

# the Legendary SHAFT

News from the Land of Enchantment BMW Riders • September 2002

## Ready to Rally

The “monsoon” season hasn’t been good to the New Mexico flora, but for us bikers it’s been pretty good. The weather for the last several months has been consistently hot hot hot and dry. The local shops are selling out of ventilated gear, water- and oil-coolers have been working overtime, and there’s little excuse not to get out and hit the road.

The heat’s been a little extreme, but there’s mountains all around where you can cool off, and we’re heading into the best riding season of the year. Lucky for us, it coincides with a ton of motorcycle events to use as a destination.

The first big one was the BMW RA rally in Red River, well attended by the club, photos of which you’ll find inside this issue. The Aspencade is in Ruidoso, and the K12LT rally is in Santa Fe this month, and a few weekends of racing left at Sandia Motorsports Park. Then there’s our own Datil ride in October, the trip of which legends are made.

But the biggest and bestest event is happening in just a few days: the Bavarian Mountain Weekend. This is always the most exciting and largest club event of the year, usually attracting over 400 riders from all over the country. As members of the LOE BMW R you’ve got the inside track to members-only extras such as the Friday night cookout (tentative, but pretty sure, in addition to the chili “snack” served to the rest of the rally), the club house with hot(ter) showers, the club keg, plus the surprises that show up each year. It’s also central location to meet your friends and kick back, kick tires, and tell lies about all the riding you’ve done during the summer. It’s going to be a great time!

If you’re around on Labor Day, you can also help out with the last (and most fun) part of rally planning: the chili cookoff. This is a huge but well-oiled creation of the chili provided to rally goers on Friday night,

held at Gary and Shelly Oleson’s house on Monday morning. You can reach them at 898-8320 if you’d like to help out. In addition to the satisfaction of knowing you’ve helped make the rally a success, you’ll also get lunch and a chance to hook up with your friends in the club.

### My New Bike!

I haven’t had much room to write for the last couple of months, during which a lot has happened for me motorcycle-wise. After all my editorializing about selling my K75 I finally did, and soon after bought a nearly-new ‘98 K1200RS (explanation to come). The acquisition and subsequent joys and trials of ownership have truly been a community effort, and I’ve relied heavily on the loyalty and help of my friends in the LOE BMW R.

I’ll be writing an article detailing all of this in an upcoming issue, but for now just let me say I’ve come to understand why people have said they wouldn’t hesitate to buy another K12, no matter if they’ve had any trouble with it.

Until then, you can bet you’ll see me on the road!  
*David Wilson, editor*



*Above: the RA Rally at Red River. Can you tell we’ve gone about as far as you can go on a*

*K12RS in one sitting? Right: chili cooking at the Oleson’s. Who knew cooking could be so much fun?*



# THE GREAT GLENWOOD Ice Cream RIDE

by **ROBERT KEEN** photos by **JAMES STEVENS** and **ROBERT KEEN**

**Story Line:** Wherein the brave motorcyclists seek out adventure and inner peace (custom earplugs are a big help) as they traverse southwest New Mexico.

## Part II

Sunday morning was cool and clear with Mariah MIA. Bikes and riders fueled up and off we went. US 180 north three miles to NM 159 east into the Gila on the narrow paved road that climbs and winds its way nine miles to Mogollon. I had a near miss with a huge jack rabbit that appeared before me at a distance best measured in inches (James, following closely, said it looked like it went between my wheels!). Better to be lucky than good?

Mogollon is an old mining town that might be resurrected as another Madrid except for the fact that it is in the middle of nowhere. There has been some rebuilding of the structures – a few artist types and brave investors are at work and I wish them well. Winters must be difficult. We didn't contribute to the local economy as we had miles to go and so onward we pressed along Silver Creek on now FR 159. The pavement was behind us and Jim's admonition about this route rang true – you don't want to try this road at night. We slowly wound our way up into the Mogollon Mountains where patches of snow hung out in the deeply shaded areas. FR 159 turns into FR 28 and we left that at the junction with FR 142, which led us to Snow Lake. This picturesque lake has plenty of water (it is the major source for the Middle Fork of the Gila River) and is popular with both the fish and horse types. We did the obligatory photo op (minus Steve, who was somewhere up in front of us or so we hoped!) and left via FR 152. We had come about 30 miles and were not yet half way to Beaverhead.

Our old nemesis, Mr. Cooney, Nick Nicholas – He is good and has the appropriate ride for the really nasty stuff. must have spent some time up in this area for we were crossing the Cooney Prarie and there is even a junction (NM59) with the name. Someone had fun coming up with names

for other features given our encounters with Tan Cow, Bull Pass, Wolf Hollow, and, of course, Cooney, Canyons. This section was mostly higher speed across Black Mountain Mesa and down Bell Canyon to the junction with FR150 and north into Beaverhead. Total off road distance was now about 165 miles.

It doesn't take much to stand out as "civilization" in this portion of New Mexico. Beaverhead has a ranger station and a campground and that qualifies.

Once again leaving the dirt behind, we enjoyed playing "Ricky Racer" on the paved portion of NM 59 as it twists and undulates into the Gila National Forest and across our old friend, the continental divide. We had planed to ride the ribbon for 30 miles to the junction with NM 52 and at that point turn north (back on dirt), but there emerged a problem. While Nick undoubtedly had the purest dirt bike, he also had the least fuel range and the bike wouldn't make it to Magdalena as things stood. So...continuing on the pavement (south on NM 52) another 10 miles brought us to Winston where both bikes and riders refueled.

I used to believe in coincidence, things happen and that is just the way it is. Nothing much sinister about life. Well, how then do I account for the following? The event: lunch at the same restaurant in Winston, NM. The riders: Steve, Jim and myself. The bikes: KLR 650, R100GSPD, and R80GS. The future ride: not good (The Mud Ride still "sticks" in my mind!).

