Los Alamos RRR club member Bob Patterson's beautiful 450hp 944 Turbo GT-3S project race-car. A labor of love and two years in the making.

Cover of the Roadrunner Ramblings that featured an article and photos by Sean Cridland of Bob Patterson's shake-down runs at Sandia Motorsports Park in early December of 2005.

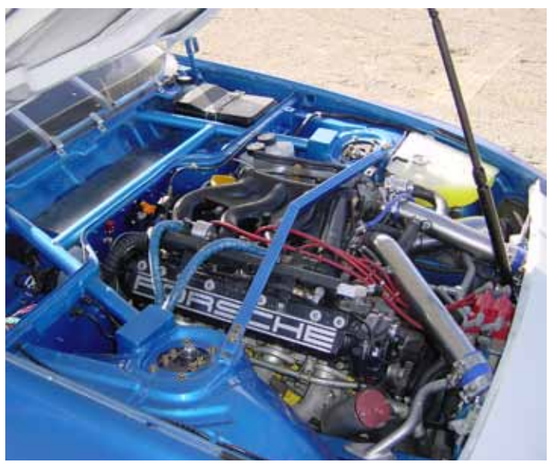
Los Alamos Rocket



Story and Photos by Sean Cridland
Originally published February 2005 in Roadrunner Ramblings

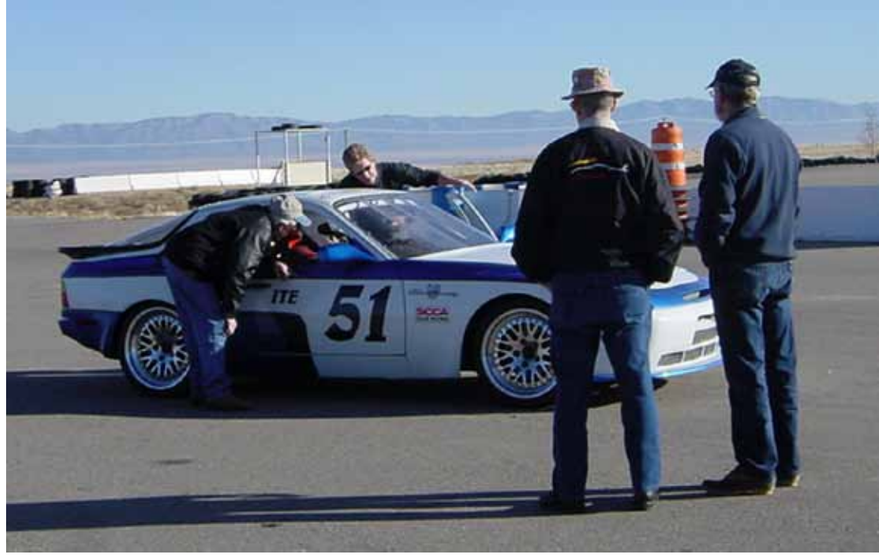
Arriving at Sandia on a beautifully balmy December 11 Saturday when only the most dedicated of souls are testing, it's readily apparent that Bob Patterson has been doing his homework. For those of you who know the quiet spoken Porscheophile from Los Alamos, you have probably been hearing and maybe have seen the car he's been working on for the past two years.

The car started out as a black 1986 951 or 944 Turbo as it was called on the showroom floor. He raced it for about two years in that incarnation. But after awhile he found himself fighting a few problems with the engine and the handling and started fixing and fiddling. And, like most of us delving into the performance aspect of our cars, found that fixing one thing meant discovering several other things that needed attention.



He considered selling it and getting a more developed race car, but wasn't really happy with the workmanship or the prices of the cars he looked at. And he liked the 951, which he refers to as the "poor man's Porsche." He says, "you can buy these things all day long for $3-4,000, so if you need a tub or any other parts, they're not that expensive. Of course racing stuff is a different story…." It was only a matter of time before he decided to take the black 951 all apart and start from scratch. During the Christmas holidays of 2002 he got started by dismantling the whole thing in about a week.

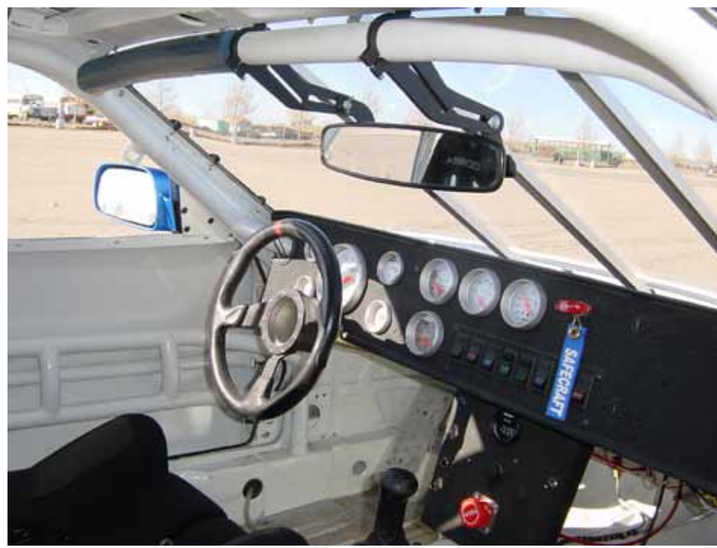
Then the car was media blasted and put back on the rotisserie for the hard work of scraping off all the undercoating (which he assures me is VERY high quality, since that took another three months to take off). He thought he could do the whole job in 3 to 6 months, but except for the paint and motor, it took a year. Having done a lot of work to the engine to improve performance, he found that the science of engine management is not to be taken lightly. He cooked two engines in the garage before he finally got it right with the third one. It turned out that his engine management system was dead-shorting the injectors and doing it randomly so that when he would turn over the starter then injector would go from lean to normal to flooding the cylinders almost instantly. But with the patience of a saint – or at least an engineer – he says that he learned a lot each time. After seizing the original block, he got a really good block and took the time to polish and knife-edge all the surfaces and edges. So he had some good practice for when he put the third one it and finally got it right. The motor did dyno time in Albuquerque and it Colorado before he ran it on the track, so he was fairly confident that he had it right. Now the little thing is getting about 400 HP from about 17 pounds of boost and about 450 HP from 24 pounds. And that's at the rear axle!!! Consider that this beast of an engine is in a car that weighs in at about 2500 pounds.

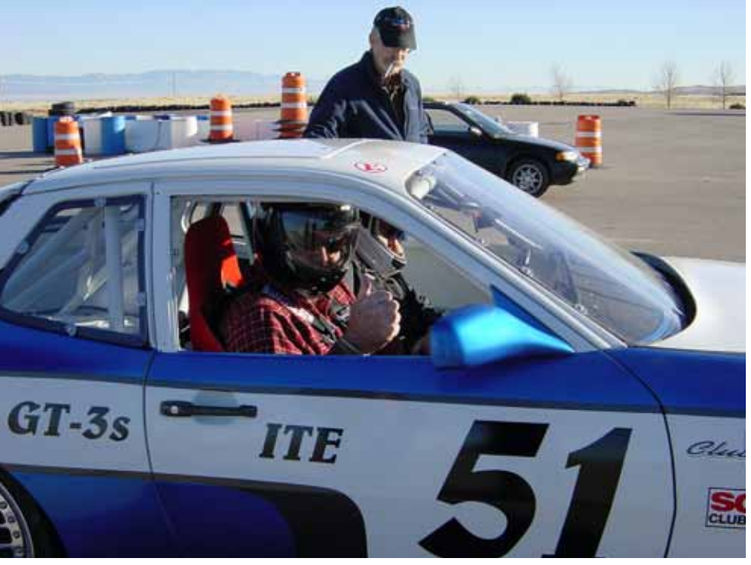


The car is meticulously painted in an ivory and metallic blue livery that Bob also did himself in the same little garage. Hanging tarps and shower curtains on curtain-rods and shower ringlets, he created his own paint shop. On the inside, the car is a clean white, with red Sparco seats and a very tidy and purposeful dashboard and control panel. The wheels are 17 by 10 inch CCWs and the tires are Michelin Pilot Sport 285/30-18. The 1.5 inch roll cage and tube frame were also created by Bob and work to stiffen the car for optimum chassis tuning through the suspension. Springs are Bilstein Cup on the front with 800/600 with very heavy 32mm/28mm sway bars front and rear, drop link, adjustable, that turn. He uses 993 turbo brakes front and rear with larger rotors, gas slotted in front, cross-drilled in the rear . Camber is negative 2.75 and 2.2 front and rear. Ride height is as low as he could make it and still clear the fender. He runs with the stock body just out of convenience. There is room for quite a bit of modification, but in GT3 you can't alter anything between the suspension pick-up points. You could have bigger flairs, but he hasn't spent the money yet. Glass is lexan all around, speed glass in the front. He bent all the glass himself in his garage.

When I got to Sandia I took a few photos of it as it sat glistening by the transporter. Eventually Bob ambled over and he asked if he could do anything for me. Take me for a ride, I said kind of facetiously, but he accepted my challenge and said sure. As I watched him take his first laps from various parts of the track he must have been smiling from ear to ear to have it running.

Russ Kelso did a few laps riding as passenger and making inspections, but finally Bob pulled back in and it was my turn to ride. Getting in through the rollcage took some help from Bill Oaks and Bob Blackwell, both of whom brought their shoe-horns, luckily for me. But once in and belted up we eased out onto the track for some good fun. Let me tell you: if this car could talk, it would say "Who's your daddy"





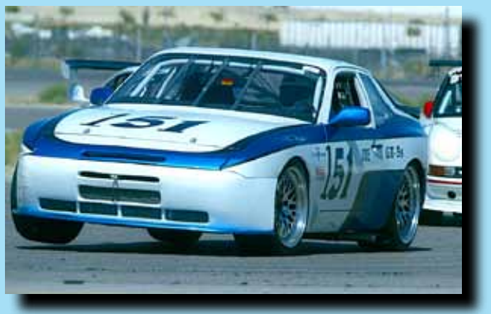
in a way that only Yankee and Red Sox fans know the true meaning of. It has control of you in ways that you're not sure you like. You realize that as you're coming up out of the rise from turn 7 onto the back straight at Sandia Motorsports Park and you hear the rear wheels chirp as you accelerate at a rate that you previously have only read about. Now I know why they put big brakes on cars like that: because you're going so fast that you have to slow down for the corners.

When I asked Bob what thoughts he had while he was driving to the track he said that he was hoping everything would work out and trying to think of what kinds of things wouldn't work or would be troublesome. Would he seize another engine? He was fairly confident that he had worked out the engine issues by that point.

His immediate impressions of the car included the observation that the engine power was too peaky. The 400+ horsepower would come on very quickly and it was a little scary at first, but after several laps he started to get used to it. Too hard and too fast. The dyno print-outs showed a much gentler power curve than what he first experienced. It's fine. He has a list of about 15 things to do. He had a little oil leak, but that fixed pretty easily in the next week.

Driving home he felt satisfied and relieved. Two years of patience and hard work really are their own reward. He said he'd run it again after Christmas. What a present!

Building a Race Car
Column by Bob Patterson in Roadrunner Ramblings from April 2006 to January 2007



Building a Race Car
By Bob Patterson

April 2006

Editor's Note: First, hat's off to Brian Leduc for entertaining the readership for the past year with his autocross column. He did a great job and I think we all learned something (quite a few things!). But all things come to pass and Brian moves onto other journalistic assignments. This month we welcome a new columnist to the pages of Roadrunner Ramblings: Los Alamos racer Bob Patterson. Though many of you have known him for far longer, I was first introduced to Bob a couple of years ago when Bob Blackwell led a drive-out up to Bob Patterson's house in Los Alamos to see his still in-progress 951 (944 turbo) race-car project. Built entirely in his garage from the ground up and including the engine (three of them) and the paint, Bob's project is something of a legend in the Region. Later on in the year I had the pleasure of being one of the first people to ride in it as he shook it down at Sandia Raceway. To say that this car is powerful would be spectacularly understating the issue. To say that it is beautifully turned out is not getting the full picture. Still, a race-car is not a race-car until it is raced. And for those of you who are fans of racing, you know that race-cars are rarely successful without a large amount of development and miles and miles of engineering experience. We're incredibly lucky to have someone of Bob's accomplishments and articulate communication skills to tell us his story for the next several months. Without further ado, I turn this column over to Bob Patterson. Read on and enjoy. You're going to learn a lot about Bob's adventure and probably some things about your own dreams of building a car and becoming a racer.

I don't think there's a car enthusiast out there who hasn't dreamed of racing. If your still dreaming... maybe even considering it, you should count your blessings as the PCA has one of the most competitive, friendly, and accessible forms available - The PCA Club Racing program. Running some of the best tracks in the US, from coast to coast and boarder to boarder, PCA offers the amateur a very "professional" experience. But the time and cost associated with a PCA only venue can be serious. For me, it mandated that I throw in a dose of SCCA and SWMS (Southwest Motor Sports) for more local venues. Taken together the average guy can actually capitalize on this suite of opportunities to campaign a car. It's kept me within a range of about 700 miles, and provides plenty of challenge. But is this whole racing thing going to be right for you, really?

Only you can answer that question for yourself (but I'd strongly encourage you to check out your spouse / significant other). Everyone gets to this racing thing differently; no two experiences are alike. What I will attempt to do is offer some insight into my particular experience and share a few things I've learned along the way in hopes of helping you avoid some of the same bumps and bruises. From the initial question of racing, to selecting a car and venue, to building and preparing your car I'll share what I've learned. From this perhaps you can determine if it is right for you.

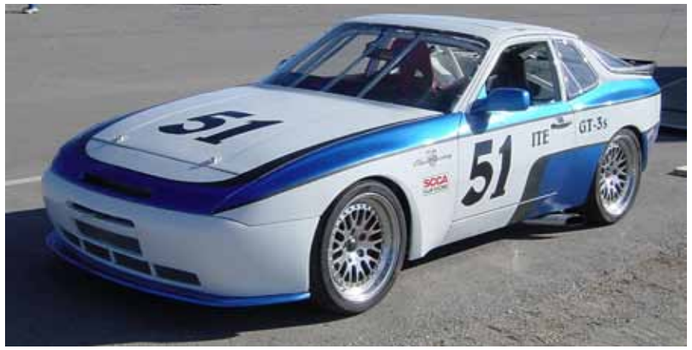
I was always a bit of a gear-head. In the 60's I build two rigs from the ground up. In 1964 at the age of 15 I had finished a simple, 1100 lb., tube-frame, Corvair-powered sand-rail with a Volkswagen trans-axle and dual, 16" wide rear wheels that would turn 72 MPH in a 2nd gear, 100 yard sand-drag. In 1969, a year out of high school I'd finished a 27 Model T roadster with a small-block Chevy with a bad case testosterone. A few MGs, a little auto-crossing in the early 70's, lots of motorcycles, 20 years of marriage, work, and family, and we've fast-forwarded to a clean, used 944 NA up in Los Alamos and a membership in the PCA. Autocrossing again...re-learning some of the basics of driving and car set-up from stalwart club members like Bob Blackwell and finding a dose of success, and that burning desire arises again. Russ Kelso (PMCI) calls one day to say a deal might be achievable on a log-booked 951, a check, and I was launched with a car and trailer. Little did I know... that nothing I'd done had really prepared me for what was to come?

In some ways that first track car was the way to go. It was a rather inexpensive way of introducing me to racing, something that I strongly recommend before one delve too far. The licensing process varies between clubs, but invariably requires some Drivers Education efforts and a sign-off by a club instructor,

Bob Patterson's 951 (944 Turbo) before it was stripped down, undercoat taken off, frame and engine rebuilt and bodywork repainted.

followed by a novice period. Another, better way may be a driving school. If you are not sure, go to professional school first and invest in yourself. A number of driver schools will provide an SCCA license with the successful completion of a three day course, and you can use reciprocity between the SCCA and other clubs to expand your venue. And you get invaluable track experience in a relatively safe instructional setting. Either way...take that baby step via a school or a modest car to get that experience before you commit.

