

EXCLUSIVE! PERFORMANCE RIDING TECHNIQUES BY NICK IENATSCH

Cycle's

SPORTBIKE

2002



GRUDGE MATCH
KING CARL VS. THE
GALIFORNIA KID

Space Race

SPORT-TOURERS
VS. THE SPACE
SHUTTLE
IN A COAST-
TO-COAST
SPRINT!



PLUS:
FAREWELL
TO 500s

TIRE TECH
BY KEVIN
CAMERON

THE BEST
SUPERBIKE
RACE EVER

NICKY HAYDEN
GOES SUPER TT RACING

OPEN WARFARE
TRACK TESTING THE
BIG FOUR'S BIG FOURS

BATTLE OF THE TWINS
THREE TWINS—AND A TRIPLE—
FROM ENGLAND, ITALY AND JAPAN

SPECIAL BONUS SECTION!
2002 SPORTBIKE BUYER'S GUIDE

\$4.95 CANADA \$5.95
U.K. £3.95



RETAILER: DISPLAY
UNTIL AUGUST 6, 2002

A CYCLE WORLD SPECIAL

Plug-'n'-Play

Fuel-injected motorcycles have ushered in a new era of digital tuning. Hold on for an age of unprecedented power and control

BY PAUL SEREDYNSKI

When your bike is jetted *just* right, you can almost taste it. Your mouth waters in anticipation of that perfect carburetion producing linear, smooth and seemingly endless thrust, drawn forth in exact proportion to your right wrist. Hanging on to a 2002 Suzuki GSX-R1000, arcing across the flanks of a boulder-strewn valley east of San Diego, I was immersed in just such bliss. But just as the landscape went liquid, I realized we'll need a whole new lexicon. This bike is fuel-injected—it doesn't "carburete." And its electronic fuel-injection (EFI) system had been modified—but with keystrokes instead of jets. At that moment it didn't matter, because the digitally tweaked machine was running so sweetly, I was almost drooling on the tank.

Fuel injection isn't new. It's been around for more than 50 years, first in mechanical form, then electronic. You haven't been able to buy a "carb'd" car in the U.S. for over a decade, the switch mandated by tighter exhaust emissions requirements. But fuel injection is just now making its way into mainstream motorcycles. For motorcyclists, the timing couldn't be better.

Current EFI systems are managed by Electronic Control Units (ECUs, a.k.a. "black boxes") that speak the same binary language as a computer. This digital aspect alone will forever alter the face of motorcycle tuning. When it's time to tweak, you need only swap files with your bike. No more hands reeking of high-test, no more fishing into a tackle box full of jets, no more dropping that last needle into... [Golly]! *Where'd that [golly]ing thing go?!*

Instead, consider pulling out your

Personal Data Assistant (PDA) and downloading entirely new fuel and ignition maps for your Yamaha YZF-R1 in about 3 seconds. Consider selecting between several fuel/ignition curves *while riding down the road*. This ain't no Buck Rogers stuff, neither; this is today. Yes, you should be excited.

Why is fuel injection better?

In general, fuel injection provides more exact delivery of fuel to your engine, and the current electronic systems allow unprecedented tuning and control. An engine is essentially an air pump, and each engine (depending on considerations such as valvetrain, combustion chamber shape and exhaust tuning) has its own "air curve" which varies according to rpm. Years of research have shown that an air/fuel ratio of approximately 14:1 produces the most efficient combustion. For maximum performance at any given engine speed, a fueling system needs to produce a fuel curve to match the air curve as closely as possible.