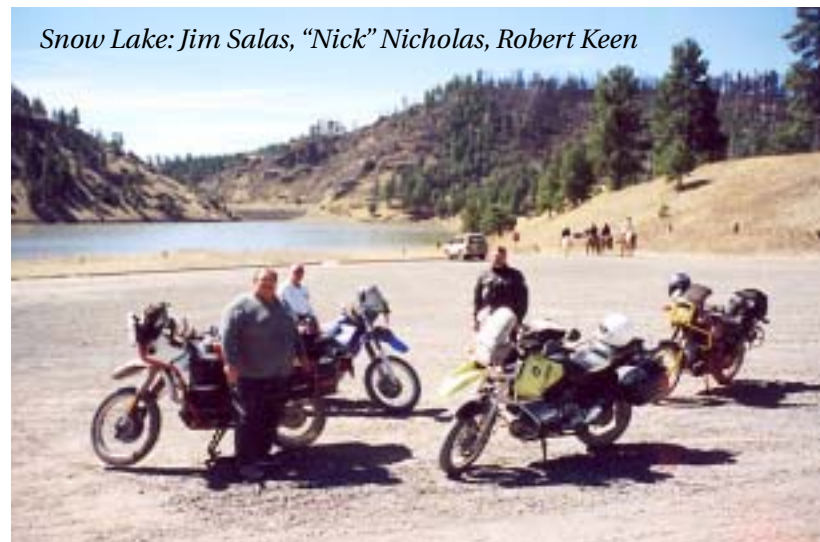
Full of fuel we backtracked north and finally entered the dirt portion of NM 52 with the plan of exiting at Dusty (aply named) on FR 478 up the southwestern slope of Mt Withington via West Red Canyon. This was an unfamiliar road to all of us and started out as an easy, but narrow route through tall brush and eventually into scrub evergreen. We turned onto FR 96 at Hudson Canyon. Our

first test came in the form of a closed (but unlocked) gate. No problem for we who had bested all that had come before. Onward through the ever-rougher road that slowed us and proved to be more and more demanding.

Some people may be curious as to when we are going to get to the "Ice Cream" portion of the Glenwood ride. The time has come, courtesy of Nick. As he explained it to us, in District 37... (You do know about District 37 don't you? Oh, well here goes – the American Motorcyclist Association [AMA] has, for many good reasons, divided the country into various districts. New

Mexico is 45; Southern California is 37 and the host for a wide variety of competition events. Nick has ridden in some of the dual sport cross-country rides and was able to describe what they are like. Riders are provided with a route sheet with specific directions. One such section was labeled as follows: what is your favorite ice cream? The

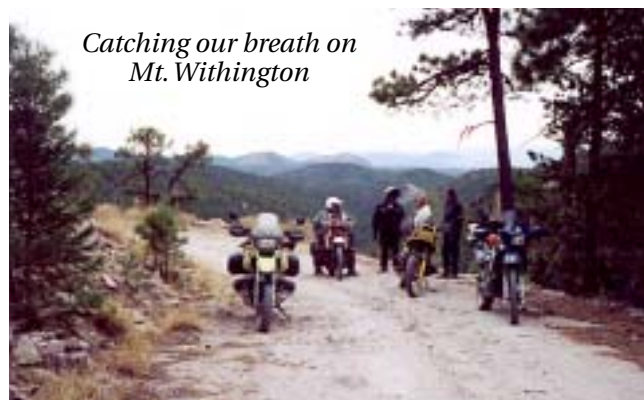
Snow Lake: Jim Salas, "Nick" Nicholas, Robert Keen



correct answer: rocky road!)...And this, according to Nick, was an easy ride in District 37. Well, we weren't in District 37 and anyway, I didn't care what the hell they called it in District 37, this was not fun.

You know you are really in trouble when you are struggling up a steep, rocky road, come around a corner and find your "buddies" with cameras at the ready to document

Catching our breath on Mt. Withington



your impending disaster. Well, if they made it, so can I! All that work that Mark Smith put into the tranny (higher numerical 1st gear) bore fruit as the bike found its way safely to the top of the section. Jim followed me up and even had to get on the pegs as he manhandled his PD successfully. Now Jim has a reputation as a hardcore GS type and at this point he

allowed that Steve and I had put on a true GS ride. Little did we know, we weren't out of the woods just yet.

The torture continued for a few more miles as we climbed ever higher to the junction with FR 138 where we turned north along the western slope of the mountain. Had we been so inclined, we could have stopped and admired some spectacular views, but it seemed people just wanted to keep moving and get off this mountain. It would have been easier if some grader operator hadn't recently bladed the road and made it as "interesting" as possible by not only loosening up the semiburied rocks, but also stirring up the soil, leaving the rocks loose and hidden under a talc-like powder. Talk about too much fun!

The turnoff to the top of the mountain came and went without a thought of taking that 1/4-mile trip – maybe some other time. Onward to the junction with FR 549

which, to the left leads down Bear Trap Canyon, a beautiful ride taken early in The Mud Ride, and, to the right, the path we wanted. Still dealing with the fallout from the crazed road grader, we descended the north slope toward US 60 and pavement. This would add another 60 dirt/rock miles to the total.

As if in penance for the rocky road, someone had finished off the last 10 miles of the road to billard table smoothness that invited a rider to grab a handfull and enjoy the ride. What a welcome relief it was to cool off, Mariah now blowing the dust to the side allowing a clear view of the strung out bikes ahead, that seemed in full flight, enjoying a last fling on the dirt. Now that was fun!

Back to the world of asphalt. A right on US 60 and 12 miles later, Magdalena appeared. We had originally planned to backtrack through Riley to Bernardo but, strangely enough, it seemed everyone had had enough dirt for the weekend. Nick fueled the Yamaha and ran solo through Socorro to Albuquerque while the rest of us (James, Steve, Jim and myself) ran as a pack back home the same way. James waved goodbye as he continued on to Los Alamos.

## Afterthoughts

*John Ephlin* – Next year, how about our "new, improved" version?

*LP How* – Thanks for joining us, care to come next time now that James has shown us the way on the big GS?

*Steve Mounce* – So who needs a GS anyway?

*Nick Nicholas* – He is good and has the appropriate ride for the really nasty stuff. A tough act to follow!

*Bill Olsson* – He toughed it out and did it with class.

*Jim Salas* – This GS ride devotee gave it a 9 (on a scale of 10) and saved us from making it even harder.

*James Stevens* – How he rode that big beast with worn T-

66's was a m a z i n g . Something to do with youth and talent perhaps?

**F W I W :** Estimated dirt miles, 225 – Estimated pavement miles, 350

Next year, a new, improved version with a different ice cream flavor – how about marshmallow crème delight?

**Mariah** (music and lyrics by Lerner and Loewe)

*Way out here they have a name*

*For wind and rain and fire.*

*The rain is Tess, the fire's Joe,*

*And they call the wind Mariah.*

*Mariah blows the stars around,*

*She sets the clouds a flyin'.*

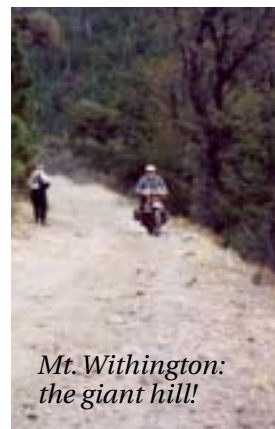
*Mariah makes the mountain sound*

*Like folks was up there dyin'.*

*Mariah, Mariah.*

*They call the wind Mariah.*

Almost home on I-25



Mt. Withington: the giant hill!