My first club-race felt like a 24 hour heart attack. That car I'd bought was modified enough that it had to run in GT-3. Believe me, a relatively stock 951 is way out-classed in PCA GT-3, and we were grouped with all the other GT cars. Staging in the center of a cluster of 20 highly prepared vehicles, with experienced drivers, sweating in that suit, unable to even hear your own engine over the din, and a yellow flag warm-up lap that felt like a 90% effort was enough to convince me I'd jumped into the deep end. The second practice session went better, until my head-gasket blew. A couple guys I'd never met - John Dunkel (of Rennlist fame), and Tim Weiner who was crewing for a Speed World team from San Diego stepped into my pit area, helped confirm the diagnosis, and said get the parts and we'll fix it. I protested - I didn't have all the tools not to mention the lights, but not to worry. So off I went...and by 5:00 p.m. that night I had the parts. We worked nearly all night - wrapping up the initial run-in and going back to the hotel at 5:00 a.m. At 7:30 the block had cooled and we were pulling the cam tower down again to re-torque the head, and by 9:00 I hit the track for the first practice session, only to get black-flagged! I ignored it the first time by – that had to be a mistake, but no. As was explained, a rookie has to do a rolling practice start, and I'd not been on track that third session. No practice starts, no racing. So onto the trailer, but wow! The camaraderie, the willingness of perfect strangers to lend a hand and work the night - that was priceless. Being able to drive my car off the trailer and into the garage a day later provided a sense of pride and satisfaction that the unthinkable could have been accomplished.

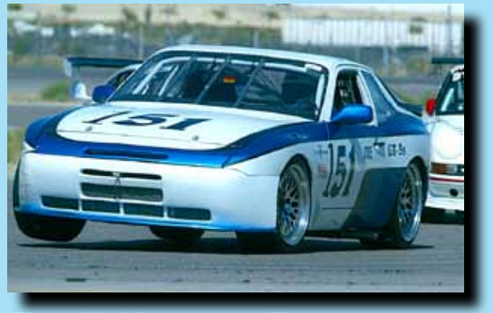


Above: Bob Patterson's 951 racecar after the re-build and just before its initial shakedown runs at Sandia Motor Speedway in early 2005.

Now I've read that getting the car is actually the easy part of a decision to race, and that could well be. I'm only in my second year of prepared effort, and already I can see that they may be right. The bigger commitment is often the trailer, truck, tools, fuel, tires, brakes, and related maintenance that eat at your recreation budget and free time. That caption that Sean Cridland put under a photo of my car last month - What Happens in Vegas Stays in Vegas - was just about true. I lost a transmission in the truck just as I pulled into town; and lost boost on the track car due to failed exhaust ring, resulting in a DNF coupled with a $2200 repair bill for the truck, not to mention the racing fuel, diesel, lodging, food, and four days of dedicated effort . Bob Carp graciously allowed me use of his truck, such that I could secure mine, but it was difficult in any circumstance. These things are going to happen to you...think about it.

And think about your personal vision of an end state? What level do you wish to participate on? Staying within a day's tow in local and regional events might dictate you set your Porsche up for a particular SCCA class, versus PCA. Maybe a different manqué, a purpose-built or specific class (like stock?) car would be best? Do you really want to push the envelope in engine and chassis development? The GT classes will put you there, but at a cost and level of effort that's truly for the serious, dedicated enthusiast. Attend some races... talk to people. Decide how committed you wish to be and at what level you'd like to compete. Believe me, pushing any car to the limit in a competitive environment is a thrill. Don't discount that. Important club resources include Bruce Phillips and Lisa Thomas, who have experience racing at levels many of us could only dream of. Then there's Tom Gonzales, who I think asked most of the right questions when he built and campaigned a serious 914-6, and who has recently moved into cup car country. And then there's Dr. Robert Carp, who's come a long way in just a couple of years campaigning a stock or prepared 911. Russ Kelso basically owns Sandia Motorsports in that 914-6 of his, and he's a capable mechanic and chassis set-up man, and general good guy. And I am learning - feeling stuck in the mid-term of the school of hard knocks. But seriously, every one of these people would give the shirt off their back to aid another racer. The easiest part of the whole project is to pick up the phone and dial 'em up. The fortune you save may be your own.

Next time I'll talk about my decision to rebuild my particular car and some factors you might want to consider. Other articles on the actual process will follow...stay tuned. BP



Building a Race Car

By Bob Patterson

May 2006

Race Cars and Racing: Build or Buy?

In the last article we asked ourselves a few questions to gauge our interest and commitment to racing. Among them, you need to personally know if you'll like racing, and have the time and temperament and ability to pay the sometimes significant dues. We discussed licensing and suggested that perhaps a three day racing school is the best way to try the sport and obtain the initial license. (Bruce Phillips has a good deal of experience with these schools, and could discuss their relative merits… or for fun you could ask Bob Blackwell about his "Mustang" experience at the Panoz School). But if you have a car with the appropriate safety equipment and set-up, by all means start with a driver's ed event or two, and if you like it, work toward your license. That's what I did. PCA, SCCA, and SWMS all work hard to ensure safe, professionally run events.

If you've decided you like it – that racing is something you definitely want to do, then let me suggest that you seriously pose the question of building versus buying. What is the end-state you seek - what sort of class and venue best suits you? A "run-what-you-brung" attitude can cost you money, time, and ultimately impact your overall satisfaction.

So what is your goal and what resources can you bring to bear? Are you technically suave, capable of pushing the limits in terms of suspension, engine, and chassis design and setups? Do you have the money and talent to push the competitive envelope in a GT class? Could you feel a 20% adjustment in rebound in a full competition suspension setup? Or could you be happy running competitively with a pack of 30 similarly matched, relatively low-tech, low-power cars where driver skills make all the difference and a set of tires could last the better part of a season? Do you need to win? How badly? How much speed is enough?

These and some associated questions will help you decide where to enter this sport. For most people, a relatively modest entry point is probably appropriate. PCA provides some very exciting, competitive stock-class racing. If you have a few bucks to throw at it, an increasingly popular class is the cup car classes, where stock Porsche GT-3 factory cars, with full race setups provide very high levels of performance and competition. At the lower end, SCCA's spec Miata class racing provides a relatively simple, low-cost entry point. Far too many options exist to discuss here, but they merit investigation.

I chose to rebuild my car after searching for a couple months for one to buy. If you've ever built a car, you intrinsically understand that the cost of building can greatly outweigh a simple purchase, and I knew that. But I also believed that I could do most of the work myself, and with a little luck, might even produce a reliable, semi-competitive race vehicle without spending the kind of money it looked like a car would cost. In the buy and sell game, timing is everything; the challenge is finding the car and a motivated seller, at a time when you actually have the money to make the deal. I didn't give it enough time. Cars seem to invariably cost more when they are initially listed, but often finally sell months or even a year later for relatively deep discounts on that initial price. I encourage a prospective racer to search long and hard before choosing to build, unless you are unusually talented and have a great shop or outstanding and rather rare chassis with which to start. Exercise due diligence too - get that prospective purchase checked out from top to bottom by neutral people that know the marque before closing the deal.

What exactly does the build game entail? Well, first and foremost consider the time. Even an experienced builder with a well-equipped and prepared shop will spend six months making that car a reality. If you are working on a limited budget, in your

home shop...double it, or in my case, quadruple it. My six month project turned into two years (and yes, I'll tell you how that happened). If you chose to run a stock PCA class, or a spec-type SCCA car with limited build latitude, then you can shave that time commitment to a couple of weekends reworking suspension and safety equipment.

Time is money - as that project drags on and gains in complexity, your costs will jump exponentially. Building a car for the GT classes, where essentially anything goes, can drive up the costs incredibly. Carbon fiber has become relatively commonplace now. Coupled with tubular chassis, light-weight fabricated cages tied to your suspension points, remote reservoir double adjustable gas coil-over shocks, engine management systems and the list goes on, and on, and on. Even if you do most of your own work you can go through a pretty penny. In my case, constant e-bay and Rennlist searches paid big dividends - I found many of the components in used, serviceable, and sometimes even excellent condition. I even developed a routine of searching PCA regional newsletter web sites for used parts. I also found E-bay provided a ready market for the many parts no longer needed, including some of the old racing parts.

Consider also your skill set. In the end it's going to be on you, especially if you are in a small town like Los Alamos. While I had a fairly solid understanding of the mechanics associated with building a car, my skills were way out of date. Consider also the skill set of your friends, followed closely by their loyalty, dedication, and willingness to work for beers, or the simple enjoyment of it. Having a mechanical engineer in the group is a real asset - Rob Meehan of White Rock helped me to understand and evaluate various situations we came across many, many times. PCA has technical representatives for each of the models, who can provide valuable insight. Rennlist.com has invaluable forums and web-sites for racers and enthusiasts alike. Specialized vendors help - Dave and Mike Lindsey of Lindsey Racing are solid with 951's, and provided valuable insight and technical assistance on a few occasions, as did others. Russ Kelso of PMCI helped, advised, and on a couple of occasions made a fix where I could not.

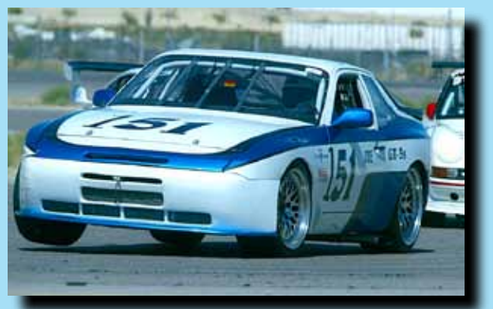
Look your garage over - consider where you will store all the stuff that simply can't stay inside with a car in pieces. Look over your tools, and understand what has to come first. My first project specific tool purchase was a Miller 250 Syncrowave TIG welder, with a water-cooled torch, followed by two classes at the local college to make sure I understood how to use it, and my limitations. It's a good time to consider sponsors as well. Is there a business' you could rely upon for support in exchange for advertising? What could you do, for whom, and how could they help you? I've never pursued this angle, given the feeling that I could not really provide any advertising exposure in my community, and my relatively spotty race record. Non-the-less...it's all worth evaluating.

But I regress. A quote comes to mind…one that seems pretty relevant lately.

> Good Judgment Comes from Experience;
> Experience comes from Bad Judgment

And so the hapless enthusiast has decided to embark upon a six month race car build project. He's given it a little thought, done some superficial shopping for other cars, and decided that it's best to rebuild what he's got. Why? Well, it's paid for and I own it. I know how to drive it at least a little, and have become familiar with working on it. I'm thinking it has a lot of potential, but am bothered by the cage (a cross-bar right in front of my throttle knee), and the fact it's running fairly stock in a relatively high GT-3 class. I'm pretty sure I can take it clear apart and put it all back together better than Porsche did (which is a little arrogant, don't you think?). So it's looking like this project is a sure winner.

Next – disassembly, cleaning, and chassis preparation. ***BP***



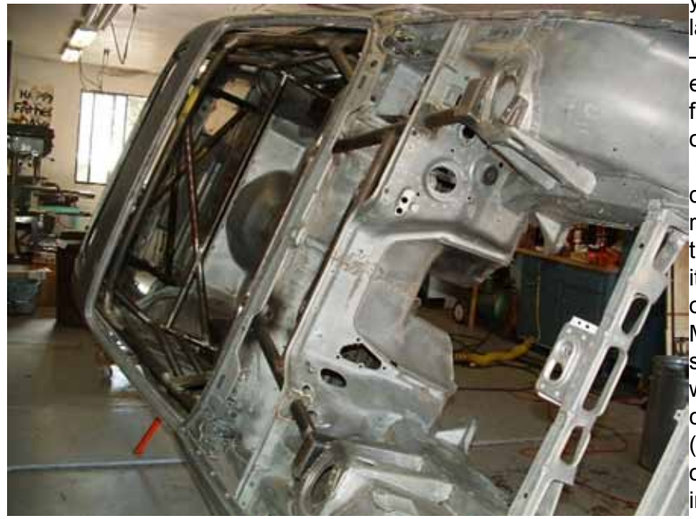
Building a Race Car

By Bob Patterson

June 2006

Building a Race Car :Tear Down and Clean-up

In the first article we asked ourselves some hard questions about our genuine interest, desire, and ability to maintain and race a vehicle. We suggested pursuing your license via a school, or by running a lightly prepared car just to ensure that you like it and are prepared to pay the dues associated with a race effort. In the last article we discussed building a car versus buying one that is already built. Buying a car is not without risk, but if it has been tested and properly set up, with log-books and annual technical inspections that substantiate its fundamental safety and performance history, it is certainly quicker than building and may prove cheaper in the long run. A proper pre-purchase inspection by a knowledgeable and qualified person will go a long way in assuring the right decision is made. If you are convinced, however, that you'd like to build your car, have that auto in your possession and like it, then perhaps building is right?



So go get the rule-books, something that can't be ignored – in other words, start with the end in mind. The SCCA publishes the "General Competition Rules", or GCR for about $20.00. Check out the PCA rule-book, and NASA / Pro Auto Sports as well, and understand your class and any limitations that might exist. Don't perform work that ends up placing you in a class you hadn't intended.

The extent of your chassis work will be predicated upon the class you choose. Stock and prepared classes may not permit the extent of work I performed. But since I was already in the GT ranks – like it or not – my choice was to pull it down. The work began during Christmas week in 2002. The objective was to strip the vehicle and have it media blasted before commencing the rebuild. The 944 chassis is a dipped, galvanized steel tub that helps with rust issues, but I still expected to move through this stage quickly. Little did I realize that my six month time-frame was about to get radically altered.

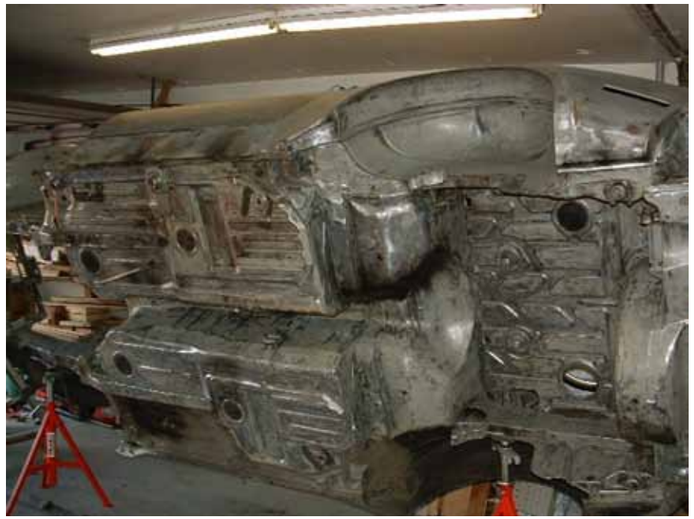
Step one was the complete removal of engine, drive-train, transaxle, interior including headliners and all trim, dash and instrumentation, glass, seals, wiring harness and fuse boxes – basically everything was pulled save the front spindles and a-arms and rear a-arms, supported by some old shocks, to facilitate loading for blasting. It took about a week. Key tip; never assume you'll be putting it back together soon enough that you'll remember what went where, or where you "stored" it. Use zip lock bags, indelible ink markers, and diagrams (or annotate a manual) as you go. Store related items in boxes – brake system, engine electronics, fuel system, etc in an organized way.

Having pulled it down I winched the rolling chassis onto the trailer and hauled it to a media-blast outfit in Albuquerque. Media blasting is basically sand-blasting without sand. Typically plastic particles (small beads), or other media, are used in lieu of the sand, holding down heat which in turn prevents distortion of the sheet metal panels. The vendor said he could handle it in a week, no problem, including the undercoat – and estimated $600. I considered dipping the chassis – where the tub is basically soaked in a chemical treatment to remove all rust, putty, undercoat, and the like, but that would have required a tow to Phoenix or Denver, a couple of days, and about $2k. It would have been money well spent.

The one-week schedule turned into nearly a month. The vendor had some scheduling issues, and also discovered that media blasting was completely ineffective on that tough Porsche undercoating – and he was unable to remove the undercoat. The resulting price adjustment reflected a cost of about $300 and a month, and I had the chassis back on the trailer for the tow to Los Alamos, with a lot of work in front of me.

But I diverted to Edgewood to speak with John Hammil who runs a small shop / business he calls Hamfab in Edgewood. John is one of the best fabricators in the nation, and certainly knows how to build a car. Some of his work takes on a beauty that can best be described as art. John suggests a uni-body car be checked out on a good frame machine and squared up before the build. He looked the chassis over, which included the old cage, and provided some great advice on the design and attachment points for a proper roll cage. Swimming with ideas, and complications, I headed home to Los Alamos.