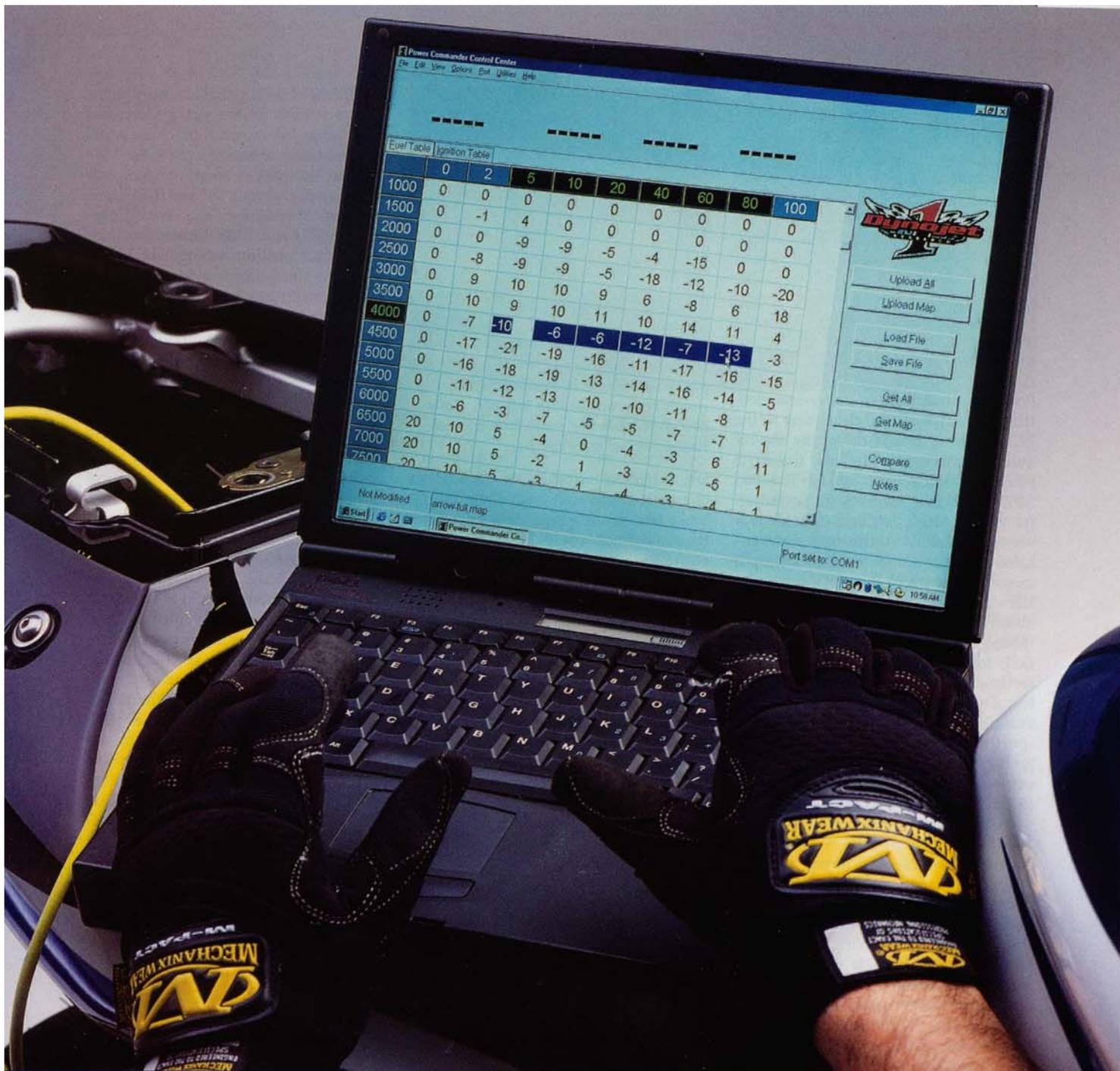
The traditional device—for almost 100 years now—used to produce this matching fuel curve is the carburetor, an "analog" apparatus that is essentially dumb. A carburetor uses vacuum pressure created in its venturi to draw fuel up out of the float bowl; the more air that flows through the carb, the greater the vacuum created, thus the more fuel delivered to the engine.

Tuned for a specific environment—such as a particular racetrack on a particular day—a carb can do an excellent job of meeting an engine's fueling needs. But a carb is not adaptable; it cannot compensate for changes in air density (elevation, weather), engine

temperature (why we've lived with chokes), etc. The bigger problems arrive when you try to modify a carbureted engine. Bolting on those gaping mixers in search of more peak power means less airflow at lower engine speeds. This makes it very difficult to tune a highly modified carbureted engine for proper response across a wide rpm range.

Like getting your cake and eating it too, EFI does not rely on vacuum. To keep the fuel delivery closely matched to the engine's air curve, EFI systems instead rely on a preset "map" stored in the ECU's memory, and input received from various sensors. Data such as throttle po-





sition, barometric pressure, intake air temperature, crankshaft position, engine rpm and coolant temperature are processed by the ECU, and then referenced against the stored map. The ECU then instructs individual injector nozzles to fire fuel toward each cylinder. The duration of each injector's "on-time" determines the amount of fuel dispensed.