# On the Road

SEPTEMBER						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3 Cowboy Curve Rally	4	5	6 Sipapu!	7
8 Mo Sipapu	9	10	11	12 Best of Colorado Gypsy Ride	13	14
15	16	17	18 Golden Aspen Rally, Ruidoso	19	20	21
22 Sandia Racing	23	24	25	26	27	28
29	30					

### Friday-Sunday, September 6-8

#### Bavarian Mountain Weekend, Sipapu

The most fun of the year! Our nationally-famous rally. New Mexico is the hotspot for rallies this year. First the RA Rally in Red River, then the Curve Cowboy Reunion, the Aspencade in Ruidoso... but none of them will top our own event in Sipapu. That's because all your friends will be there, with all the great food and club activities you've come to expect. So pack up the tent and head on into the mountains for what is always one of the most fun riding weekends of the year!

## Bavarian Mountain Weekend 2002



1980 BMW G/S 2002  
Land of Enchantment BMW Riders

### Join the LOE BMW Riders

Yearly dues are \$15; payable each January 1. New member dues prorated on a quarterly basis. For more information or to pay dues, write or go to the web site:

**Land of Enchantment BMW Riders**  
PO Box 92095  
Albuquerque, NM 87199-2095

[www.nmbmwmc.org](http://www.nmbmwmc.org)

or call Terry Tombaugh at (505) 821-0063.

OCTOBER						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4 Datil	5
6 Camp 'N Ride	7	8	9	10	11	12
13 Be a HOG!	14	15	16	17 Biketoberfest in Daytona	18	19
20	21	22	23	24	25	26
27 Sandia Racing	28	29	30	31		

### Friday-Sunday, October 4-6

#### Datil Camp 'N Ride

The last big club ride of the year, where we say "Thanks" and pat ourselves on the back for doing such a good job at Sipapu. Not to mention riding like crazy people all weekend. All the best club legends come from this event. Come be part of it! Details to come.

### Sunday, October 20

#### Alien Crash Site Tour

One of the best kept secrets about all the places aliens are said to have crashed in our great state is that they all crashed along roads that are ideal for motorcycle riding. We'll tour several of the claimed locations and end up in - do I need to say it? - the UFO Museum in Roswell. Not for the weak minded, we'll be challenging both those infamous coverups and how long our butts can last in the saddle. Those aliens must have ridden sport bikes, and not very well. See story following the listings. Contact RJ Mirabal at 299-4916 for details.

*Please note that if no person is listed as ride coordinator, you can check the club website at [nmbmwmc.org](http://nmbmwmc.org) for updated news and events. Or call RJ Mirabal, our fearless and constantly busy Activity Committee Chair, at 299-4916, (email [rjmirabal@yahoo.com](mailto:rjmirabal@yahoo.com)).*

*If you're looking for an impromptu ride check the club web site's Message Board for unannounced rides and changes in the above schedule.*

## AND BEYOND...

### Saturday, December 14

#### The Christmas Party

Maybe there aren't as many people here as in Sipapu, but they're packed into a much smaller space so there seems like more. And dressed pretty snappily too. Come to one of the biggest bashes of the year at O'Neil's Uptown restaurant. More details will come.

*(continued on next page)*

## NATIONAL EVENTS

**Sunday, September 22**

### **Motorcycle Racing at Sandia Motorsports Track**

Okay, I missed most of this year's schedule, but there's still a couple left. Check out one of the most fun, not to mention squidly, motorcycling events to be found in New Mexico, right at the top of Nine Mile Hill. Follow all the sport bikes to the track. Bring an umbrella (for the sun). Starts at 11.

**Tuesday-Friday, September 3-6**

### **Cowboy Curve Reunion, Santa Fe, NM**

Formerly known as the BMW K1200LT Rally, you can book-end your rallies with the Iron Horse (Four Corners) Rally and our own Sipapu rally. All bikes are welcome. Check out [www.curvecowboyreunion.com/index.htm](http://www.curvecowboyreunion.com/index.htm) for details.

**Thursday-Sunday, September 12-15**

### **Best of Colorado Gypsy Ride**

Sponsored by the BMW Motorcycle Club of Colorado, this event is a 1,500 mile rolling gypsy ride on Colorado's best 2 lane roads, mostly scenic byways. Go to [coloradobeemers.com](http://coloradobeemers.com) for more information, or call Brad Bolton at (303) 399-7029.

**Wednesday-Sunday, September 18-22**

### **Golden Aspen Rally, Ruidoso, NM**

One of the biggest touring rallies in the country. Relaxed and unpretentious. Contact Ron Andrews, PO Box 1458, Ruidoso, NM 88355, (800) 452-8045 or go to [www.motorcyclerrally.com](http://www.motorcyclerrally.com) for details.

**Sunday, September 22**

### **Motorcycle Racing at Sandia Motorsports Track**

At the top of Nine Mile Hill, thrills and spills guaranteed. Reports are that the racing this year is even more exciting than last. Follow all the sport bikes to the track. Don't miss the impromptu bike show in the parking lot. Bring an umbrella (for the sun). Starts at 11.

**Thursday-Sunday, October 17-20**

### **Biketoberfest, Daytona, FL**

Did you miss the Big Event? Well here's your second chance. Turn right at Louisiana and follow the line of bikes.

**Sunday, October 27**

### **Motorcycle Racing at Sandia Motorsports Track**

The last one of the year. If you like seeing bikes go fast, this is where you want to be. Racing starts at 11.

**Thursday-Sunday, November 8-10**

### **Deming Cycles Cookout, Deming, NM**

Contact details to come.

## *Shopping in Sipapu*

### **Enjoy the Generosity of Vendors**

*by RJ Mirabal*

Once again, all the folks attending our Bavarian Mountain Weekend rally can look forward to the very good odds of

## *LOE BMW R Infobits*

*Photos by Terry Tombaugh*



*Robert and Z3: Fearing lack of balance, Robert opts for four wheels.*

*Mike at Hurricanes: Mike saddles up for the last time at Hurricanes. No need to be so sad Mike. You'll be back!*



*Dave and Amy and K1: Our new members and only the second K1 in the club.*



*Mike and bottle: At his own going away party, Prof. McKee expounds on the financial future of the wine industry.*



winning one of our many great door prizes due the generosity of many vendors, local and from across the country. If our attendance is close the 500 registrants of last year, than about one of every four people will get a door prize. I'm not sure that's a record, but it's probably better odds than one would have at most rallies around the country.

Not only do we have the volume, but quality, too. Even the famous leather key fobs (donated by Dowco along with a great motorcycle cover) are pretty nice, too (no, really!). Many prizes are gift certificates so winners can choose their own prize.