During the blasting period I was able to borrow a home-made rotisserie from Art Montoya of Santa Fe. This is basically a pair of vertical-sided, tri-pod type frames that supported a couple of heavy Ford truck hubs & bearings with mounting plates about 48" off the ground. I fabricated a pair of front and rear mounting frames from ¼" plate and thick walled 2" square tubing. The front frame attached to the front bumper shock mounting points on the chassis, the rear frame to the rear bumper mounting areas. Each stood off the chassis about eight inches to provide clearance to work the front and rear of the car, with mounting plates to match the rotisserie. Plate height needs to approximate the centerline of the chassis from a weight perspective. If your mounting plates are too far "off center", the chassis will want to swing the weight to the low-point, and you won't be able to rotate the chassis easily on the frame. I eyeballed mine, and got it close enough so I could rotate it alone. The second key point is to recognize that these two rotisserie frames will want to twist away from their load, to fold up flat, and hence one must secure the two bases to one another to keep them upright – a 20' chain and binder worked fine. After attaching the mounting frames to both ends, we jacked the car using blocks to raise the chassis (and jacks) progressively until we had the mounting points and frame level with the bolt pattern on the rotisserie. Be careful here…this can get a little precarious.



If you don't have an absolutely positive, pin-type lock for the bearing plates on the rotisserie, secure a pair of adjustable pipe stands or other supports that can easily be adjusted to support the chassis on each side. It's much safer than having a friction type bolt slip that allows the chassis to rotate unexpectedly while you are working on it.

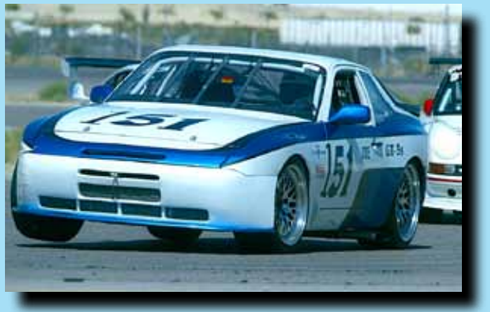
With the chassis on the rotisserie, the final disassembly of the wheels and a-arms completed the tear down. Discard any bearings, seals or wear parts that were present during media blasting process – they simply can't be relied upon having been subjected to that environment.

Now that undercoat – what a job! Porsche's materials are extremely durable, to say the least. We tried sample areas with strippers, and found them ineffective and messy. Wire wheels and even heavy wire cups on a muscular ½" grinder, simply scratched and smeared the base materials, and if you did get through, they'd assault the underlying galvanizing. And so a variety of scrapers were employed, which were entirely ineffective without the use of a small, hardware store propane torch. Some flame should be expected, with the associated sooty black smoke. It is slow and dirty. In between scraping sessions, which lasted about three months, I got the sawzall out and cut out the old cage, dressing down the mounting plates with a grinder as appropriate, being careful not to weaken any chassis points.

Russ Kelso (PMCI) kindly loaned a manual pipe bender and some mandrels, and I cleared one end of the garage, drilling the floor and anchoring the pipe bender. I procured 120' of 1.75 inch DOM tubing, which is probably the easiest to work with – though clearly larger and heavier than chrome moly tubing. At this stage, it's critical to really understand the sanctioning rules and requirements, which include tubing sizes and wall thickness (based upon vehicle weight), clearances, and minimal design characteristics. An e-mail to rules officials resulted in a response regarding an SCCA bulletin limiting chassis contact points to eight, which I'd not otherwise known.

It's now mid-February, we've just begun scraping undercoat – a project that will ultimately consume about three months. We've studied the rules and know what is necessary to get a cage in place, and secured some tubing and a bender for some weekend work. Stay tuned for the next article on cage fabrication, fitment, and further chassis preparation.

BP



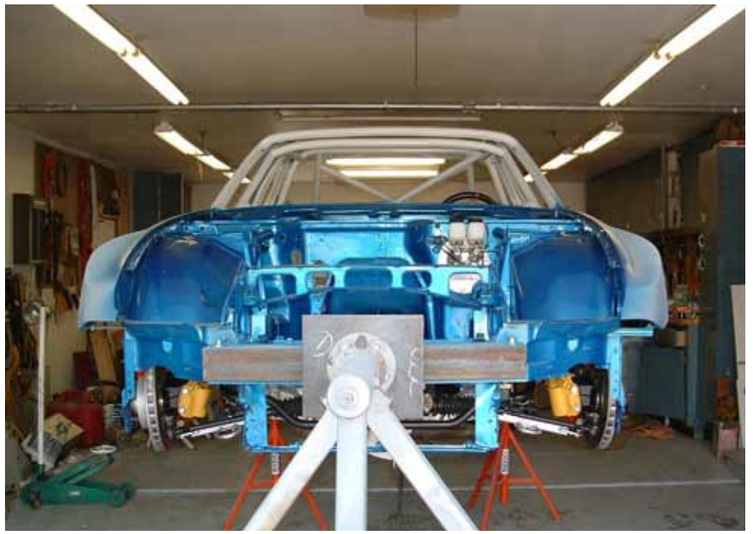
Building a Race Car

By Bob Patterson

July 2006

Race Car Cage and Chassis Preparation

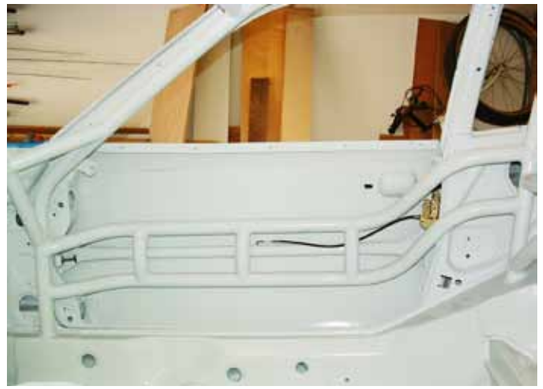
In the last article we had the stripped chassis on the rotisserie, were scraping undercoat – a project that will ultimately consume about three months, and were the lucky recipients of a manual pipe bender and mandrels kindly loaned by Russ Kelso of PMCI. We've studied the rules and know requirements and have cut the old cage out and cleaned up the former base plates. We've sized the tubing, selecting 1.5", .120 wall DOM tubing based upon final vehicle weight. We first located the base plate locations, maximizing their size under the rules, and shaping and fabricating to best capture the strength inherent in the uni-body structure.



Starting with the ever-critical main-hoop, we carefully measured for overall length and bent lengths of 3' welding wire to the desired bend radius. Working the manual bender required a 4' cheater bar and a lot of space to accommodate some long runs of tubing, recognizing that square, vertical, and tight were key factors to maximize clearance and fit. Modeling the bend radius with the wire and carefully measuring, we fashioned two side hoops in lieu of a front hoop, bending tight to the roof line and front pillars. At this point, one must fish-mouth the tubing ends, which is to say to cut the ends so they fit tightly to the tubing they are mating to. There are tools for this, but unless you are in the business it's a one time thing, so I purchased bi-metal hole saws and utilized the drill press. I probably went through 20 hole saws…you learn who sells the best one. It's great to have the chassis on the rotisserie as you can roll it to accomplish the fitment and tack welding necessary to hold things in place. Following the main-hoop, rear braces were run from the main hoop back near the rear suspension points and tacked into place.

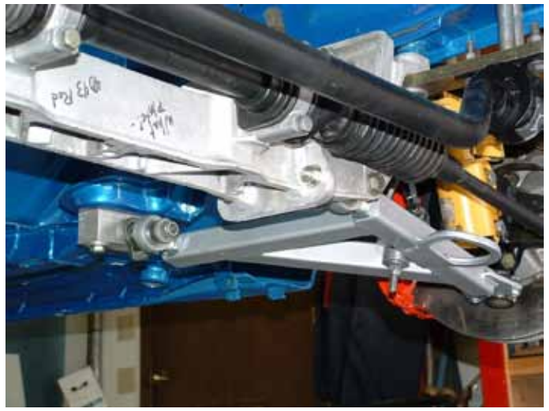
We spent a lot of time figuring out the front hoop, as I wanted to penetrate the firewall / dash area and tie into the front suspension points. A curved, bent front hoop was fashioned to run parallel and about an inch above the lower windshield mount, and tacked between the side hoops. Using weld rod, we plotted the line and drilled holes through the chassis firewall to facilitate installation of tubing to the front suspension towers, ensuring no contact to avoid a rules penalty. A cross brace was installed between these two to triangulate the cage, as well as 45 degree tubing reinforcements to the side-hoops.

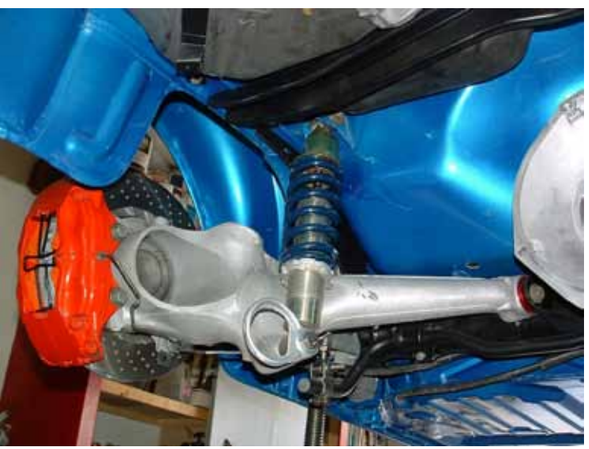
We junked out a few pieces of pipe bending the crash bars that run between the main-hoop and the vertical portion of the side hoops, striving to fit as closely as possible to the door skin and provide great driver protection and a roomy fit (once you manage to get in). At this stage, think through and weld all the tabs and pins for your window net, fabricate the system for your seat-back brace, and install the cross bracing for the main hoop with proper belt attachment height. About three weeks were dedicated to bending and fitting that cage, and the bender gratefully returned to Russ at PMCI.



With the cage tacked in place, my welding instructor helped me locate one of the best welders at Los Alamos National Laboratory to do the final welding. This guy does it all, from electron beam welding to the finest hand-work you can find. Rounding up some neighbors, four of us pulled the chassis off the rotisserie and placed it on his trailer, and a few days and $175 later, he returned a beautifully welded cage. Note that most rules require a certified welder – don't overlook this requirement. Back on the rotisserie, and back to scraping…

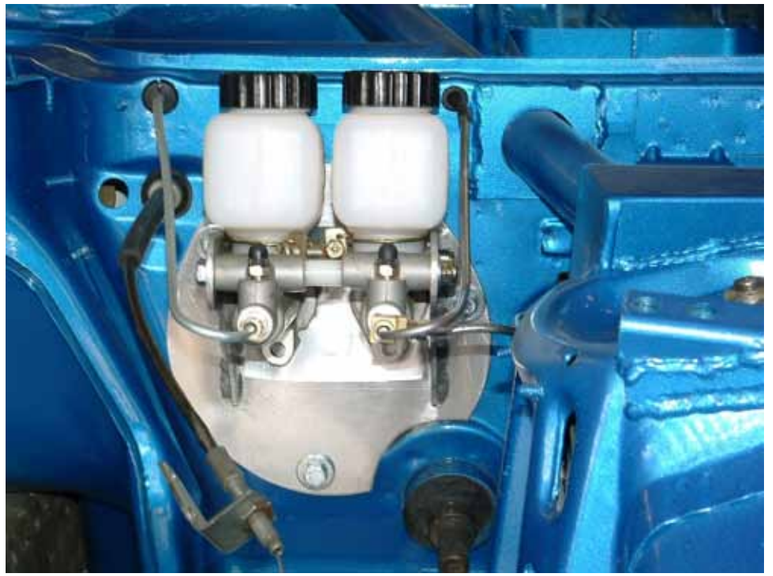
One of the issues relative to working on and maintaining a 951 is access to the bottom end of the engine and clutch. The aluminum cross-member must be dropped to get the pan off, which requires dropping the front suspension. To make matters worse, the turbo is fed via a cross-over pipe that runs from the headers down and across below the pan near the bell housing. To do a clutch, or change rod-bearings, the fuel rail, intake manifold and related hardware up top all have to be removed to access and remove the turbo, and only then can that cross-over pipe be removed. So to occupy myself during the under-coat scraping and provide some badly needed task variety, I drilled a set of mounts to precisely fit the cross-member ends and center section and welded up a steel jig that securely mounted the cross-member. Locating some cut-points, we cut ½" out of each side of the cross-member on a band saw and welded in ¼" aluminum plate (6061-T6) to each piece, using the jig to keep things in location, hence creating a three-piece cross member. Now, eight bolts can be removed to drop the center section of the cross-member, providing access to the bottom end. The cross-over pipe was cut as it turns up toward the turbo, and an exhaust v-clamp welded in on the upward side of the crossover pipe feeding the turbo, eliminating the need to take the top-end apart to get that cross-over pipe off. Lindsey racing sells both these modifications, but they are doable yourself with some time & effort. Burns Stainless on the web is an excellent source for exhaust components / clamps / related supplies.





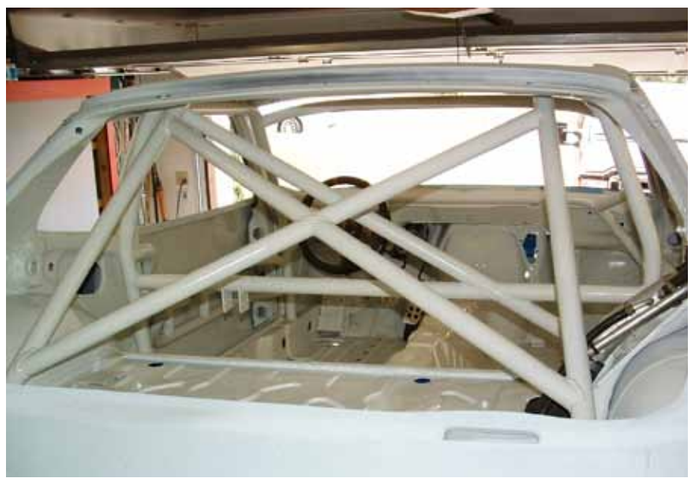
Another weak point on the '86 951 is the spindles; in 1987 and later a larger spindle, bearing, and corresponding hub were produced, and I secured a complete set from an '89 S-2. We magnifluxed the spindles to ensure there was no cracking. Wanting to maintain my 18X10 front wheel set-up, I chose to stay with the early off-set a-arms, but procured a set of fabricated a-arms from Marcus Blasik in Canada, which eliminated another known weak spot relative to the stock aluminum a-arms, which are known to crack around the ball joints, particularly on lowered vehicles.

I relied upon Carl from Racers' Edge to help with solid, spherical bearings for the front and rear suspension bushings, solid caster blocks, and a set of initial spring rates that we set at 850 front, 700 rear. I fabricated some steel rear torsion tube mounts to replace the rubber ones, and found a used solid Kolken rear transaxle mount on e-bay. The torsion bars were removed and polyurethane bushings installed to locate the spring plates. Diligent searching on E-bay yielded a set of 993 Twin Turbo "big red" front calipers, and a new set of rear 993 twin turbo calipers were secured, and the mounting points machined .10 mm on the rear calipers to center the larger rear discs. Porsche cross-drilled rear discs and the gas slotted, hat-style front discs were all cryogenically treated at Diversified Cryogenics. A couple words on lessons learned – while I'm darned proud of those new rear 993 calipers, they are essentially equivalent to the 951 front calipers, which would have saved a few bucks. On discs… beware cross-drilled after-market applications as they are reportedly much more prone to cracking than the Porsche units, which are cast with holes that are reamed to final dimensions just out of the forge, reportedly providing a much more durable disc.



To try and maximize the flexibility in the braking system, I procured a twin master-cylinder set-up and bias adjustment from Tilton, and using the old mount for the brake booster as a pattern, I fabricated an aluminum mounting plate to catch the stock firewall mounting points and fit the dual master-cylinders. The rod-type bias adjustment was fitted in the consul area. E-bay came through again with a used set of Bilstein cup shocks / struts which appeared to be a great replacement for my old Carrera coil-over system. While sourcing these parts, most spare minutes went into scraping, scraping, and scraping some more, until we were finally down to a bare, clean chassis. I cut the inner door panels back to clear the crash bars with a plan to relocated the interior handles to the bottom door casing.