Though the ECU makes fuel adjustments based on input from the various sensors (say, a change of ambient air pressure), it still consults the preset map. This means a decision by the ECU to richen or lean out the intake mixture affects the *whole* fuel map (keeping it in line with the

air curve). This makes the map extremely important, so you're probably wondering where it comes from.

Fuel and ignition maps are generated by manufacturers during engine development. This is an intensive process, as an engine is run throughout its entire operating range, at varying throttle positions, under various loads. This procedure builds a map that serves as a reference for the ECU. As you're riding down the street, the ECU is getting constant input from the sensors on the bike, *i.e.*, 30 percent throttle, 3800 rpm, 1000 feet above sea level, etc. The ECU takes that info, consults the map, shifts the preset

fuel curve as required, and sends a signal to each injector to best match the predetermined air curve.

Why mess with ideal? If the manufacturer has gone to all that trouble to get the perfect maps burned into the ECU, and the sensors on the machine allow it to adapt to environmental changes, why would you modify it? Two reasons: 1) The fuel/ignition map that arrives with your new fuel-injected sportbike is tuned to the conflicting goals of producing maximum power *and* meeting government emissions standards; and 2) the instant you bolt on that aftermarket exhaust (or air filter, cams, headwork,

Plug-'n'-Play

etc.), you've changed the engine's air curve, and the map stored in the ECU no longer matches that curve. If you want your sportbike to serve one master (performance), it's time to re-map.

Aftermarket to the rescue

Anyone who's ever slung a Kerker on a Katana is familiar with Dynojet, which for years specialized in jetting "tuning kits" for motorcycles. Thankfully, Dynojet hung with the technology curve, and developed a similar product for fuel-injected bikes.

In 1997, Dynojet produced the first Power Commander, an under-seat electronic box that altered data going to the ECU, tricking it into delivering the required performance (telling the ECU you were riding your Suzuki TL1000S 5000 feet below sea level, for instance). As fuel-injection systems quickly advanced (thankfully), this option evaporated as the newer ECUs limited output ranges. The current Power Commander IIIr and the conceptually similar Yoshimura Engine Management System (EMS) now alter the data leaving the ECU for the injectors, and can also directly alter ignition timing. We installed the Dynojet and Yosh systems—each available for nearly all fuel-injected sportbikes—on a 2002 GSX-R1000 (hey, go big, right?), and found the small investment in time (see below) and money (\$300-\$500) to be hugely worthwhile.

Plug...

Anyone who has spent hours trying to re-jet a quartet of carbs will not believe how easy and clean this digital stuff is to install. Unlike some of the earlier iterations, the current offerings are literally plug-'n'-play. There is absolutely no splicing or dicing. You unplug the under-seat or under-tank connectors leading from the ECU to the fuel-delivery and ignition devices, and then plug in the aftermarket controllers midstream. Thanks to extensive work with the OEM wiring harness suppliers, the couplings are identical and literally snap in. Removal of the system is just as easy: Unplug the connectors and your bike is back to stock in a matter of minutes.

Basic connection can take less than 30 minutes, and involves nothing more complex than running a single power lead to the bike's battery. The EMS sys-

Dynojet's software currently lets you download fuel and ignition maps into your Palm Pilot, but promises that the entire Power Commander program will one day fit in your handheld.

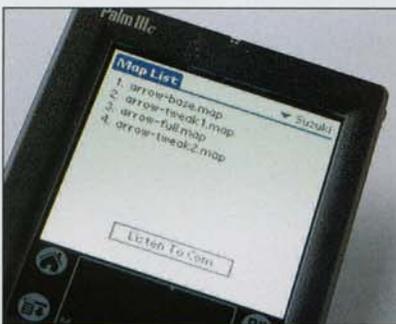


Dynojet's Power Commander IIIr picks up where the company's much revered jet kits left off. Units are available for most late-model fuel-injected sportbikes.

tem offers a number of accessories channeled through an adapter that looks like a miniature USB hub. Even the uninclined could likely install the entire EMS collection in about 4 hours, including the most time-consuming portion of artfully weaving sensor wires around your bike's chassis. The real tweaking begins once the components are installed.

...and Play

Okay, so you've plugged in another box, it was easy and it didn't take long. What exactly does it do? Using supplied software that you load onto a computer, the



programs present a logical and graphically friendly interface that lets you make changes to your machine's fuel and ignition systems. You now have the keys to the castle; what you do with them is up to you.