At press time, here's a list of our great vendors (some of which will be on site at the rally): Roadgear (always a top of the line jacket), Santa Fe BMW, Deming Cycle, Works Performance, and Pacific Products (Frogg Toggs) are making donations that retail in excess of \$200. Prizes of around \$100 or more in value have been provided by Bob's BMW, Van Leeuwen Enterprises, Collett Electronics, Gerbing's, Dowco, Aeroflow, and Al Simmons (Mustang seats). Donations of around \$50 in value arrived from Ehlert Publications (Rider), PITS Rally, Motorcycle Consumer News, Sliks, Dennis Kirk, K&N Filters, CycleGadgets.com, Simichrome, Bing, and Conspicuity.

And chances are, more will come by rally time, so I will have a follow-up list after the rally. Be a winner, come to Sipapu this year!

## Special Request

by RJ Mirabal

In October, I will be leading an "Alien Crash Site" ride to Roswell and I need club members' suggestions for a good place to have lunch in Roswell. I rode there recently and had a sandwich at the Crash Site sandwich shop. It's was good, but they had a rather limited menu. Most riders like the option of a good chili-cheeseburger along with New Mexican fare, so if you know a great place with reasonable prices, let me know so I can contact them to be sure they'll be open for lunch on Sunday, October 20th.

More details in the October *Shaft*.

## BMW Turbos

<http://www.rbracing-rsr.com/bmw-turbos.htm>

**15 Years: The Good the Bad and the Ugly**

RB Racing designed and produced Turbochargers for BMW motorcycles for over 15 years encompassing kits for both air cooled twins as well as inline 3's and 4's (R100/K75/K100/K1000/K1100) as well as the newer R1100RS models. The bikes were used for daily commuting, racing, dyno contests, and for all we know coffee tables. We know of K100 bikes that went over 80,000 miles with turbochargers tucked under their chins.



### My touring bike can beat your sport bike

The first and only BMW ever to exceed 200 mph was turbocharged by RB Racing and used an RSR Closed Loop Fuel

Injection system with 8 injectors. RB Racing turbos were the first BMWs into both the 10's and 9's at the drag strip. They were also the world's first fuel injected and inter-cooled bikes in 1985 with the debut of the new K-bikes. There probably isn't anything funnier than a K bike with saddle bags running ten second quarter miles at over



130mph! Dyno contests promptly shut down when K bikes hit 180+ rear wheel horsepower...the ZX-11s went home to find leaf blowers for their ram-air systems.

### Black leather, Black streaks

Sport Rider tested an R1100RS and with only two passes ran a 10.64 second 130.80 quarter mile with 12psi boost on 92 octane unleaded pump gasoline. Journalists Joe Haile and Paul Peczon both proclaimed the R1100 Turbo to be flawless in its power delivery and civility. The R1100RS used an RSR AIC400 Additional Injector Controller to provide the additional fueling.

Initial tests at El Mirage put a dead stock K1100RS through the traps at 194mph with only 8 pounds of boost.

Multiple 200 mph records were set on 2 valve K100's which were putting out 312hp in full race trim. In case you are wondering, no they weren't your average street kits...they had bigger turbos, bigger intercoolers, RSR Fuel Injection and of course, bigger gears.



### Show Me The Horsepower

We know they are well made and they have driveshafts. We also know BMW car owners always say "I didn't know BMW made motorcycles!". What you don't get to show anyone is a lot of horsepower and your disappearing license plate because 70hp K100s and 90hp R11s and K1100s aren't going to warp drive when you twist your wrist. People ask us how much power the turbos produce and we always tell them it depends on how big the turbo is and how much boost you are running. Here's some figures to ponder: R1100 225hp @ 22 psi; K100 180hp @ 15 psi (street); K100/K1100 (Race) 275hp @ 18 psi. We use different turbos with different size compressors, exhaust housings and fuel control strategies depending on what you want to do. No one said it was easy, but we have 20 years of experience that guarantees you will go turbo and stay turbo.

### The Ugly

All kits are currently under revision due to the business failure of the BMW distributor formerly known as Luftmeister, Inc. We spent an inordinate amount of time and effort on their behalf and finally gave up when they collapsed, taking a lot of people with them. It's funny how people can screw up a deal when they're handed a "done deal". It's even funnier when they think what you do is "easy" even

though they've never done it. BMWs do not deserve half-ass, misguided, uninformed treatment.

### Polish your propeller, there's hope

BMW's remain perhaps the toughest motorcycle engines alive due to BMW's philosophy of overbuilding compo-

nents then detuning the motors. Nikasil liners, Mahle pistons, dry automotive clutches and splendid cooling make them ideal turbo candidates. Probably the worst thing you could do would be to “build” the motor as they aren’t set up to be bored / stroked etc. Changes in camshafts and cylinder head work will always benefit a turbo as the engine is nothing more than a glorified air pump and anything you can do to help it breathe will benefit a turbo motor.

Turbo systems are now being built on a custom basis to your exact specifications depending on the options and intended usage. Contact RB Racing for initiating your custom order for your particular BMW motorcycle.

Kits are fully developed for K100RS/RT, K1000, K1100RS, R1100RS models. Earlier R100 and the newer R1100 models require fit and installation at RB Racing...K1200RS/LT (180 / 275hp) models are available (see below). Bonded and insured shipping to and from RB Racing is available. Contact RB Racing for details.

### Expansion

RB Racing has opened a second large R&D facility for prototyping, installations and development. No phones, no TV’s, no lookie-loos, to interrupt progress. One radio for mind-numbing motivational background noise. Custom installations of turbo systems, engines, and advanced product development can proceed in a more relaxed atmosphere. Interesting developments are in the works. Pure stealth. No numbers, no names, no windows, no photos.

### New Shipment of Custom BMW Intercoolers

These are the cores that we used on our first intercooled BMWs back in 1985. Unfortunately when we checked on their availability earlier in the year no one made this particular size anymore, so we had to have a custom run of them made. It was a long wait but it means we can start production of the R and K series turbos once again. The models that we had not done like the later K1200RS/LT models with the Telelever suspension have been schedule for prototyping. Kit prices for the various kits range from US\$3,995.00 to \$4,500.00 to \$6,000.00 depending on options , number of additional injectors etc. R1100/1200 series use two additional injectors. K100 series use either 1 or 4 additional injectors. K1/K1100/K1200 series use 4 additional injectors. All additional fueling is controlled by our AIC400 additional injector controllers. All kits, except the K1200RS / LT are intercooled. All kits feature positive oil scavenge systems and sophisticated inlet breather/blow-off valves.