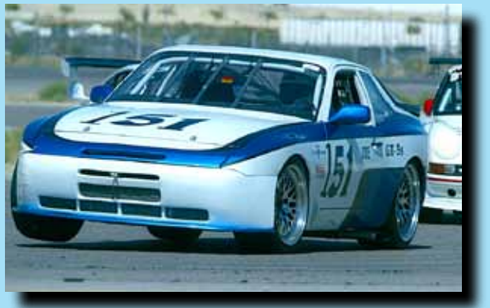
Bruce Phillips and the whole staff at Professional Paint Supply were super, offering a jobber rate on paint supplies and a great deal of patience in talking through the job with a guy that hadn't sprayed anything in 15 years. Having cleaned the entire chassis, and cleaned some more, I draped the garage in plastic, wet the floor, began with a metal prep over the entire chassis, painting the undercarriage, interior, and exterior while on the rotisserie. The metal prep was followed by a catalyzed primer, and then a single stage blue for the undercarriage and engine bay, and a single stage white for the interior and roll cage. I chased the interior with a couple coats of clear for more durability. The outer body was left in primer, recognizing that a full sanding would be required, but the protection was worth it. From there, the brake master-cylinders, front and rear suspension, and springs and shocks were installed, all of which helped prepare the car to settle back to the ground, wheels down.



At this point it's late July, and we're ready to pull this thing from the rotisserie. At this point I had naively thought I'd be back on the track – so much for baseline schedules! To console myself to the obvious total loss of the racing season, I reasoned that we were doing this thing right. But good golly – what a lot of work remained! Little did I realize…but that all comes later.

Next time, we'll get this car onto the ground, and provide more insight into a novice's perspective of a few of the details related to building a race car.

BP



Building a Race Car

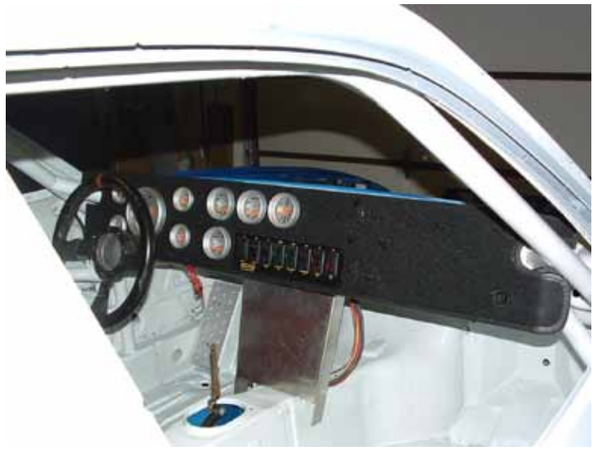
By Bob Patterson

August 2006

Article 5 – On the Ground Again

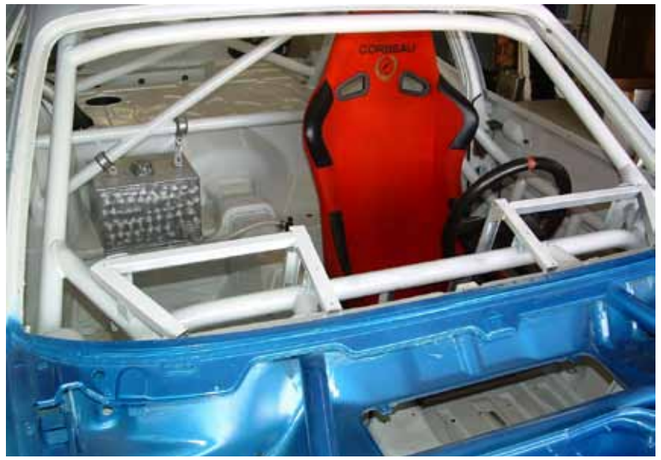
Last month's article culminated in getting this car project back on the ground. Having been placed on a rotisserie, we had actually finished scraping that undercoat; fabricated a cage; sprayed the undercarriage and interior and primed the outer body, and assembled a potpourri of new and used parts from various sources to install the suspension, brake system, crossmember, steering, and related chassis components. I am not sure I mentioned the fuel tank – but that was done too before we set it down. (Note that one ought to place a fuel cell in a dedicated race car – they are unquestionably safer, often lighter, more reliable via a better surge control and pickup designs, and safer, did I say safer?) Unfortunately, 944/951 tanks are not simple or cheap – and my budget would not allow it. The class I was building to permitted factory fuel tanks, so that is the way I went. However, the Porsche 944/951 tank will starve on hard right hand turns if it's a little low on fuel. The fix is to remove the pickup from the tank, remove the stock filter assembly, and JB weld a 3/4" copper extension that is perhaps 5" or 6" long with an end-cap, and a suite of large holes drilled around the bottom perimeter, but none on the top. Then visit your local auto-parts store, and go through the filter boxes until you find a mesh filter that fits your custom intake. Slip it on, secure it, install it, and starvation is a thing of the past.

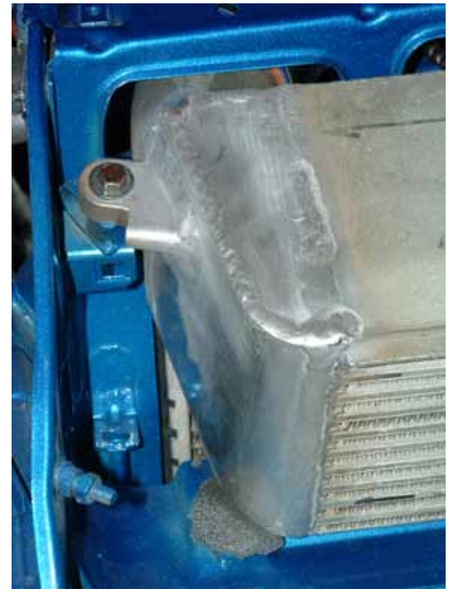
Another thought just occurred to me that I ought to share. Racing is inherently risky, and race care building can hurt you in a number of ways. There are safe shop practices – like using face guards, proper tool guards, the right tool for the job, and then there is the issue of doing it right. Doing it right means using the right lifting equipment, being safe with welders, grinders, and related equipment, and also completing your work properly. Something as simple as a poorly done oil fitting or fuel line placement (looked good at the time) that just wasn't well thought out could result in a failure or fire on the track. Pay it forward by being careful and thoughtful while being creative – and think durability under severe stress. It'll pay you back.



I had no idea how to build a dashboard. Some 944 photos I had gave me some indication of where I wanted to go, but how? About that time while on travel a Supercuts was displaying one of the NASCAR vehicles they sponsor. I waited my turn with the kids, and then crawled inside and under that thing, noting that 1) it was easily accessible, 2) very simple layout, 3) easy to read / reach, and 4) supported by some simple angle and channel between the body structure and cage. Other options exist – a number of people have done curved, cockpit like fiberglass / carbon fiber dashes that tend to wrap the driver and are beautiful and functional. Another theme angles a consul from the right of the steering area, effectively blocking off the passenger area and creating a flat panel, angled dash that tends to wrap the driver. I chose simple and flat.

With some images in my head, I simply shaped a rather basic ½" channel frame from the dash area of the tub, across the upper roll cage tube, welding these in place in a symmetrical shape to provide good mounting points for a dash face and top. From there, I fashioned a cardboard face, and hit the catalogues, selecting an Auto Meter model. I think the best cars have a couple gauges and a big red light that says turn me off. I wanted to monitor a lot more, but didn't want to lose focus on what was important, so I sized and located the gauges based upon importance. EGT, fuel level, and voltage are less important than oil pressure and water temperature, for instance. Your fire pull (if you use a bottle) should be considered. Switch locations must be reachable and gauges readable through your selected steering wheel, while fully strapped into your harness. I set a seat, mounted the wheel, and played with size and layout for a couple of evenings with that cardboard template. I ordered the gauges, fabricated a 1/8" aluminum plate with Ditz fasteners that could be removed easily, and set it aside.



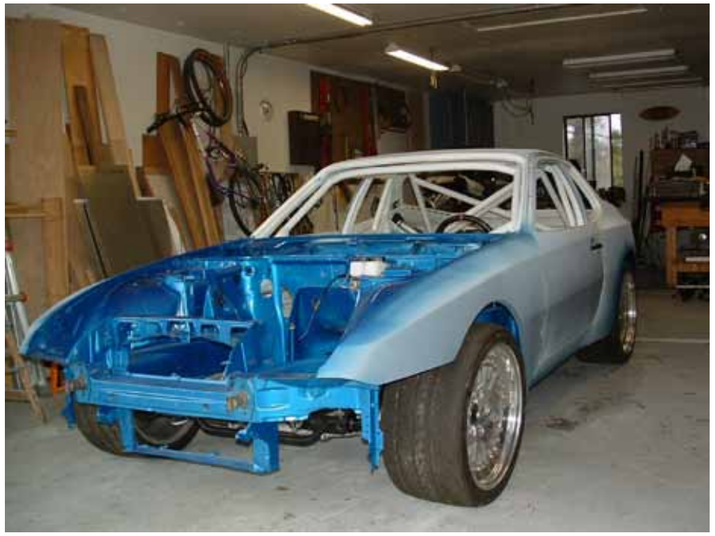


It was time to start a harness, but needed to select an EMS (engine management system) first. Rob Meehan helped me source this; we looked for sensor requirements (can you use any stock Porsche sensors, and how hard is sourcing / modification of a sensor package), flexibility relative to tuning capabilities, and availability of accessory outputs. After considerable searching and reading, it was clear that an Electromotive seemed to be the market leader, with Wolf in a decent second place for 951 applications; several other good ones exist. At $3-$4k for the better systems, they were simply too expensive at the time. We found a PRS system made down-under that was fully laptop programmable, capable of skipped tooth operation on the crank sensor, with about 12 optional accessory outputs. (What I am referring to as an accessory output is the availability of programmable outputs.

An example might be programming an output off water temperature, such that when engine water temperature hits 210, the computer powers the designated output which in turn powers a relay that drives an optional cooling pump.) We found the US distributor in New Jersey, talked him into a discount, and picked the package up for about half price ($800), which proved to be a false economy (but more on that later).

With these basics in hand, I created a simple list reflecting all the electrical demands by the area of the car (front end, driver side front, passenger side front, cabin, rear cabin, and rear), ground locations, and how many leads each device needed. Consider also whether they need dedicated power. By that I mean a cooling fan triggered by a thermostat should run regardless of whether the ignition is on or not; same with brake lights. A power cut-off switch needs to be located in an acceptable area, and must kill everything. I chose Painless to procure a basic relay package and switch panel, and began running wire, making notes of color / purpose, and binding them all within an oil / fire resistant wrap. We located the relay package in the stock Porsche relay box, modified with an aluminum floor with an easy release system to allow quick removal, as well as access to the pedal system. Grommets and rubber trim are critical here for any penetrations or sharp edges – McMaster Carr (on the web) is the best general source I've found for miscellaneous trim and hardware parts. We mounted the EMS on quick release fasteners under the passenger side of the dash, included a 12v accessory plug on the consul so we could power the lap top during tuning, and started running wire, dropping individual leads out of the loom at appropriate spots, and continuing assembly as I went.

The last modification we'll talk about today is the intercooler. The 951 intercoolers have significant flow restrictions, particularly in the input side where the plenum shape is very restrictive. With the limited budget, a bench-flowed, stage II or III intercooler



drivable. Majestic Turbo in Texas provide their proposed solution – and this is not an endorsement. More on that issue in future articles.

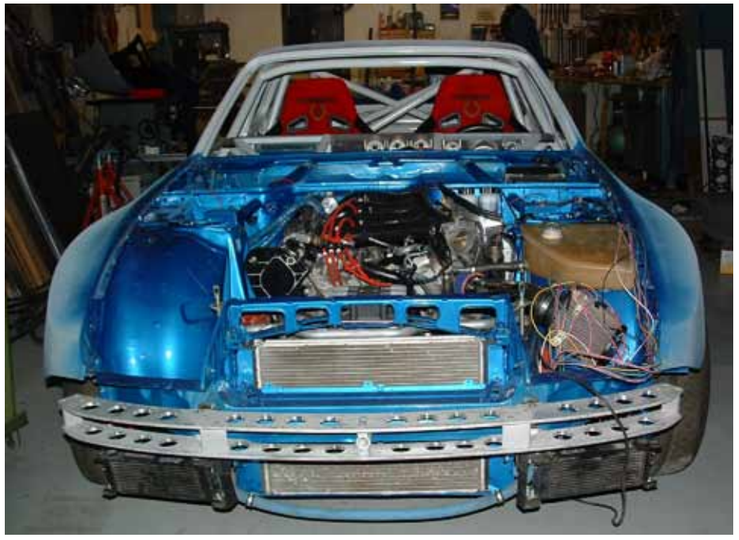
Be careful out there, and enjoy.

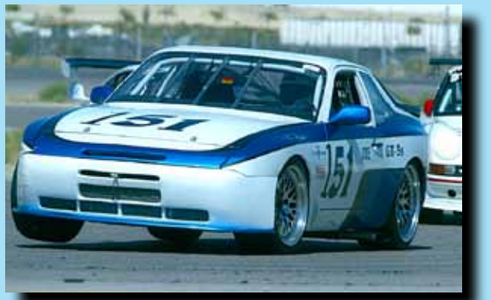
BP

Left: The front end, sans engine.... **Below:** ...and with the engine. It's finally starting to look like a car again. Note the lightened front bumper and various cooling devices.

wasn't going to happen. What did work pretty well was to simply sawzall the input end box off in a neat, square cut leaving the input tube in place, and shaping a new input plenum that eliminated the restriction. Welding it into place was straight-forward, and resulted in an almost no-cost intercooler. At about the same time, we set the engine that we had pulled nine months ago into place to facilitate the harness installation and wiring scheme, with a revised turbo charger.

The general plan was to not fix what wasn't broken, and the engine had been fine, but was suffering from a poorly sized turbo that presented incredible lag, followed by extreme power far too high in the rpm range to be either predictable or





Building a Race Car

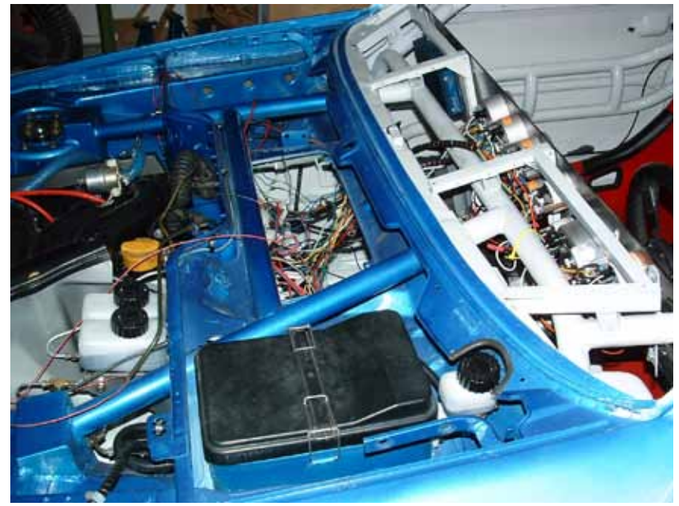
By Bob Patterson

September 2006

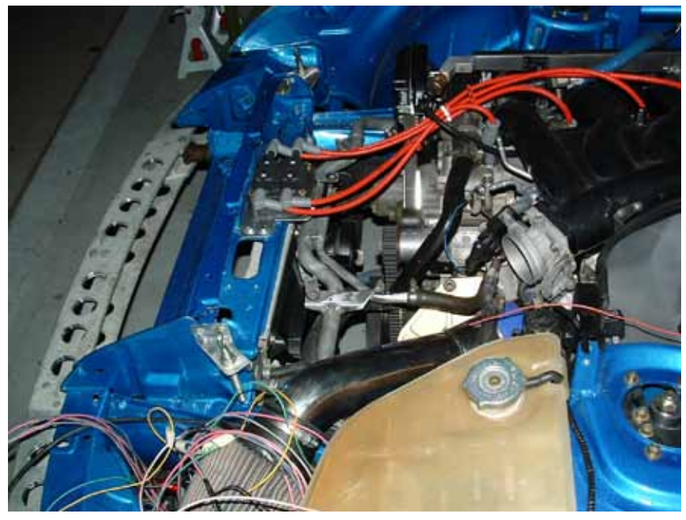
Article 6 – Getting Wired!

In last month's article we crafted a dash board and installed the instruments, selected an engine management system, installed the engine (hence completing the drive-train), began wiring the car, and discussed a modification to the intercooler to flow better air. In this article, we'll continue with what was gradually becoming a very complex effort to bring this car to a running state. I don't want to skip issues related to durability, and some of the engine work, so we'll back-track a little to cover a few details. One thing of great importance is the selection of the right fastener. I highly recommend Carrol Smith's book, Nuts, Bolts, and Fasteners; Plumbing and Hardware.