On most machines, the Power Commander IIIr and EMS control fuel metering and ignition timing. For highly modified or racing engines (especially turbo/supercharged or nitrous applications), ignition timing becomes a critical and often engine-saving tuning component. Suffice it to say that both the IIIr and EMS systems offer a fair amount of timing leeway (normally a max of +/- 11 degrees), enough to affect performance, but hopefully prevent you from making catastrophic timing alterations. Most sportbike folks will concentrate on fuel modifications, which is what we'll do here.

Numbers game

With these ECU-helpers, you have a number of options in how to tune your bike, each upping the level of involvement but increasing the certainty of results. Your first option, of course, is to do nothing. Power Commander units arrive with a map optimized for an otherwise stock motorcycle. With EMS, if you purchase the unit with a Yoshimura exhaust setup, it arrives with a map optimized for that bike/pipe combo. Install them properly, and you need do nothing but enjoy the newfound throttle response and rideability.

If your bike is not stock, or if you wish to further optimize the fuel curve, there is a trio of tweaking options. Power Commander units feature buttons on the faceplate itself, which can be manipulated to alter the stored fuel curve. If



Yoshimura's EMS works in fundamentally the same manner as the Power Commander, but adds numerous options. It, too, fits virtually all EFI-equipped sportbikes.

you refuse to go near a computer, but must tinker with the stored map, this is your sole tweaking option.

For those who have no fear of PCs, provided software offers a simple way to alter the fuel and ignition curves on your motorcycle. Both the Power Commander and EMS have serial ports, so using a serial cable, you first connect the units to your PC. Then, fire up the supplied software and you're able to make

extensive alterations to your bike's fuel and ignition curves, plus quickly download new maps to the bike.

If your bike isn't stock, you'll want to make this computer connection, because it lets you easily modify the existing map to match your particular aftermarket alterations. With the PC involved, you can also find a matching map on the supplied CD-ROM (Dynojet puts all its maps on every CD-ROM it ships), or via the corresponding website (www.powercommander.com or www.yoshimura-rd.com/ems.asp). These sites contain the very latest maps, which you can download to your computer, then upload to your motorcycle. The usefulness of this CD and internet-based support can't be overstated, as almost any popular bike/pipe combo has already been mapped.

The third tuning option is to have a custom map built for your exact bike and its air-curve altering components. Dynojet has created software and a tuning procedure—available at a growing number of "Tuning Link" centers—where for an additional fee (starting around \$150), a custom map can be built for your particular machine. This is done by running your bike on a specially prepared dyno (equipped with a

load cell and an exhaust sensor to measure the air/fuel ratio), which gathers data on the bike as it is "driven" at different throttle openings under varying loads. This data is then used to program your Power Commander, giving you the optimum map for your particular bike and aftermarket engine components.

This last tuning option is obviously the most thorough, even for those who just want maximum performance out of a common exhaust-pipe upgrade. Anyone who has extensively altered his bike's stock air curve, or whose machine now houses a collection of less common parts ("Made the pipe and cams myself, airbox is off a John Deere...") should definitely check out this custom mapping alternative.

New thinking

Unlike many engine mods, the key to all this digital tuning is not peak horsepower, but rideability. In fact, remapping the fuel curve can drastically improve throttle response without increasing peak horsepower at all. How is this possible? Well, going back to the whole engine-as-an-air-pump thing, where unhindered by government noise and emissions requirements, the manufacturers do an amazing job of tuning their

Welcome to the Revolution!

Innovative design combined with revolutionary construction have created the lightweight, strong and stylish PM Forged Aluminum wheel for high performance Sportbikes.

PM FORGED Revolution!
LIGHTWEIGHT ALUMINUM WHEELS

- Lighter & stronger than OEM sportbike wheels!
- One-piece Forged aluminum with billet modular Hubs!
- Design matched, full floating, discs w/ stainless bands!
- Will also work with stock brake calipers & discs
- Rear wheel includes PM cush drive and sprocket!

For a FREE catalog,
Check out our website www.pm-wheels.com
or call 800-774-3479

Performance Machine Inc
DISC BRAKES AND WHEELS

714-523-3000 fax 714-523-3007
6892 Marlin Circle, La Palma, California 90623

MAHLE
and approved
TUV & DIN Standards

Top performer in an independent test report!