### Don’t Confuse Boost with Airflow!

We’ve been at this over 20 years and everyone wants to talk

about boost when it comes to turbos. We are engine people and we know it takes more or less 160 cfm per 100 hp so we pay attention to the pumping of the air, not the “boost”. If your stock K1200RS has 130 hp at the crank it makes no sense to put on a turbo that can’t move that much air at low pressure ratios to feed the engine. People confuse boost with airflow. If you have a small turbo you’re going to have to run a higher pressure ratio to get the same airflow as a larger unit...and you’re going to have to go to more restrictive (smaller A/R) housing to move this air sooner. The result of this will be excessive backpressure and “crossover” where the exhaust pressure exceeds the inlet pressure. We use turbos to increase torque where you need it, at the lower rpms without having to run much “boost”. There is virtually no need for you to run more than 5 to 8 psi for 99% of whatever you use the bike for. Oh sure, we know you have to turn it up to see what it will do and find out what 250hp feels like...that’s what the water injection is for. Even at those power levels the system is blindingly efficient. Just remember, we have engineered a system that at 8 psi moves 200 hp worth of air into your motor. Leave the

wastegate set at 5 psi and turn it up when the need arises...or leave it set at 8 psi and simply short shift and let the additional torque do it’s job. By 8 psi the turbo delivers 80% of the airflow it delivers at 15 psi! If you don’t think turbos are torque monsters you haven’t seen the Audi R8 Le Mans prototypes.

### Turbo Tech

If you want to enjoy some history we suggest you purchase the three volume set of Smokey

Yunick’s chronicles of his long racing career and life. There aren’t many original thinkers around and most of them don’t do a damn thing. Smokey was different and a genuine legend in American motorsport history. If you just happened on the scene we suggest you buy his books. It’s the most entertaining and best investment you’ll ever make. Smokey pulled 1000hp out of a destroyed 200 cubic inch Chevy at Indy over 30 years ago. If you like technical matters and a bit of history these are the books to buy. Engines, whether they are small block Chevrolets or Bavarian twins all sing the same song.

We get asked all the time about what should be done to prepare your BMW for turbocharging...Well, this depends on what your goals are. Before we get into this we should give you a brief rundown on what you already have. If your bike was a Honda it would be superbly engineered and every part would be optimized for performance and reliability at the oem designed rated horsepower...double that figure and the rods, clutches and pistons are past their limits. BMW does things a bit differently. They build it to run for 300 hours non stop at 2.5 to 3 times the rated horsepower, then they cut things by 2/3 and sell it to you. The rods, pistons, cranks and base engine drivetrains are over engineered on most of



the models. The exception to this is the early air cooled models which started out as low horsepower, low rpm engines that weren't tested at 150 to 200 hp. Early K100's are practically bulletproof as they start out with 70 hp and at 125hp turbocharged they will run forever. We pumped them out to 312hp and never had a crankshaft problem although at rpms approaching 12000 they would float their valves and break camshafts.

### Pans That Suck

Customer pans sent to RB Racing for oil scavenge modifications featuring o-ring boss AN8 fittings for AN8 stainless steel braided lines. Positive oil scavenging "dry-sumps" your turbo, leaving no residual oil in the drain line. No matter what the circumstances i.e. shut-off, heavy braking, full boost acceleration or high G cornering loads, the turbo will drain properly. There won't be any tell-tale blue smoke foretelling of turbo bearing demise or "coking" of the oil resulting in spun exhaust shaft seals. The two pans below were born 17 years apart...the black one from a 2002 K1200RS and the other from a 1985 K100RS. BMW sure is getting some mileage out of that tooling. Along the way the oil pickups went from steel to plastic...the German metal workers must love extrusion machinery. When you go turbo on your K bike, you have to send us your pan with the filter cover in place. If you



have the metal pickup send it also. We spent over two months in 2001 revising our oil scavenge system so we are intimately familiar with 5mm Allen wrenches and the feel of BMW oil.

All of your BMWs employ Mahle pressure

cast pistons that have excellent oil control and tightly controlled expansion with shapes designed to go 200,000 miles with little fanfare. Unless you are racing and want to go to a forged piston that will deform before it will break, you would be crazy to take out the Mahle pistons. The slipper style pistons on the late model "oilheads" are particularly pretty. They look like a 962 Porsche piston.

The exception to this rule, and there are always exceptions to rules, is the late model K11/K12 series which are more highly stressed. Early K100's were rated at about 70 horsepower whereas the K1200RS is at 130hp. The engines are very similar in architecture and we can tell you that lower compression forged pistons are necessary on these bikes. We are designing pistons for all the newer models, both K and R series, to include the older K100's. No, we didn't make 312hp and go 206mph with the stock pistons.

All late model BMWs, including the later series of air cooled R bikes employ Nikasil lined cylinders. These are Formula One items as they provide the best heat trans-

fer as well as wear and oil control parameters. Even in NASCAR which mandates iron blocks all the teams have gone to coatings on the iron cylinders...that should tell you something. Nikasil provides the best surface and heat equation for turbocharging.

Windage, or internal oil control relative to the crankshaft is an area often forgotten. Oil will wrap itself around your crank and kill your horsepower. Late model BMWs although they are wet sump designs get a bit tricky in this regard by keeping the sump below the crank, thus cutting down on windage losses. Oh, they still don't give you and oversquare engine with a 90mm bore that will rev to 18,000 rpm, but you can dream.

Power is what this is all about. In general all the RB Racing turbo kits are designed to give about a 50% increase in power at 8 psi of manifold pressure. At this level they will run forever although at 8 psi you accelerate quite quickly and you don't stay in any gear too long and run out of gearing quickly. We tell customers to turn their Dial A Boost pneumatic controllers to 8 psi and short shift through the gears for normal operation. Turning the controller "off" will let the wastegate go to its minimum setting of 5 psi, which will remind you that the turbo is there. Check out our K1200RS video to see what 5 psi of acceleration will do for you.

Higher boost levels: Everyone wants to go hunting now and again. To those of you who cannot resist the lure of dialing up the power as you ride we offer the following advice. All RB Racing turbo kits can be briefly run to 12 to 15 psi of boost on pump gas...although we caution you that 12 psi is the limit we recommend. For excursions in the 15 to 22 psi range we suggest increasing the octane via racing gasoline, colder spark plugs like NGK Racing plugs, and careful attention to engine temperatures. Your cooling system will not sustain 250+ horsepower very long. We held a K100 on a Superflow Dyno for 2 1/2 minutes @ 15 psi (275 hp) and blew the coolant right out of the overflow tank! There is no free lunch in this game. When we went for records we chilled the intercoolers, ran blower gas and racing spark plugs.

### RSR Boost Compression Ratio Calculator

Click on the web site link to go to our RSR Boost Compression Ratio Calculator. This allows you to run scenarios of how boost affects your effective compression ratio as modified by altitude considerations. It will give you a good idea as to why turbos go so fast and also how to plan your motor for your particular circumstances. Knowledge is power.