Before installing the engine, we gave some careful consideration of engine mounts. The stock Porsche units for 951 are prone to failure. Investigating a number of solid mounts, I was inclined to go that way, but was also noticing a lot of them for resale. I wrote a few sellers, and got some feedback that solid mounts simply were not the best option for a 944/951, particularly if you are running solid mounts through the rest of the drive train. One fellow reported he'd rattled the pan bolts out of his engine. The final choice was a Super Mount – warranted for a lifetime against failure while providing some needed dampening in an otherwise solid drive train.



We pulled the pan from the engine to baffle it before we installed – in fact, I ended up crafting baffles for three pans before it was all over. To help prevent oil starvation, one simply installs a rather simple one-way hinged plate on the inside of the pan to limit oil flow away from the pickup during hard turns. The galvanized, 3" hinge with riveted flap is mounted on a plate shaped to fit the dished area of the pan, and welded in place 2" from the outside sealing surface of the drain plug.

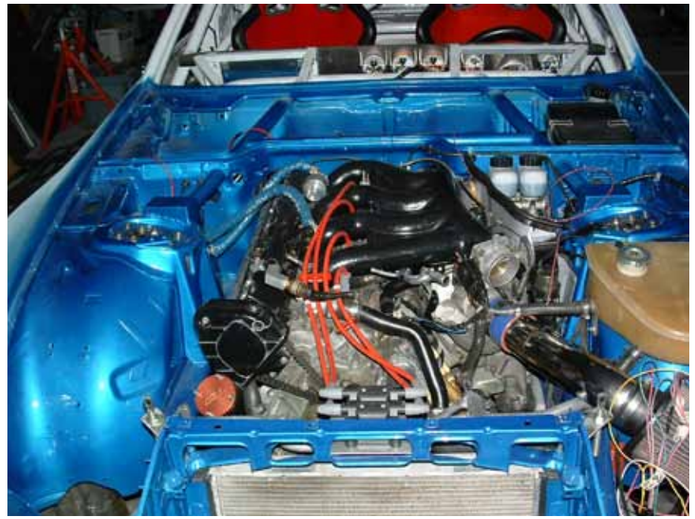


I installed two Straub oil cooers in lieu of the single factory 951 unit. They were mounted on either side of the radiator, placed to catch air flow from the front valance. The oil temperature thermostat was retained, but replaced with new. From a cooling perspective, I had set up a little misting system, whereby some water is misted to the front of the radiator and intercooler, and so I relocated that small tank and pump consistent with the new cage. I believe you should not rely upon systems such as these to maintain operability – your cooling system should be adequate to meet your engine's needs, but I found this add-on handy on really hot track days before, and presumed it would be helpful again.

Getting the engine ready to run was folded into the overall scope of the wiring job. The first issue was coming up with a crank trigger for the EMS. There are only a couple of vendors out there, and their product invariable involves bolting a skipped tooth wheel to the front damper pulley, and mounting a hall effect sensor off the tensioning rod to the alternator. We set this up, and simply didn't like it. The skipped tooth setup looked cumbersome up front, and the sensor mount off the alternator tension rod appeared tenuous at best, and difficult to maintain an appropriate gap. Either of these could be dealt a severe blow by track debris, which would be an immediate end of the day.

These sensors are called Hall Effect sensors, and are fairly typical for an EMS system, and proved to be similar to the Porsche crank sensor. This type of sensor sets up

a magnetic field established when a closely gapped series of teeth pass by. This field is interrupted / triggered by the skipped tooth when it passes. When that missing tooth area passes under the sensor, it triggers an electrical impulse that is read by the computer, which uses that to identify where the engine is relative to TDC, and to time injection, spark, and related signals. The EMS I was using permitted you to load the approximate advance represented by the trigger – so placement of the actual skipped tooth in terms of top dead center was not critical. We did some ohm testing on the Porsche crank sensor, and decided to use that in lieu of a front mounted system. Not only is it a stock part, but the location is well protected on the upper bell-housing, and the mounting rock solid.



So we pulled the engine again and had the flywheel CNC drilled around the perimeter, in line with the sensor placement, at 10 degree intervals. These 36 holes were threaded for 1/8" set screws, and 35 screws were placed using Locktite. The blank was at about 12 degrees before TDC, and served as our skipped tooth. The pins were all set at the same height, and the sensor gapped to factory specifications.

Other sensors, such as air intake temperature, water temperature, and the like had to be calibrated to the computer. We would give the sensor a good ice water soak and take a corresponding OHM measurement to set the lower parameter, and a hot water soak (with a thermometer) to establish a second, higher parameter. Plug the sensor in, bring it up on the screen, and enter the two points and the computer then assumes a straight line relationship from zero to about infinity relative to OHM to value. This unit uses MAP sensor, or absolute manifold pressure, to adjust fuel and timing, which is calibrated with a vacuum pump, and a little air pressure to establish the linear relationship.

As we proceeded with the wiring, we fabricated an aluminum battery mount and relocated a sealed batter to the rear in the spare tire well. We already had oversized hard pipes, and had rebuilt the turbo via Majestic in Texas. A little judicious cleanup of casting marks inside the intake manifold, just behind the throttle body and at the end of the runners, was done to improve air flow. A high capacity Bosch fuel pump and stock filter were used. We stuck with the 56 lb injectors we had previously run on this engine.

You'll learn a few things as you go through this process, such as Ohm's Law: V = AxO. [(V = volts (pressure), A = amperes (current flow), and O = ohms (resistance)]. You'll get to play with resistors to tamper with your fuel signal to correspond most closely to your gauge range, and how to dampen voltage spikes with condensers and power conditioners. The most useful book I found on all this was the Automotive Electrical Handbook, by Jim Horner.

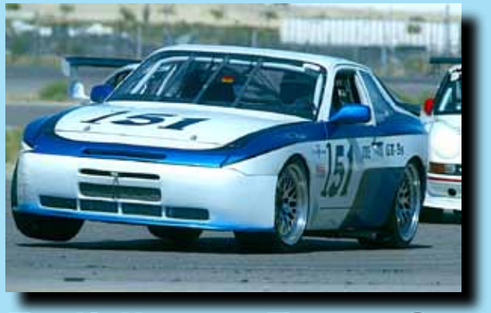
This Perfect Power PRS unit had a 24 pin plug, and an 18 pin plug. The 24 pin dealt with all the basics – a ground, power input, crank and cam sensor inputs, engine temperature, O2 inputs, fuel pump lead (that has a start mode and automatically shuts down when the engine rotation stops), tachometer drive, LED drive, MAP switch, and several 5 volt power pull-ups to piggyback to sensor leads that require stimulation.

The 18 pin connection is largely for accessory outputs and some basic functions like injectors and coil drives. For instance, when engine water temperature hits say, 200 degrees, the PRS could trigger the fans. If intake air hits some value, say 180 degrees, it could trigger the misting system to cool intake air. You can get imaginative.

We went with batch sequential fuel injection pattern, because we were using the skipped tooth without a cam sensor. This triggers injectors 1&3, and 2&4 in a batch mode. The cylinder that fires has therefore gotten two fuel shots – so injector pulse width must be set to not go too rich. Porsche uses the batch method from the factory for the 951. This is coupled with what's referred to as "wasted spark", whereby the spark is also triggered in a batch method, one firing at TDC, and the other on an exhaust stroke – the wasted spark. All of this is very low voltage, low amperage stuff, so most of it triggers relays to power up things like fuel pumps. Injectors and coils receive power all the time, and the PRS unit simply stimulates a ground to complete the circuits. This was coupled with a lot of hours on the laptop trying to ensure proper calibration, and choosing some tuning maps that were provided to try and set something up that would let us "get started."

Next time…we'll get started, or die trying.

BP



Building a Race Car

By Bob Patterson

October 2006

Starting It Up

In last month's article we discussed final drivetrain assembly, instruments, wiring, and sensors for the EMS, and brought the project to the start stage. It's Christmas again, and one year since we began the tear down. We're ready to fire this thing up. I'm feeling a little defeated that it has taken so long to complete, but satisfied with the quality of work performed, and the scope, having done much more than originally planned. From a budget perspective, we've judiciously used E-bay, Rennlist, and other sources for parts and sold many items we no longer needed. At this stage, without exterior paint, we've invested about $5k net of sales, with a great deal of sweat equity. In retrospect, we were at the base of "Heartbreak Hill."

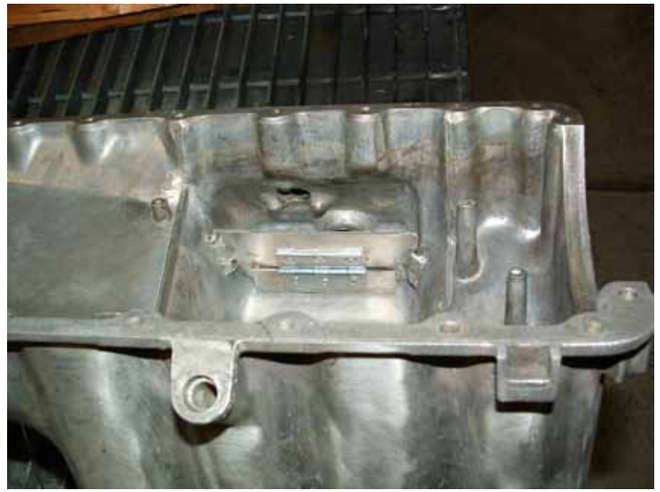
Our initial attempt at starting was proceeded by a thorough oiling of the cylinder walls, as the engine had sat for a year. Fresh fuel, plugs, etc. in place, we cranked successfully and without incident, but were not firing. We traced and re-traced ignition and coil wiring, and put a scope on the crank sensor to ensure an accurate, clear signal. The EMS dealer in New Jersey provided limited feedback, when he'd take a call. We cross-checked the advance with a dial-type timing light to ensure our initial advance settings in the computer were about right. The lap-top I bought to use for programming (a used IBM on E-bay) was marginal, but worked. Still no sign of life, and given that the crank signal instructions could be read two ways, we changed the skipped –tooth pin locations on the flywheel, but still no luck. Through the PRS dealer we learned they had updated software, so we loaded that and ran through our set-ups again. The old IBM wasn't handling this new software too well. We had fuel, but no spark, and ultimately traced it to an intermittent failure in the three wire connection to the quad coil. This trouble-shooting was time consuming and frustrating, and much unnecessary work was performed in wiring, checking, switching leads and output functions, changing lap-top settings, checking sensor signals, and the like. If you have not caught the drift, you will as this story unfolds. I can't over-emphasize the need to select and install a proven EMS system.

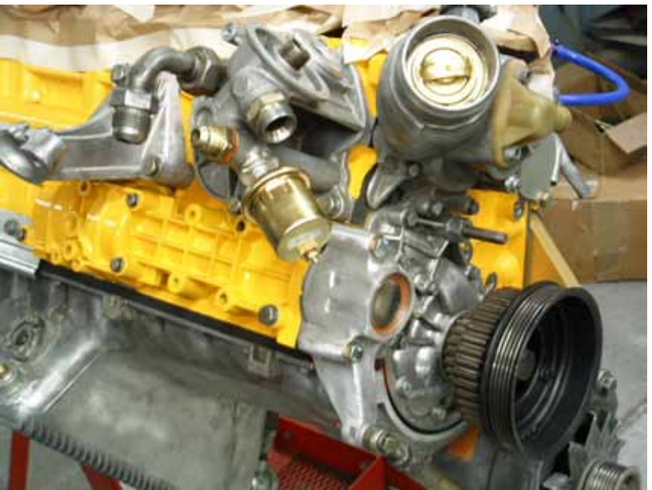
Now we're getting an occasional backfire (not too turbo friendly), indicating spark and fuel, but a timing issue. We refined the timing settings, getting the engine to sputter, but still not start. Then, when hitting the starter one evening, it froze. When I say it froze, I mean it really, really was locked up solid. The starter wouldn't budge it. A flex handle, with cheater on the crank bolt would not yield movement.

The in-chassis tear down was followed by removal of the block, where we found a badly scored / seized number four cylinder (see photo). There were fragments of a paper towel – yes, I use paper to plug the intake runners, etc., and had been using those perforated sheets. Quietly cursing my competency, I speculated that a half sheet had been "around the

bend" in the head and unobserved during assembly of the turbo and intake manifold. Presuming this to be the problem, we mounted the block on the engine stand and completed the tear-down, while simultaneously looking for a new engine block.

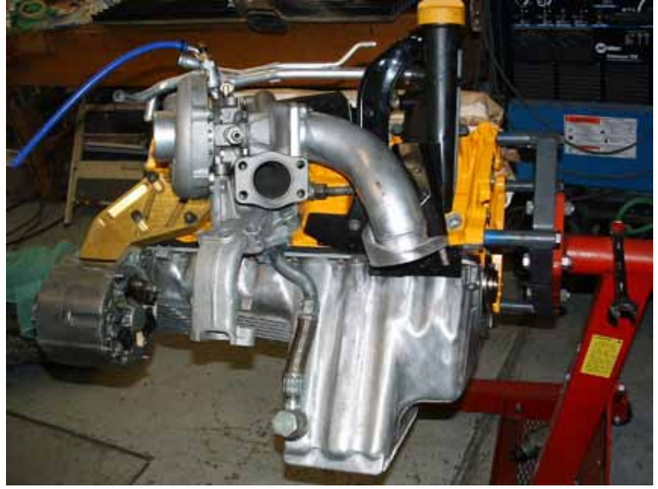
The 951 / 944 blocks are an aluminum silica compound, similar to the early Chevy Vega aluminum blocks. Boring and lapping are not difficult, but must be done precisely and accurately to bring the hardened silica surface to bear against the rings. The cost issue is pistons. Common aluminum racing pistons can't be used against this surface or galling will occur, and Porsche's oversized pistons were running $1500 a set. A good, number one, low mileage 1989 turbo block with girdle and pan were secured in Cincinnati for $900. A similar used number one piston was found to compliment the three I had. Of note, the 1989 951 blocks have a pan ½" deeper and a longer pick-up tube, which were part of the package. The new pan was baffled.





For those of you contemplating a 944/951 block, a number of options exist now that did not seem very acceptable two years ago. For one, boring is more practical as Lindsey Racing now sells a piston in common over-sizes for about $800, or half the cost of the Porsche units. Another approach is to sleeve the cylinders with a steel liner, which entails boring the cylinders, pressing in sleeves, and then honing to fit an aluminum piston. Early sleeves were known to slip within the block, so most who promote this process machine a lip in the deck, with a corresponding ring at the top of the sleeve to secure it between the deck and head. Still, slippage has occurred, and failures reported at any observable frequency raises concern. Chris White recently introduced yet another sleeve approach that basically replaces and interlocks the cylinders that is reportedly not subject to slippage. Lastly, two shops, US Chrome and EBS offer a bore, followed by a nickesil plating of the cylinder walls, with honing to final piston fit. This is an extremely durable metal that is often used in two stroke motorcycle engines, and it will accommodate standard piston materials. Wear is reportedly minimal, piston selection wide, and no expansion / sleeve issues to deal with.

This block had been reworked some, including a start at deleting the balance shafts, so I went with that theme. The reduction in rotating mass makes for a more responsive engine, and deletion is relatively simple. The downside includes greater internal vibration, particularly at idle, but given the total control over the EMS system, I felt we could minimize that by raising the idle a bit. Motor mounts were



more than adequate and comfort was not an issue. The lower balance shaft oil passage simply must be threaded, plugged, and sealed. Use a metal plug with similar expansion characteristics of aluminum. The upper shaft oil feed also serves the turbo oil, and so that threaded hole accommodated a basic 90 degree elbow and #4 AN fitting. Braided hose feeds the turbo through a similar modification to accommodate the AN hose and fitting on the turbo side.

The cover for the balance shafts was modified to clean up the unnecessary castings / mounts, and the oil filter mounting housing modified to accommodate an Accusump oil reserve. The stock oil pressure sender location was bored and threaded for the 12AN oil feed hose, and a threaded plug welded in place in a soft-plug location on that same housing to relocate the oil pressure sender. The final result is clean.