### RSR BMW Advanced Dynamic Compression Calculator

If you know the specifications on your motor, such as the K1200RS described below, you can see what the effects of bore, stroke, static compression, rod length, cam timing, boost, and altitude are on your motor. Although you may not be able to change some of the variables, you will at least be able to see how they interact and how you can use this information to your advantage. Knowledge is power. Pictured above are our new K1200 series forged turbo pistons that come with an improved ring set and special wrist pins. The pistons are sold in sets and are 7% lighter than the stock components. The picture on the



right shows the 2mm pins you need to “pin” the second ring into the “up” position. For more info on this go to our K1200 Tech Page.

#### **K1200RS Turbo: Before**

When you strip off the bodywork you are greeted by what is perhaps the most tightly packaged, complicated, collection of castings, forgings and molded plastic you'll ever likely encounter in denuding any modern sportbike. At this point the bike has already been instrumented to measure stock parameters and the fuel system and oil system have been thoroughly modified to accept our Turbo components. Don't look for the turbo because it isn't in its home yet. Stay tuned as we will be posting additional pictures of the bike being assembled as well as the extensive instrumentation that comes with the package. Capable of more than twice the horsepower of a ZX-12! You might be limited in your final drive ratio but you will get there faster than anything else you might encounter...and gears can be changed!

12-16-2000: Turbo oil system testing completed with new scavenge system (first major revision since 1985). Scavenge ratios under cold and hot conditions from idle to 9000 rpm have been documented and main system remains unaffected. Four different turbos were tested to find the optimum solution. Zero leaks or capillary bleed down means 100,000 miles plus of trouble free turbo operation. Design work begins on header, turbo, and ancillary components.

Jan 2002: Testing continues with customers.

#### **K1200RS Turbo: After, With Bags**

We designed the turbo muffler portion to have two inch-



es of clearance between the cannister and the bags...and the final exit extends to the fender/ license plate. There won't be any cooking of your gear with the air gaps we have provided.

#### **K1200RS Turbo: After, Without Bags**

All major components are in place. No alteration of the stock parts is necessary except for the oil pan. Oil pans need to be sent to RB Racing for machining and TIG welding of the oil scavenge port, The braided stainless AN8 scavenge line is visible beneath the 4-2-1 header. The EGT (Exhaust Gas Temperature) probe is visible on cylinder number three.

#### **On Steroids, Abs no Flab**

A lot of information if you have a roadmap. Ceramic coated 4-2-1 Header. Red BoostMaster wastegate visible. Black ceramic coated cannister muffler. K&N Air Cleaner cover / splashguard. Silicone coupler hoses on chrome inlet plenum with 4 additional injectors and Inlet Blowoff / Breather valve. At front edge of rear tire is brass valve regulating water injection. Water injection tank, hard



anodized black, beneath the license plate. 350hp turbo hidden behind the transmission. Braided oil scavenge line headed back to the oil pan. All this fits under the fairing with no compromises in ground clearance or engine serviceability. Everything long-term corrosion protected. Completely docile day to day operation in a package that moves the K1200 up the food chain.

#### **Bend Over and Cough**

The turbo kit has no affect on ground clearance. Everything is tucked inside the “centerstand / sidestand / footpeg envelope” even figuring in suspension compression. Are those nibs still on the edge of your tires? Compatible with the optional wider rear rims and tires.

#### **Water Injection for K1200 Series**

K1200RS series bikes have about double the hp of the earlier and slightly smaller K100 series four cylinder machines. Because of this higher state of tune we need to add a form of detonation control to these bikes. The hard anodized water tank rests in stealth mode beneath





the license plate with its knurled filler cap easily accessible on the right. Put in a 50/50 water alcohol mix for those higher boost blitzes. Does not use any water below 5 psi and very little till

you up the boost past 8 psi. If you have to up the boost with your pneumatic Dial a Boost controller, the percentage of water injected will scale up giving you a safe power boost through lowered inlet temperatures. Two minutes and fifty seconds of 15 psi pressures, which is just long enough for the long course at Bonneville. Six minutes of water at 8 psi of boost, which is a long, long time considering the brief time we spend in boost going through the gears. Just sneaking into boost at 6 psi the tank will provide eight minutes of inlet charge cooling. Get out your calculators.

#### **K1200RS Turbo Kit: The Main Parts**

Update 4 May 2001: Final testing completed, production parts finalized. Pictured are finalized parts for the K1200RS Turbo Kit.. Mechanical modifications to the engine's fuel control system have been completed and tested. OEM primary injector fuel rail replaced by hard anodized high flow part. Modifications to the Bosch electronics and final testing of the RSR AIC400 programming to maximum potential (275hp @ 15 psi) are completed. There are no compromises in ground clearance, lean angles, fuel economy, or driveability. Center and side stands are completely unaffected. Oil filter and drain access are also unaffected. Chrome heat shield on turbo exit. Header pipes are ceramic coated. Connector



pipes from the turbo to the inlet plenum are chromed. The turbo itself receives a black protective coating.

#### **K1200RS Turbo Pod: Red Hat, Black Dress**

You know what they used to teach you in Boy Scouts... "Red and Yellow Kill a Fellow...Red and Black Venom Lack". Well in this case the Coral snake and this



turbo kit are on opposite side of the fence. This Red and Black Turbo Pod puts out enough air to kill about anything you might come up against. This is the same turbo we ran 206mph with on a 2 Valve K100 and the same turbo we used on our Suzuki GSXR1100's that hold every record at Bonneville and El Mirage (1989 to present). The BoostMaster wastegate dumps directly into the tailpipe for the ultimate in sophistication (no wastegate noise). The Turbo Pod is mounted directly to the frame, independent of the exhaust manifold and tail section.

#### **BMW K1200RS/LT Plenum Chamber**

Complicated puppy! BMW sure didn't make our life easy on this one. This is the third and final design that we executed. The first two

designs used smaller volume plenums in order to squeeze in a small inter-cooler but this, in turn, precluded the use of four additional injectors as there was only room for two larger ones. Testing showed we were trying to do too much in too little space so we opted for better breathing and fuel control. The four additional injectors are controlled by the RSR



AIC400 Additional Injector Controller which is programmed to meter fuel up to 350hp. The inlet runners have integral radiused velocity stacks to boost torque. The four additional injectors are aimed straight down these velocity stacks Formula 1 style. We felt the larger inlet plenum plus the additional accuracy provided by four injectors (instead of two larger ones) was a better compromise. Our attempts to squeeze in an intercooler were very expensive but in the end the core size would not support the horsepower potential and added additional airflow complications.