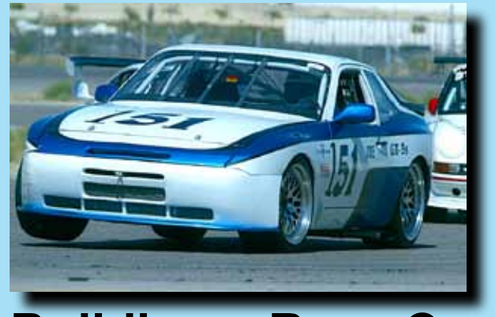
Under Pressure Performance forwarded a beefed up pressure plate and Kevlar disc, and the pistons, rods, crank, pressure plate, flywheel, and all associated rotating mass were delivered to a machine shop to be balanced. A used, custom grind Web Cam appeared and was snapped up. Re-assembly was routine, following the general Porsche shop manual procedures, with great care taken to keep things spotlessly clean, and to make sure all paper towels were removed.

The new block was installed with head and headers in place, and final assembly completed in chassis. Initial start-up attempts were promising, as it popped, bubbled, and struggled to run. And then it froze.

It's now May, and engine number two is toast. Disassembly reveals excess fuel in one of the cylinders, where seizing of the rings to the cylinder wall occurs because of fuel wash on the cylinder bore, which removes all lubricants. No evidence of paper towels. No response or suggestions from the PRS dealer as to why an injector would have dumped. Quiet resolve to see this through, and do it right, and to understand exactly what / why this happened. Maybe the first engine wasn't lost due to a paper towel problem?

Next time…engine three; saving the best for last.

BP



Building a Race Car

By Bob Patterson

November 2006

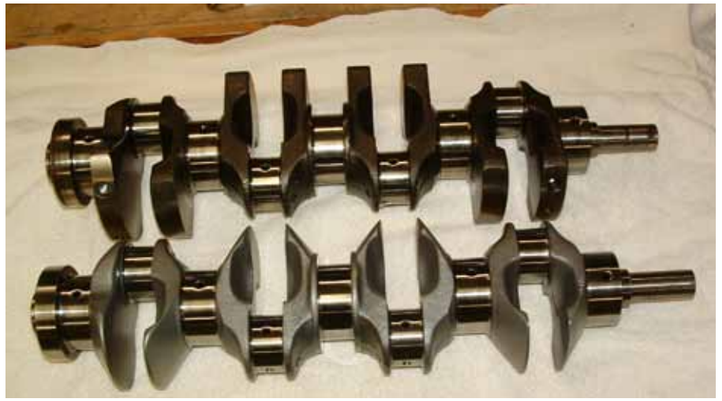
Article 8: Engine # 3

Last month we detailed the attempted start of the original engine, and the seizing problem that arose. Then we built a fresh engine, using a late Turbo S block (essentially identical to the entire four cylinder 944 genre), and after a bit of trouble shooting, seized it. We immediately began disassembly on this engine, and found a cylinder full of fuel – leading me to wonder if the first engine hadn't had that problem as well.

Since any race car project is an evolutionary sort of thing (bringing up all sorts of thoughts related to survival of the fittest), I began an immediate search for another block. Amazingly, a low-mile, 84 normally aspirated car within the county had recently spun a bearing, and the block and girdle were available for a paltry $150. Inspecting the block showed minimal wear on the trust side of the cylinders, and good, clean, unscarred cylinder walls. It was a #1 block – matching the three good pistons I had, so I grabbed it. A few phone calls secured a good #1 piston.

While I was at it, I stumbled upon a lightened, knife-edged and cross-drilled crank. Given the fact we were running without balance shafts, with a lightened flywheel, this seemed like the right adder to minimize rotating weight. You'll find various approaches to lightening a crank – some more extreme

than others. This one struck me as a piece of art. Note the cuts on the counter-balance weights, the knife edge treatment (to help reduce oil foaming), and cross-drilled and chamfered oil feeds to help reduce the dreaded bearing failure reported on the number two journal of these engines. We had the block boiled / cleaned, and made the modifications to the oil passages to accommodate the balance shaft delete, and feed the turbo. The piston was sent off to the machine shop to get the weight matched up to the others in order to keep our balance.

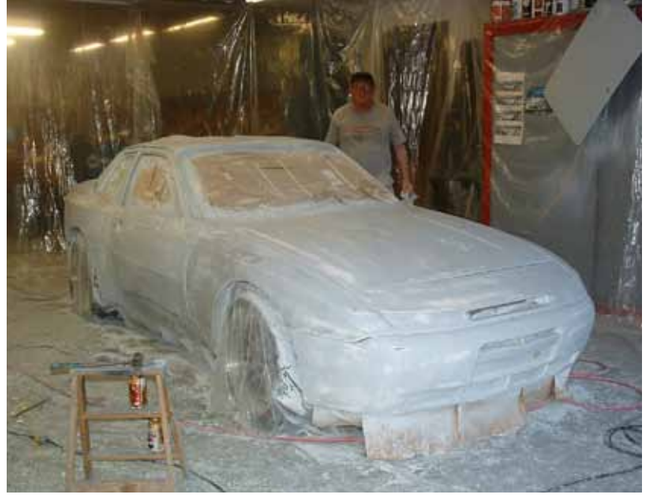


About this time a 968 transaxle (G-44) six speed appeared in San Francisco. Recently rebuilt, it lacked a limited slip, but was otherwise in excellent condition, so I purchased it. A month or so later, as we were completing the engine rebuild, I found a Cup Spec limited slip differential that had recently been rebuilt. Not wanting to attempt this myself, I packed the transaxle to Russ Kelso (PMCI) in Albuquerque to get the limited slip installed, and to check the pinion lash and setup. Does one need a six speed? Not really; each gear is essentially identical to the 951, but the final drive on the 968 box is a lower ratio and I was hoping it would help pull better out of the low speed turns at Sandia and elsewhere.

Installation of the transaxle requires the 968 shift rod, 968 shift lever, and the drivers' side axle (if I remember correctly), as one side is a bit shorter than that on the stock 944/951. The 951 drive tube and housing don't match the profile of the 968 gearbox, but the key mounting points and locations are similar, so they bolt up. The 968 shift rod is shaped a bit differently, and has a different centering bolt / lock at the transaxle shaft, and is therefore essential. This rod catches the shift lever pin at a lower point on the lever, and not having the lever, I simply chopped the stock lever down a half inch or so to accommodate that lower position. I retained all the solid mounts, but did space the transaxle down with a ½" solid aluminum plate to provide a bit more linkage clearance against the gas tank.

At this stage, it's now early July, and engine #3 is about together. Not wishing to repeat my prior mistakes, I had spent some time working with PRS (the EMS manufacturer) distributor in New Jersey, and consulted a shop in Denver that sold and installed them. In the process, I learned that I was only the second guy who'd ever tried to run an engine of this nature on the skipped tooth principle (not very encouraging). We did have the latest software, and had troubleshot the wiring and sensors.

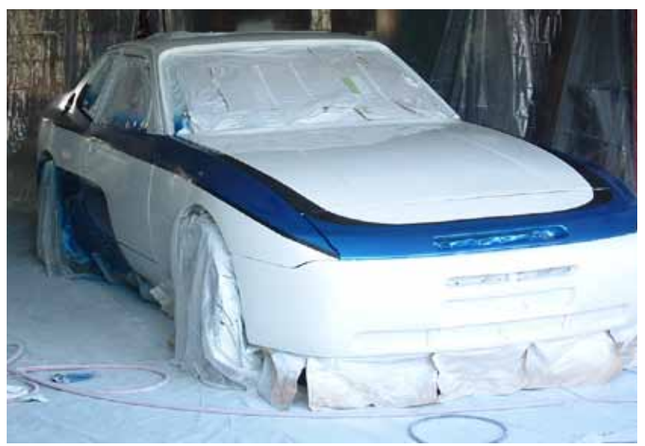
I then took the number one block that had seized, and stuffed the old crankshaft into it, mounted the flywheel and bell housing, and installed this rotating mass in the engine bay adjusting the flywheel sensors and the like as if we were going to run it. With no rods, pistons, pan, or head it was a strange sight indeed, but it served the purpose. We then bought some noid lights – small, clamshell shaped lights that are very sensitive to voltage, and wired these noid lights



up to the ignition and fuel injector leads. The starter spun this light, resistance free assembly quite easily and quickly, and this allowed us to do a visual on the computer outputs to ignition and fuel injectors. Injectors are powered continually, and "fired" by providing a ground, which is adjustable in terms of duration.

For comparative purposes, I strung some noid lights into my normally aspirated 944 and spun that to get a visual on the intensity and duration of the lights. We were not getting a methodical, routine pattern that one would expect. We shifted outputs on the computer (we had 18, after all) and eventually seemed to find a combination that yielded a methodical ignition signal, and adjusted the duration on the injectors to get about the right light intensity.

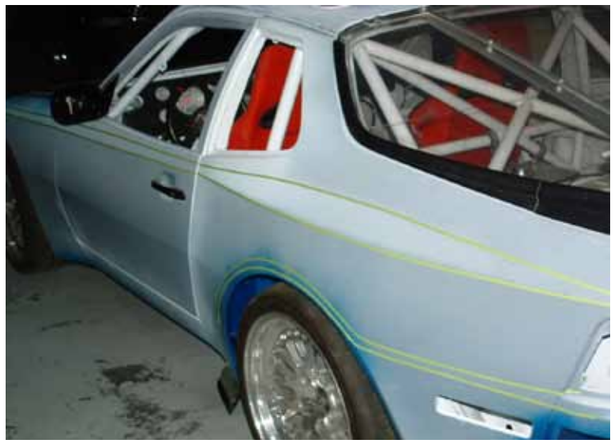
Comfortable that we were closer than ever, the bare block came out, and the flywheel and associated hardware swapped over to the new engine. We slipped that into place, and did the associated wiring and testing to ensure we had fuel and spark. Again, running the skipped tooth system, your using wasted spark system where two cylinders fire at the same time (one into the exhaust stroke), and batch injection – where two injectors are firing at the same time. This is necessary when you don't run a cam sensor.



(Only with a combination cam and crank sensor can the engine really know which stroke is number one compression.)

As you can well imagine, I approached the starting of this third engine very carefully, checking plugs, ensuring cylinders were not flooding, checking spark, and dialing in the advance one last time to ensure our settings were about right. We primed the oil pressure to ensure we had lubrication quickly. Final installation of fresh plugs, and with a few ruh, ruh, ruh's, she fired and idled. Raising the RPM to about 2000 to help seat the new cam and lifters (that had zero hours after two engines), there were no obvious leaks. Oil pressure at ~90 psi…smoke rising from the headers, paint, and general assembly residue on the block; no immediate cause for alarm. Everything was checking out…water temps well within range, no leaks…I cannot describe how good it felt to make that engine run. What a relief!

It was time now for the exterior paint. Again,



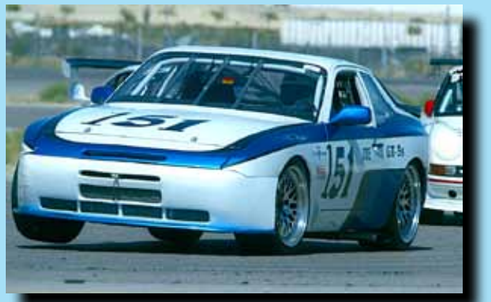
Bruce Phillips lent a hand, and his staff at PPG in Santa Fe was extremely helpful. Having collected a bunch of photos and ideas, I began taping the body looking to find the right design. The pictures tell the story. The primer, having been on a year, had to be sanded and re-shot before any topcoat could be applied. Having developed a plan, I tented the garage again with plastic, watered the floor, fired up the explosion proof fan (that's important, folks), set some temporary lighting, and started the final taping. I went with a two stage on the body. Once you lay color you have to clear coat the same day. There is a lot of tape and paper involved in a three color job, and that can be a full day for the inexperienced. Given my wife had invited a couple over for dinner that night – interrupting my work; it was late and dark when the

final clear coat was on.

In retrospect, there are a couple of thoughts worth mentioning. First, as I've found out, race cars get beat up – particularly when you run back in the pack. If your driving skills are on par with mine, you'll also have incidents. The two stage process adds complexity to repair work, and while beautiful, can prove to be a burden on successive repaints / spot repairs. Secondly, know your assets. Having struggled to do a decent job in a somewhat dark and dirty garage, I found out a week later I could have had the high school paint booth for a weekend – all I had to do was ask. I should have. Lastly, if you have an experienced partner who will do the spraying, take the offer. With practice and good equipment, you can too, but I had not painted in 10 years, and made some foolish mistakes.

Next month we'll talk tuning, and initial run in. Until then – keep it shiny side up.

BP



Building a Race Car

By Bob Patterson

December 2006

Initial Tuning and Run In…

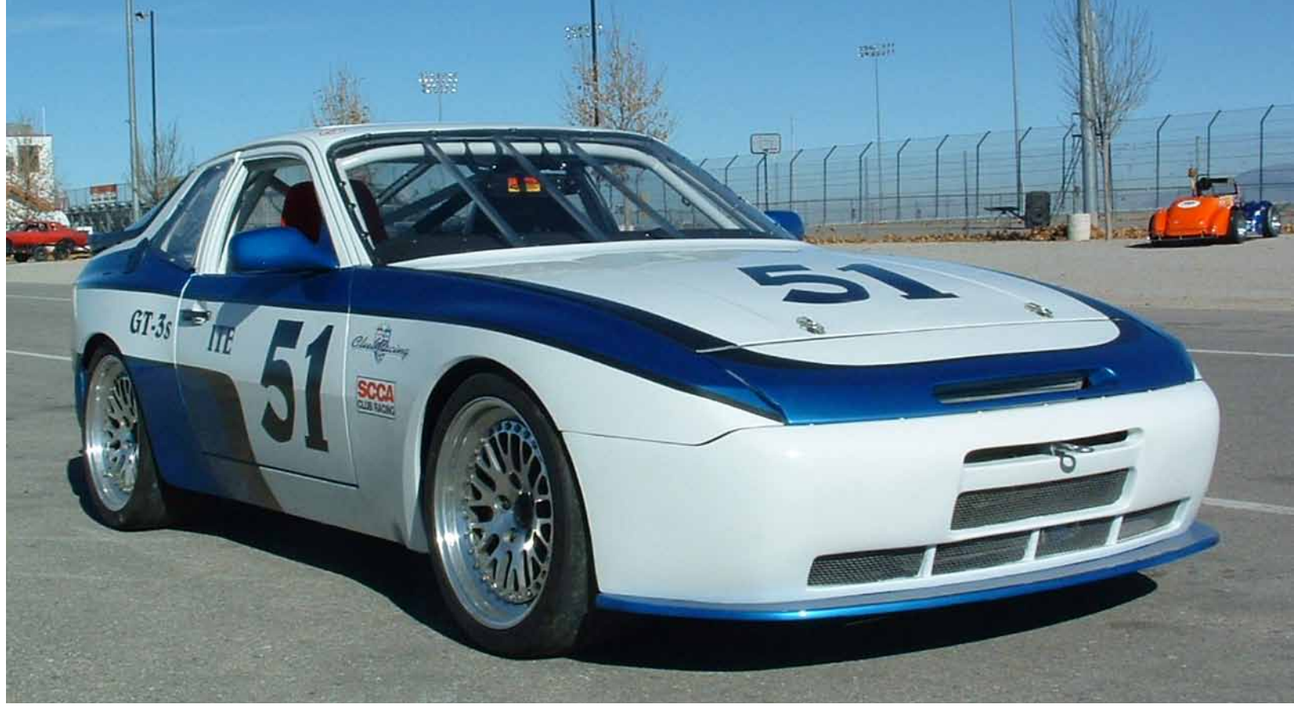
In the last article we covered the final installation and startup of engine #3, followed by the paint work. The EMS system, a PRS 8 unit, had been a problem requiring we rather unconventionally wire the outputs relative to the injectors and coils in order to achieve start-up. This was done by spinning a crank in a bare block with appropriate sensors, noid lights, and a scope for strength on the crank signal. It's now early August, just over 1 ½ years after project start, and I can see completion just around the bend. It feels like it's been a battle, but the car is looking good, running, and so far the PCA and SCCA have cooperated with my sad songs and allowed me to keep my competition licenses despite my failure to do the requisite number of annual races to stay current.

New, scratch resistant Lexan was cut and installed for the side windows, and the old, fairly scratched Lexan windshield I'd crafted was discarded for a treated Lexan product called Speed Glass – which has much better optical qualities, superior scratch resistance, and comes molded to the body shape, and requires only some trimming for a decent fit, making it much easier to install. Three vertical braces for the windshield were installed, per SCCA rules, and the cabin / exterior were essentially complete. Number and club decals were applied, and the car was coming together, at least from an appearance standpoint.

Having played with the tuning a bit on the laptop, we were achieving reasonable O2 levels running the engine at relatively steady RPMs, choosing to error on the side of rich versus lean. With paint on the body, and all systems generally functional, I scheduled a tuning session in Denver with the shop that distributes the PRS units. They have a chassis dyno and the experience necessary with the EMS system to achieve what I hope will be a good tune to get this car track ready. I'm hoping that we can get this done in September, and maybe, just maybe, allow me to run it once before winter sets in.

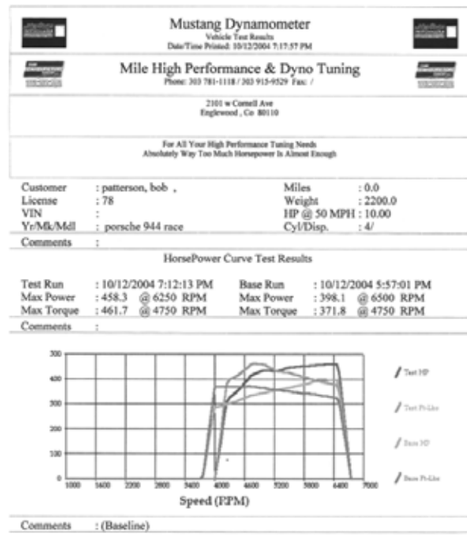
Because the dyno runs are typically full-throttle and abusive and a number of new engines are known to fail for one reason or another, I was worried about subjecting this essentially zero hour engine to full-tilt runs without some run-in time under a load. So I rented a couple hours of dyno time in Albuquerque to simply run the engine in a bit under load and ensure everything was seating, and systems functional. We set it up, strapped it down and ran it, doing a bit of light tuning while subjecting the loaded engine to alternating throttle and compression to help seat the rings. Temperatures and oil were all well within range and in general the car ran well. The transmission worked – everything seemed good. I felt the session was worth the expense and effort and would breathe easier having done this before subjecting it to WOT runs in Denver.

A week later we towed to Denver. My expectation was to spend a couple of days there, if necessary, while we did a final set-up and full tune. Off-loading and parking the car outside the shop, the technician hooked up his laptop and started frowning at the outputs. By the time I'd parked the truck and trailer and walked the half-block back to the shop, he was re-wiring outputs to set up the more conventional injector & coil drivers. And presto…in a wink, the car would not run. My heart sank as I tried to explain the issues we'd had, and how we got to where we were.



The finished product: one and half years, countless hours, thousands of dollars. Experience: priceless!

As he "played" I got progressively nervous and insisted we pull plugs after each start attempt to ensure we didn't wash a cylinder. Sure as the sun rises in the East, about the third try after pulling the plugs, the rotation resulted in a stream of gas shooting into the air. Tracking that cylinder / injector back and testing the feed, we found it to be a dead ground – in other words it had failed, and in so doing opened the injector continuously and filled the cylinder. I was running 82 lb injectors, about 8 times the size of a stock injector, and these babies do put out the fuel. So, Frank became a believer and we began to pressurize the fuel system and then turn off the fuel pump and just watch the fuel pressure gauge as we attempted starts. About the third start attempt the fuel pressure would drop to zero. Pull the plugs, and one cylinder would be full. Change the leads, repeat the process, and presto, same result – on the third start attempt another output would fail and a cylinder would flood. By the end of the day we'd gone through half-a-dozen outputs, and watched them progressively fail. The shop had another unit, a PRS-4 with fewer capabilities, but that should be adequate to run the engine, so we pledged to renew the effort the next morning by plugging in that unit and doing further testing.


Mustang Dynamometer
Vehicle Test Results
Date/Time Printed: 10/12/2004 7:17:57 PM

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Customer	: patterson, bob ,	Miles	: 0.0
License	: 78	Weight	: 2200.0
VIN	:	HP @ 50 MPH	: 10.00
Yr/Mk/Mdl	: porsche 944 race	Cyl/Disp.	: 4/
Comments	:		

HorsePower Curve Test Results

Test Run	: 10/12/2004 7:12:13 PM	Base Run	: 10/12/2004 5:57:01 PM
Max Power	: 458.3 @ 6250 RPM	Max Power	: 398.1 @ 6500 RPM
Max Torque	: 461.7 @ 4750 RPM	Max Torque	: 371.8 @ 4750 RPM
Comments	:		

Speed (FPM)

Comments : (Baseline)

The next morning dawned, as they seem to inevitably do, and as far as this EMS system, the PRS-4 didn't work (either) which was beginning to feel about as inevitable as the dawn itself. Then the starter failed – and I chased around Denver to find a starter and get it installed. Then an injector body ruptured (brand new, mind you…) and I hooked up and over-night shipped one of those. We called the PRS National Distributor to talk it through – and it wasn't encouraging. We became acutely aware that we were on the ragged edge in terms of setting up a skipped tooth system on a high HP engine using batch injection and spark with this PRS unit – like only the second people in the country to have tried. I harkened back to a comment

my wife had made after engine number 2 had seized – “Maybe you are just not smart enough to make this work?”

We began discussing engine management system options – but the technician was convinced he could make the PRS-8 work just fine at less cost than a new system. But we were looking at a few weeks to get a new PRS-8 swapped out for mine – which had to be returned first. I left that night, heading home with an empty trailer, having left the car in the shop in Denver, and with only a faint hope that within the month we’d get it back, and at a reasonable cost. As surely as the sun rises…I didn’t.

We began what ultimately became a two month exercise with me bothering the dyno people at least weekly relative to status, and them becoming increasingly frustrated with the effort. In the end, it was November when I picked up the car. The resulting $4k tab included a new PRS-8 unit, installation of a cam sensor, setting up for sequential injection and ignition settings (recognizing that a skipped tooth approach just wasn’t going to work despite advertising and manuals to the contrary), and any number of sensor adjustments, including a Chrysler (don’t tell anyone that) ignition module that works off a seven pin flywheel setup, some sort of black box signal converter he custom built, and any number of power / sensor capacitors, resistors, and cleaners to smooth, stabilize, and clean up the computer signals and triggers. The end result met my general expectation as we produced ~398 rwhp and similar torque at 1.1 bar, and 458 rwhp and ~450 foot lbs of torque at 1.5 bar.

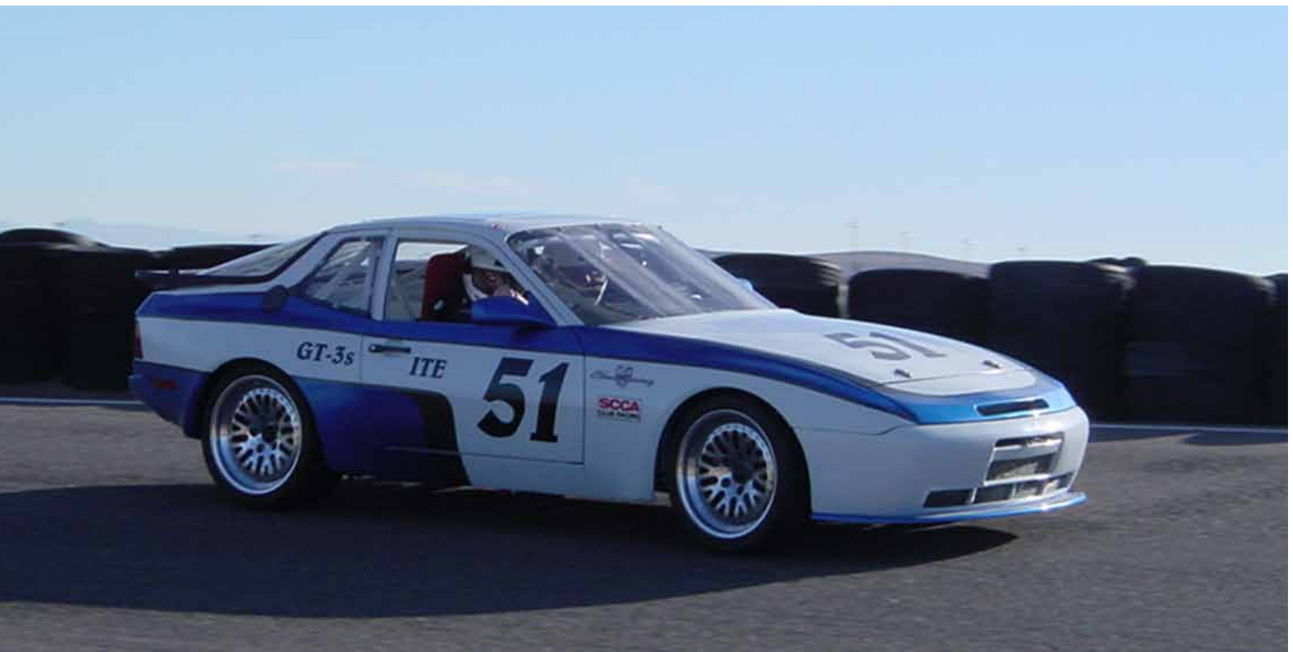
But before we get lost in horsepower euphoria, consider the two years and the effort expended, and let’s go back to some of the initial thinking I shared in my first article. Remember the suggestion that one seriously consider their willingness, technical abilities, and finances before embarking upon a build? Do you recall my rather hap-hazard search for existing race cars, and the rather casual decision to just build what I had as opposed to doing a good search, and buying a proven car? Think about it.

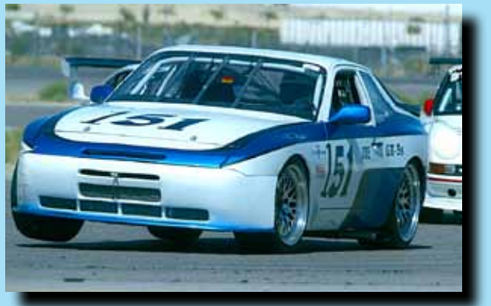
I have to say that I got a great deal of personal satisfaction for having taken this on and actually done it. But I hearken back to an earlier day, when I was about eight or nine years old and got my first job digging some trenching for a retired Air Force Officer down the street. He watched me shovel a bit, and then came over and showed me a better way, and said… “Son, always take the path of least resistance.” I wonder some times if I ever did “get it”.

I think the next article will conclude this series. I’ll focus on the first season, and the inevitable issues that arise as one actually begins subjecting the car to the abuse of a track, and what gives (and what doesn’t)

BP

Below: On track at Sandia Motorsports Park for initial shake-down runs in early December of 2005, with Russ Kelso in the passenger seat.





Building a Race Car

By Bob Patterson

January 2007

In this issue we come to the conclusion of Bob Patterson’s highly informative and entertaining series describing the building and running of a race car from scratch to race. Many, many thanks to Bob and we wish him all the success in the world running this awesome and beautiful car in future PCA and SCCA events. Ed.

Conclusion: Shaking it Down…

For our final installment of this series, we’ll focus on our first season of running the car in. Your results will vary – so this isn’t necessarily indicative of the typical experience. But as a rookie builder and racer…here’s my story.

First Track Day: In late November of 2004, I rented Sandia Motorsports track for a couple of hours. It was a bright, warm, sunny day, good tow, and the car started and ran as expected. I was surprised and pleased to have Blackwell, Oaks, Cridland, Kelso, and McReynolds there – all a little curious. The initial experience was: WOW! Very peaky – fresh engine putting out much more power than what I’d expected. No problem spinning the 285 x 30 x 18’s in second gear. Some smoke from turbo area was a concern – obvious oil leak, but the longer I drove, the less smoke we had.

Homework: Pull the intake and examine the turbo, tightening a loose AN fitting on the oil feed line.

Second Track Day: I went to an informal practice session organized by the Corvette club, again at Sandia Motorsports. It was colder, an overcast early January day in 2005 with temps in the low 50s. My first lap was reassuring, familiar, and as I entered turn one I saw Chuck Tipton up ahead, and decided to catch him. I opened it up coming out of turn one and it broke loose into a slow power slide that put me into the inside tire wall about half way to turn two. Minor damage to fiberglass in the right front, but caved the right rear fender in pretty well. I loaded up, admonishing myself extensively for driver stupidity.

Homework: Remember that tires have to be warm. Pound out the rear fender and repaint inside and out. Tape up the front.

First Race: This was an SCCA Event in Arroyo Seco in March of 05. The first two practice sessions were good – I like this track (no walls). Lots of acceleration and speed, but rear end is loose and I had to be gentle coming onto the power out of turns. Then it suffered a loss of boost. I found a failed seal in the waste-gate flange but was able to replace it in the pits without any problem. So far the first race was going well – running near the front when, about 12 laps into it smoke suddenly filled the cabin. Backing off, I checked the temps. The oil pressure and everything was fine. When the smoke began to clear, I started getting with it again only to notice the clutch slipping on the front straight. When the slipping got worse and worse, I brought it to avoid ruining the flywheel. Weekend over.

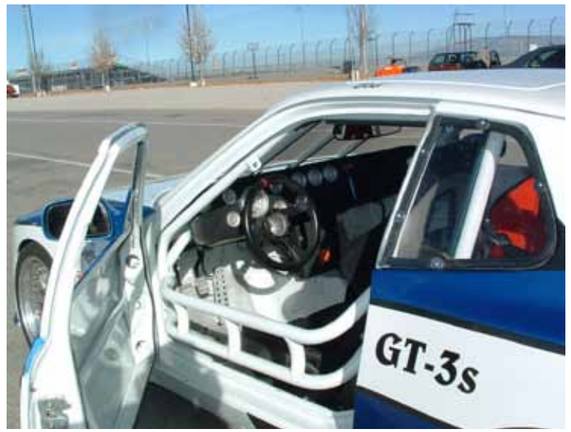
Homework: Make sure the oil filler cap is securely in place (it had blown off). Pull the engine out to find the “rebuilt” pressure plate and Kevlar disc from a vendor wasn’t up to snuff. Replaced with a Stage III SPEC clutch package. As this was about the fifth disassembly in a year (and I’m getting old) both shoulders basically froze up, a situation requiring several months of physical therapy.

Second Race: An SCCA event at Pueblo Colorado. I like this track too. Only one wall section, and some great elevation changes. Practice resulted in a loss of boost, attributable to another gasket failure in the waste-gate. Replaced, and power restored, I qualified fourth, with the 2nd, 3rd and myself all within ~½ second of one-another. First race is going great – some very tight racing and jockeying for position when on about the fourth lap the clutch went away. I mean gone. Pit diagnosis revealed it was internal – not fluids or a cylinder.

Homework: Towed it to Russ Kelso of PMCI who accomplished the heavy work of replacing the broken clutch fork. (I’m still doing physical therapy on the shoulders from the last pull down.)