In case you are wondering, the Black Billet Gizmo poised on center stage is a dual function inlet breather and compressor blow-off valve. Under vacuum conditions the engine breathes here bypassing the turbo. Under boost when you close the throttle blades, as when shifting, or just backing off, the pressure releases here preventing a surge back to the turbo. This keeps the turbo speeds up and prevents damage to the turbo. We've been building these in several variations for over 15 years but like the abominable snowman they have never been seen before. The high capacity secondary injector fuel rail is hard anodized. To keep things symmetrical and avoid flow problems we also supply a hard anodized high capacity fuel rail for your stock injectors.



### **And you thought Carroll Shelby had all the Snakes!**

Black mambas, king cobras, have nothing on this piece of sculpture! BMW did not want this K1200RS turbocharged! We were absolutely determined to do it anyway and this is the result. The turbo has a special corrosion resistant coating so the elements won't eat it up. The inlet system is sealed and has a 300+ hp K&N filter (housing removed to see the filter). All this serpentine meandering requires a pile of production fixtures the size of the bike itself...but the result is a completely functional turbo system that does not intrude on the rider in any manner, nor does it require any major surgery or nasty compromises.

### **Turbo Header K1200RS/LT**

Four into two into one configuration. Ceramic coated inside and out to prevent heat losses and for long term durability. OEM four wire oxygen sensor for closed loop operation is retained. We built three variations of this header and this was the winner. It provided the best compromise between surface area versus velocity versus broad band power delivery. The protrusion on cylinder number three is the port for the Type K Thermocouple that provides inputs to the EGT (exhaust gas temperature) gauge. The turbo header will never fatigue or break as it features a slip joint and does not support the turbo. New configurations have helped bring in boost as low as 1800 rpm.

### **Instrument Rated**

Standard instrumentation on the K1200 series is shown above: Vacuum / Boost Gauge (30 InHg to 20 PSI); EGT to 1600Deg F; and RSR Air Fuel Ratio Gauge. You generally want to see the tach and the boost gauge and the boost gauge and the RSR Air Fuel Ratio Gauge in pairs. EGT gauges are slower responding but provide valuable information just as they do in aircraft. All gauges are lighted for nighttime operation and the RSR Air Fuel Ratio gauge is visible in direct sunlight and has an automatic dimmer for night operation. There is a warning light, an ultra bright l.e.d. on the RSR Air Fuel Ratio Gauge that activates when you hit 8 psi of boost. At 8 psi you need to be reminded that things are getting serious, because by 9000 rpm you are closing in on 200 hp.

The Dial-A-Boost is the round black knob on the left handlebar. Turn it fully clockwise and you will see 28 psi. Turned fully counterclockwise the wastegate opens at 5psi. Between these extremes are 11 turns of decisions. Pull up the dial to unlock it, turn to the desired boost level and push the knob down to lock it...all while you are riding. A mark on the dial gives you a visual reference of the number of turns. In case you are wondering, 8psi will push you past 200 mph if you regear.

The water / alcohol injection system kicks in after 5 psi.

### **Bags Packed, Ready to Go**

There is not even a hint of what this bike is capable of. No neon lights. No loud pipes. Just a big old heavy BMW sport touring bike with enough horsepower to deal with those things we face like Porsche 996 Turbos,

Z06 Corvettes, and various pesky Sportbikes. Sit up and enjoy the view. Convince Seven of Nine to join you on a tour of the Delta Quadrant.

### **Customer Testing Continues on K1200RS**

Everytime we build, refine and test things work fine. When you turn things loose in the world all sorts of new things crop up. Customer testing continues with slightly revised fuel maps in our RSR AIC400 that controls the four additional injectors. Further tests are scheduled for a slightly different collector and a minor change in the plenum shape. We just want to try the changes to see what happens. Bike has exhibited excellent driving characteristics with a large increase in torque, pulling cleanly to redline in all gears. Testing continues at 5, 8 and 15 psi. In warm weather a slight increase in heat was felt around the left ankle...a small airfoil / vortex tab may clear this up. Cold weather testing is taking place in Nevada along with higher elevation testing...the bike needs open spaces to stretch its legs.

### **Update K1200RS/LT**

The K1200LT makes the RS model seem like a minibike. Lots of complicated bodywork and a sea of underlying brackets forming a Maginot line against turbocharging. As you can see (or can't see) our efforts got the work done with little external visual clues.

### **Clean Installation, No Compromises**

We have completed ( after four months) the initial tests of the K1200RS and K1200LT models and are making some changes based on these tests. We were able to design the K1200RS without any modifications to the bodywork. On The K1200LT the lower lefthand (silver) panel has to be trimmed and the underlying tubular support bar has to be modified. Both bikes require modification of the oil pans and the installation of our special scavenge system. Testing of the two bikes showed we had to have a slightly different scavenging system for the LT model as the lower front of the engine castings are not the same as on the oil cooler equipped RS model. Initial testing on both the RS and LT was with a small intercooler (there is no room for a large capacity intercooler) and two extra injectors. At the completion of the testing we felt the trade off of having an intercooler that was half the required size and two additional injectors was not as



good a solution as having room for four injectors and a larger inlet plenum and the corresponding gain in fuel delivery accuracy.

#### **High Static Compression, Overlap, Cams and Pistons**

Cold cranking pressures on the RS and LT are very high due to the 10.8:1 pistons on the LT, and 11.5:1 on the RS. Camshafts on the RS have about .050" more lift than do the ones on the LT model. If you look at BMW's published cam timing specs on both models, the cams have zero to negative overlap (only 2 degrees on the RS and -4 degrees on the LT!) Some overlap is required to cool the exhaust valve and to allow the engine to deal with the higher volumes of airflow. Lobe centers on the LT model are spread further apart, shortening the overlap period and thus keeping the cold cranking pressures similar to the RS model. BMW publishes their figures at 3mm (.118 inches) of valve lift which is more than twice the industry standard of .050 inches lift for both opening and closing events.

When we measure the K1200RS using the standard industry figure of .050 inches for closing and opening events the picture changes somewhat. Instead of two degrees of overlap, the figure changes to 27 degrees of overlap. The duration on the cams goes up from 210 degrees to 234 degrees and the new lobe centers sit at approximately 103 degrees on both inlet and exhaust. These are not ideal figures for turbos but they are livable. We would like to see more duration which would allow us to push the lobe centers out somewhat without losing overlap. We are working on camshafts to do exactly that.