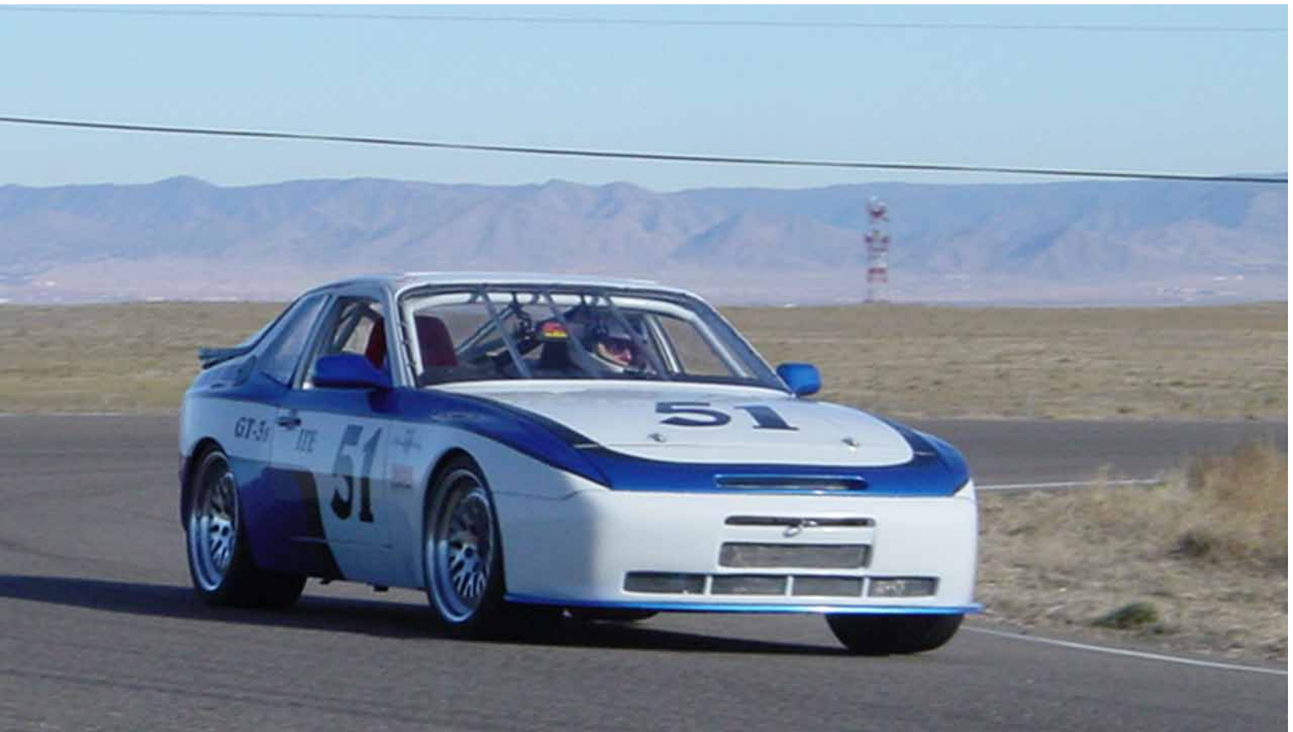
Third Race: Las Vegas, Nevada PCA race in May of 2005. Pulling into town the transmission began to fail on the F-350 Diesel. Limped to the track, dropped the trailer, and found a shop. Submitted the Ford to a transmission rebuild and got a ride back to the track. I had to attend the evening orientation (as I’d not raced PCA in two years) and afterward found my daughter Julie and I stuck there. No taxi company

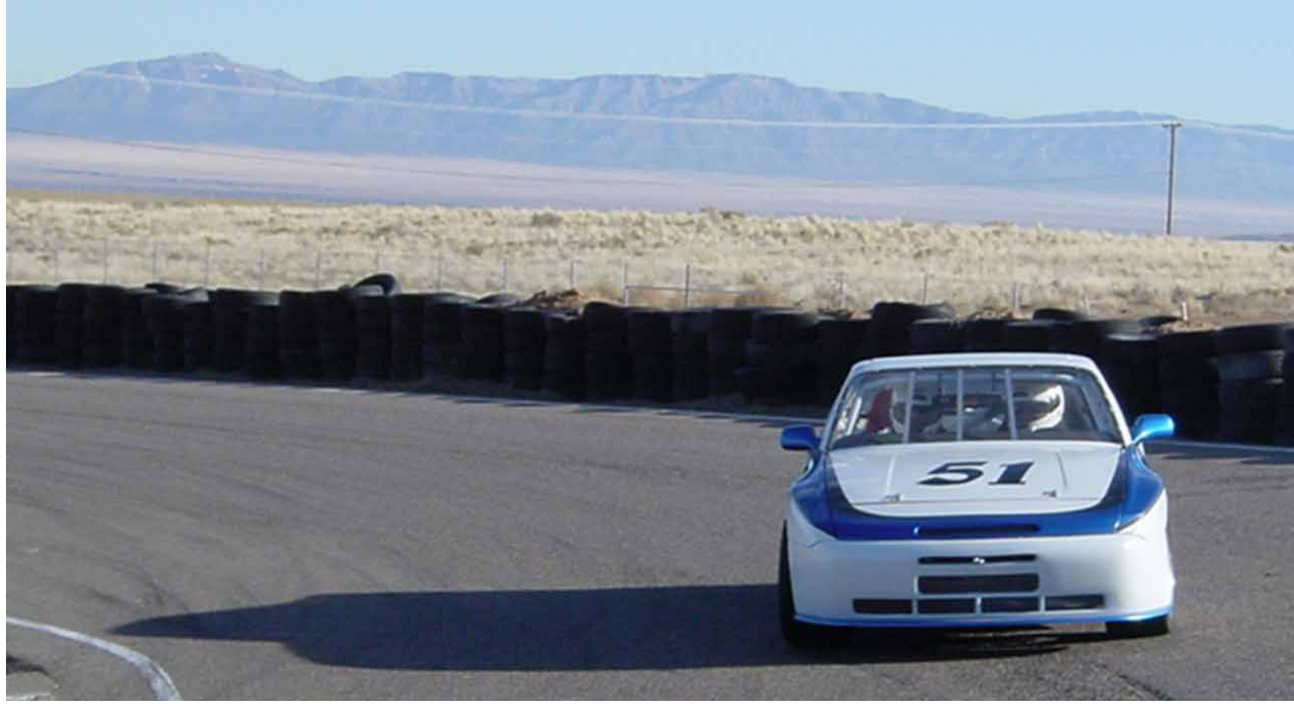
would answer our cell calls. It's late – 11:00 pm now, and we're cold and tired. A lady who's been drinking a bit understands our plight and just offers us the keys to her car. "Your Porsche people, aren't you?" she exclaims, and we drive off to the hotel with her car. That was one relieved lady the next day when we came back!



First practice session we experienced a loss of boost again. But, Bruce Phillips digs through a box of gaskets and manages to produce one of the seal rings (thanks, Bruce!). We replaced the waste-gate seal too and started the second practice session. It's going better, but I notice a similar, but different, loss of power near the end of that session. Of course I concluded wrongly that it was a fuel venting problem, and work that over. Bob Karp graciously loaned us his truck to chase some parts, and later to reclaim our truck with the $2300 rebuilt transmission. Then the race starts, I romp on it, the car surges forward and...dies. A dangerous situation – and predictable. Total loss of boost (again), no more spare gaskets, and we're back on the trailer for the tow home. Homework: Re-evaluate the mounting system for the waste-gate, and fabricate a new mount with added flexibility and a second attachment point.

Fourth Race: A "home" race at Sandia Motorsports Park. We're bogging coming out of the tighter corners, and not maintaining enough corner speed. The rear end was still loose on turns despite full sway adjustments and a re-evaluation of spring rates. Second practice session we lost boost again so I drive all the way home to get the spare seals and miss the Saturday race. Sunday started good, but on lap two of the race the 20 cent clip holding the shift rod to the shifter slips off. This R+D work is hard on the ego. Homework: Replace the retainer, and make a mental note never to use a spring washer directly against a retainer clip. Have Russ check the car over, with emphasis on the waste-gate, and discover that it's missing an internal pipe, hence allowing the seals to compress and fail.





Fifth Race: Back to Sandia Motorsports Park. Not the fastest car by a long-shot (after all, Russ owns that track), but an incident free weekend. No problems, no issues, and no sweat and blood crawling around in the gravel in the pits. Yea! It was absolutely a fun weekend, memorable in a number of ways, and I felt the jinx might finally be off my back.

Season two, 2006, was markedly improved. The car was reliable, but still loose in the rear. Going to a 12" rear wheel shod in 335's helped immensely, and I had a good race at Arroyo Seco, and another at Pueblo. In July I managed to set an SCCA track record for ITE-O at Pueblo, and in the final race actually overtook and led a GT-2 Porsche that was featured in Excellence that month. I none-the-less ended up second due to (guess what?), smoke in the cabin and another lost oil filler cap. With the additional grip, I was now having problems with under-steer, and went to a 305 tire up front. It's always something!

In September, back at Pueblo, the car felt great, but driver judgment, well, it wasn't quite up to par. I'd learned a "rhythm" for turn 10, a third gear right hand turn onto the front straight. The complicating factor is that I use a long toggle switch which lets me run high boost on the straight, then flip it back down for the technical portion of the course. Well, about half way through a lap I came out of a turn really hot. Guess what: I had failed to flip the boost down and decided to just run it , not thinking five turns ahead.

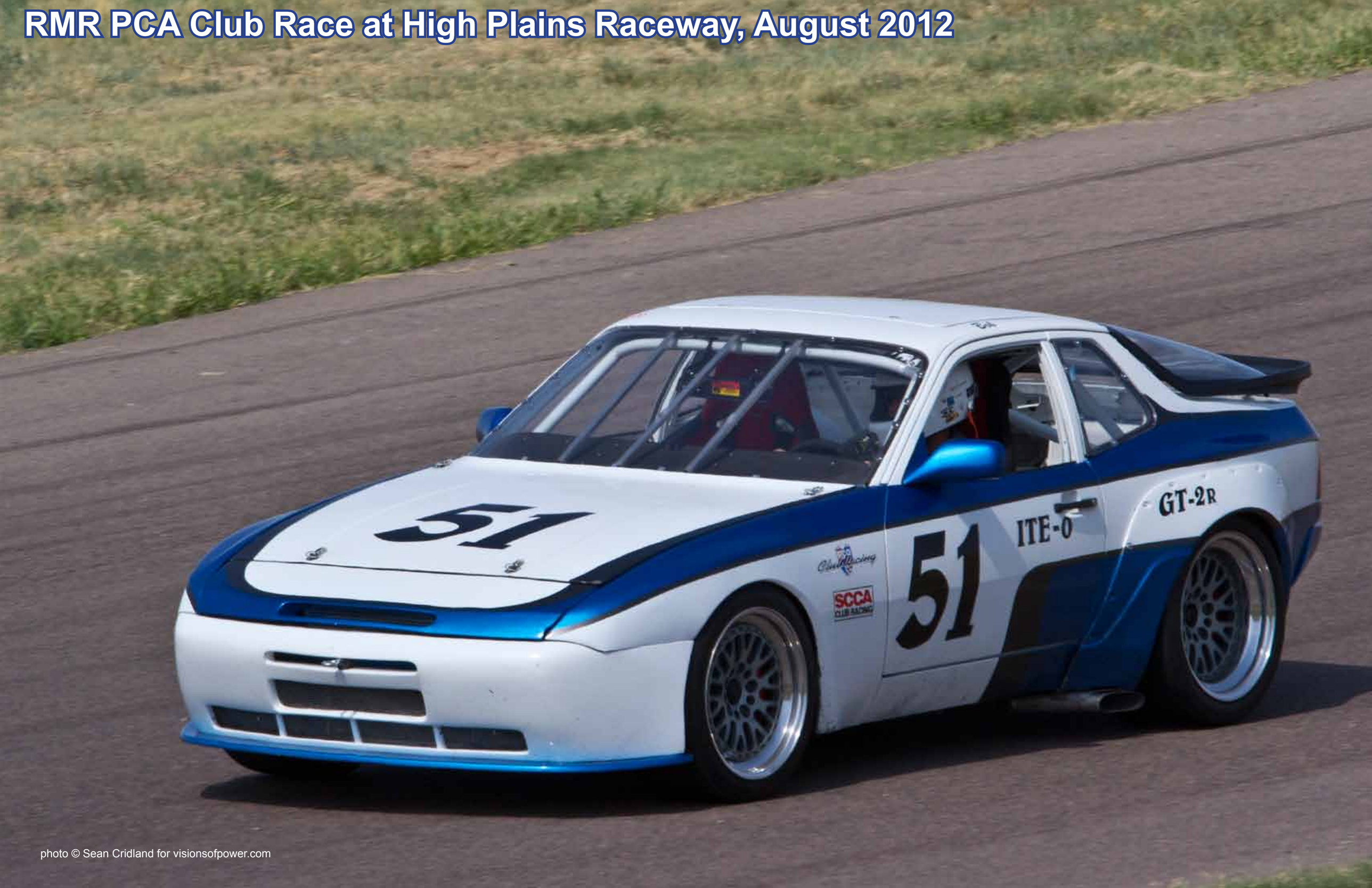
Another 50 hps gave me another 15 MPH into the next turn. The rhythmic pulse of the brake with the left foot set me up for turn 10, and coming out, probably ¾ of the way through the turn, I was full on throttle when the rear broke loose again putting me into the concrete wall. This time we got the other side – left front and left rear, and a couple of bent rims as well. The flatbed shoveled the car into my trailer. Bruce Phillips suggested a shop, and as I write this, I'm facing a couple of weeks worth of hammer and dolly, putty and paint. Fortunately, there was no really serious damage, but what a lot of work!

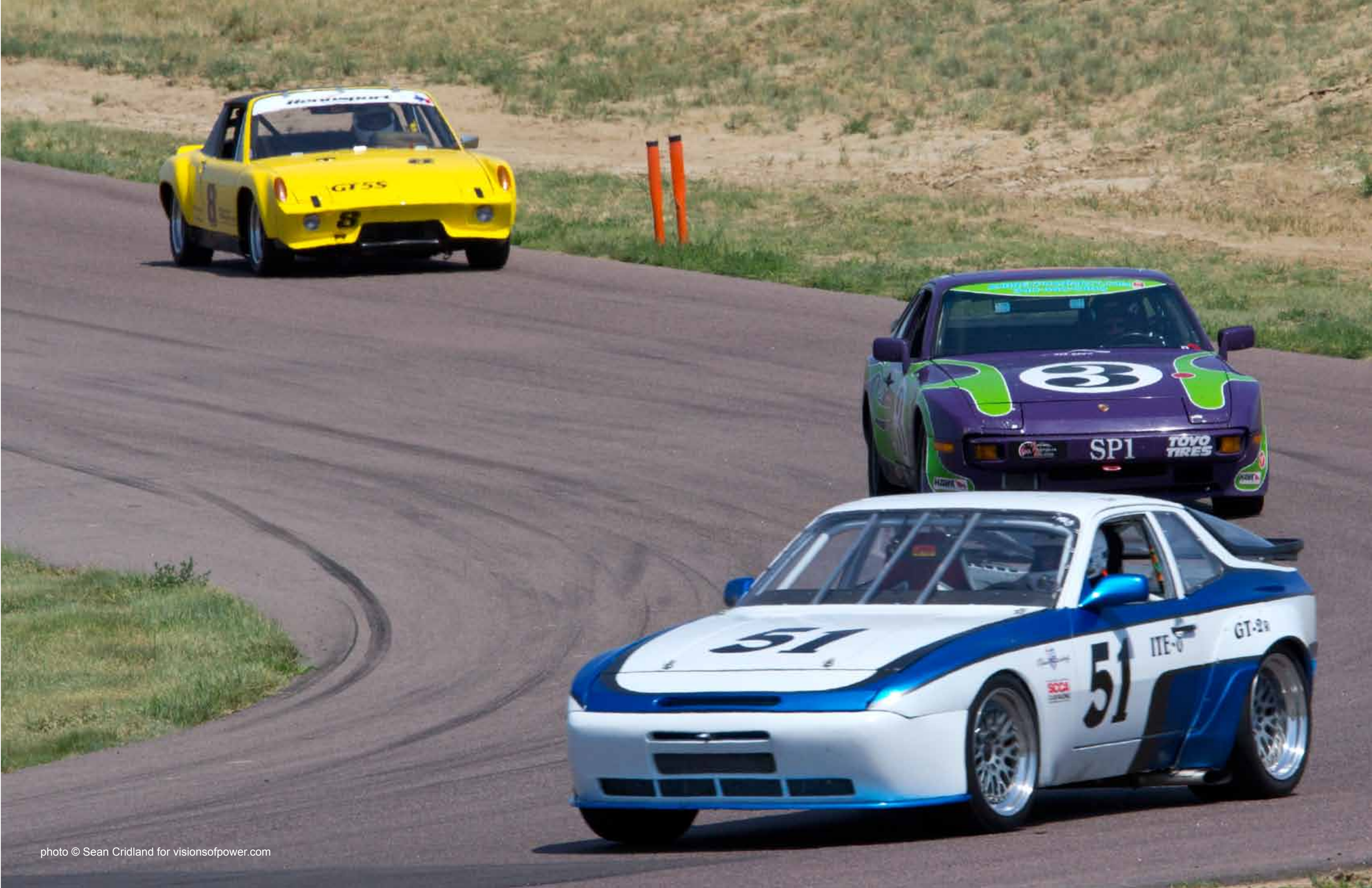
What's next? I'd like to get the shocks tuned, drop the brake master cylinders a size to get more bite, and find a wheel size that will still fit the brakes but allow for the availability of slicks versus the dot tires I've been running. And I'd like to build a rear wing to help hold the rear end down. And when that list is taken care of, there'll be another...and another... and another. Such is the mind of a racer. Which brings me back to the title of the first article, "So, you think you'd like to race?" I think you know what I mean….

I hope you enjoyed these articles and have learned something about what it really takes to become a racer from scratch. It's a lot of work, but if you're patient you can learn a lot. Maybe more that you wanted to. And, of course, definitely spend more that you want to. But that's the life of a racer right? As that old play was named "You Can't Take it With You!" Take care, be safe, and have fun.

BP

RMR PCA Club Race at High Plains Raceway, August 2012





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