We are also having forged turbo pistons made that will replace the stock pressure cast pistons for those of you who want to run elevated (15 to 24 psi) boost levels. These pistons will feature pinned rings for the same oil control as on the stock bikes. This will allow higher boost with increased safety. If you are thinking of worst case scenarios, we have arranged for Nikasil cylinder repair should the unforeseen happen... You won't have to worry about completely replacing the block! In case you were wondering about the pistons we used in the 206mph, 312hp, 980cc K100's...they were forged, not stock...and no, we did not run stock cams or stock timing.

#### **Panels off, Turbo, cannister and connector pipe shown**

Both bikes' driveability is stock and ground clearance is completely unaffected. Serviceability is uncompromised and clearance between the exhaust cannister and the luggage on both models is better than stock. The chrome cover on the LT exhaust can be reused (see top photo). Noise levels are slightly above stock and decidedly pleasant at touring speeds. These are very complicated motorcycles, and although this can be an advantage, it has made engineering the turbocharger systems quite a challenge. There will be two turbo choices for both models ranging from 200 to 300 plus horsepower. Normally the LT model is set for a maximum of 180hp at 15 psi with a smaller turbo whereas the RS model has the larger turbo rated at 255 hp at 15 psi.

Instrumentation for both models is standard with EGT (Exhaust Gas Temperature), RSR Air Fuel Ratio, and

Vacuum/Boost. On the K1200LT these three gauges mount on the center dash "pod" just above the stereo controls. The turbo occupies the area formerly occupied by the exhaust system / catalytic converter. The turbo itself is supported by a triangulated steel mount independent from the 4 into 2 into one exhaust header. The RB Racing Boost Guard wastegate (hidden behind the passenger footrest) is dash adjustable and dumps into the cannister exhaust effectively muffling the wastegate as it controls the exhaust pressure. We have used both chrome and ceramic finishes...there may be some choices in this area. The exhaust pictured on the LT is chromed with a brushed aluminum cannister. Production parts are ceramic coated with a black cannister (see photos).

#### **No, that's not an exhaust system!**

With the turbocharger underneath the bike it was quite a problem to fit an air cleaner assembly. On the K1200RS we managed to get the air cleaner on the left side of the bike into a cavity above the exhaust cannister. On the K1200LT model there is no room to do this so we created a right side air cleaner assembly. The filter is the same K&N filter we use on our 350hp Suzukis and 425hp



Kawasaki turbos. On both the RS and LT models both center and side stands function normally.

#### **K1200LT Weak Point**

Right now the clutch is the weak link. We are working on heavy duty clutches that will need to be installed with the turbo kit. We are hearing of short clutch life in stock bikes and our own testing has shown the clutch will slip quite early if it is not fully engaged under low boost shifts.

#### **K1200RS/LT : Costs**

K1200RS and K1200LT systems are sold on a complete basis only. Both are \$5,500.00. The only option on both systems is the license plate mounted Water Injection System which is an additional \$295.00. The only requirement is that your oil pan with the three bolt filter access plate in place be sent to RB Racing for modification for the oil scavenge port.

#### **K100 2 Valve Models**

Turbos are available for the early K100 series. We will be doing a few of these at RB Racing to update oiling systems, wastegates and instrumentation. These kits feature

# Red River!

The August RA National Rally was a big hit, with a big crowd. And not the least among them was our own club, the best-represented club at the rally (well, we should have been!). The LOE BMW R also spent lots of time volunteering with registration and running an information table, not to mention bringing home awards: Steve Mounce won the Best Bike award for his immaculate R69S. There were new bikes, old bikes, weird bikes, and even bikes that weren't BMWs. But overall it was one of the quietest rallies you can imagine, and the route there and back was some of the best riding to be had in America. It was a blast!



Right: The rally gang.



Above left and right: Dinner on Saturday night, the Germans eat Italian. Right: There was so much to see at the rally Terry walked the shoes right off his feet. The club was instrumental in volunteering at Red River, from registration to touring suggestions. Far right: BMW NA brought all their hardware to see and ride. Two semis full of all the coolest BMW gear! Anybody for a spin on a police bike?



Above: Main street, Red River; bike parking only! Right: At the top of the ski lift, Lynn Coburn strikes a scenic pose. Beauty could be found



everywhere you turned. Left: Not just beauty, but great riding – straight into Eagle's Nest, a very short break between the mountain roads.



Above left: Dave Wilson, Gary Oleson, the BMW trucks and lots and lots of bikes. Above right: See anything unusual about these twin K1200RS's? Below: The vendor and parking area. More BMW's than you can shake a wrench at.



the later design split intercooler and stainless steel 4-1 turbo manifold. Fuel control is via our RSR AIC400 additional injector controller. Kits are available for fifth injector operation with the oem air box or with four additional injectors located in a new inlet plenum. Power is rated at 180 hp @ 15 psi.

#### **K1000 / K1100 4 Valve Models**

Turbos for the first of the 4 valve inline fours are available in two models: 180 hp @ 15 psi and 255 hp @ 15 psi. These kits are receiving newer, updated oil scavenge systems, more instrumentation and revised Boost Master wastegates.

#### **R100 Series Air Cooled Twins**

We made a lot of the draw through carbureted kits in the early 80's. This is something we do not wish to revisit as technology has progressed since then. A complete review of these early bikes is being undertaken and we feel that some new innovative designs will give life to the older boxers. Maybe you remember the Futuro.

#### **R1100R / RS / RT / S / SL / GS / I150R and I200C**

K1200 series and earlier K100 series turbos are shipping, so a complete revamping of our "Oilhead" series of turbo systems has started. R1100RS turbos are in production and the I200C model has been scheduled for testing and prototyping. Turbos and intercoolers for these models are in stock.

Previous R1100RS turbos were quite spectacular, beating full race (privateer) Ducatis in Magazine sponsored impromptu road races at Willow Springs as well as running 10.6 second quarter miles at 132mph. We have higher goals for the newer models. Photos of these models will be posted in June/July 2002 time frame along with detailed specifications.

#### **Quicktime Video of K1200RS Turbo**

We have posted a Quicktime video of the K1200RS Turbo on our Cinema page. There is no lack of power even at the minimum wastegate setting of 5 psi.

## **Moto Joke**

A mechanic was removing a cylinder head from the motor of a motorcycle, when he spotted a well-known heart surgeon in his shop. The surgeon was there waiting for the service manager to come take a look at his bike.

The mechanic shouted across the garage, "Hey Doc, can I ask you a question?"

The surgeon, a bit surprised, walked over to the mechanic working on the motorcycle. The mechanic straightened up, wiped his hands on a rag and asked, "So, Doc, look at this engine. I open its heart, take valves out, fix 'em, put 'em back in, and when I finish, it works just like new. So how come I get such a small salary, and you get the really big bucks, when you and I are doing basically the same work?"

The surgeon paused, smiled, leaned over, and whispered to the mechanic, "Try it with the engine running!"

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**The Rear View**