DETAIL + WAX

S100

Like Water off a Duck's Back...

... or a hog's back or whatever you're riding. That's what happens when you spray S100® Detail + Wax on your ride. Light road film and bugs disappear and a brilliant carnauba-beeswax shine takes their place. Best of all, it's a wax job that happens in seconds, not hours. No wonder an independent test of 29 detailers rated it "the most consistent performer of all". Available at better bike shops everywhere. For free catalog of all S100 products: S100 • 550 E. Main St, Branford, CT 06405 • 203-488-6569

DISCOVER TODAY'S MOTORCYCLING™

1-800-833-3995



CLYMER® Detail from experience...
Count on Clymer!



Each Clymer repair manual provides step-by-step procedures based upon the complete disassembly of the motorcycle. This hands on experience and extensive research results in a manual that is user-friendly and detailed, making it easy to save money in repair costs and gain the utmost satisfaction in your motorcycle.

Available at your favorite dealer.
Call 1-800-262-1954 for a free brochure or visit clymer.com.

SCWSB02

Plug-'n

engines. At particular throttle settings and points on the tach where EPA regulations are not a factor (80-100 percent throttle, anywhere near redline), it's difficult to eclipse the power output the OEMs have achieved with a stock pipe. When not kowtowing to Uncle Sam, the manufacturers need no lessons on how to map for max power.

Away from more aggressive throttle openings and engine speeds, however, is where serious improvements can be found. In order to pass government emissions regulations, most bikes run quite lean right in a part of the powerband where street riders spend much of their time: 3000-5000 rpm. This is called the "EPA line."

While building a map for our Gixxer, we added up to 15 percent more fuel at this point to maintain a flat fuel curve. According to Brett Miller, the EFI sage who builds most of Yosh's EMS maps, the 2001 Kawasaki ZX-12R needed 45 percent (!) more fuel in this same region to flatten the curve. Digital tuning allows you to easily erase this EPA line (and the annoying dip in the powerband), creating a more linear throttle response. This can significantly boost the power of your machine at engine speeds and throttle openings where you spend tons of time on the street. It may not alter your bike's quarter-mile time or top speed, but it can make you a faster rider, because any time you can open the throttle sooner exiting a corner, you'll get down the following stretch of pavement faster.

Similar tools

In their basic functions, Dynojet's Power Commander and Yosh's EMS system are nearly identical. For the extra dough, EMS basically adds an expert's level of tweaking capabilities on top of the shared Power Commander functions. Designed for racers and the serious tweaker, EMS accessories include nifty items such as a clutchless-upshift circuit, a handlebar-mounted map selector and a programmable shift light, all of which can be integrated and controlled by the same EMS software.

This includes the ability to create separate fuel and ignition maps for *each gear*, or carry three separate maps in the control unit at the same time, and move between them via a bar-mounted switch. Though great tools for the track, hardcore sportbikers can also benefit: Imagine a fuel-economy map (Honda RC51?) for the ride to your favorite backroad, a second map for ripping it up and a third map for rainy conditions. Hide the selector switch and you could



Dynojet's latest development is the Tuning Link, which calculates a map for your bike based on its performance on a rear-wheel dyno.

create a "valet program" to help you tame your turbocharged beast should your kid decide to take it for a spin.

Because the maps are relatively small (just 3K), and take only a few seconds to swap, Dynojet even offers a Palm handheld option that lets you store and swap maps onto the bike. This means you can leave the laptop at home, and with your Palm in your tankbag or pitlane toolbox, you have instant access to hundreds of different maps. Dynojet has also mentioned that, as soon as they get the small screen size figured out, you'll be able to run the tuning software on your Palm.

We spent several weeks on the GSX-R1000, tweaking like fools with both the Dynojet and Yosh systems. We ran a full Arrows exhaust with the Power Commander, and a Yosh Tri-Oval slip-on with the EMS system. Starting with baseline maps provided by Dynojet and Yosh for each setup, we ultimately arrived at only small changes from those original maps. This illustrates how impressive a job each company does on its in-house map building. Most riders will never feel the need to alter the provided maps; it's just cool that you can.

One of our favorite tweaks (besides using a long serial cable to tune the bike from the living room!) was a track-based trick of enriching the mixture at small throttle openings at the top of the rev range (above 7000 rpm, adding 15, 10 and 5 percent more fuel at 0, 2 and 5 percent throttle settings). This made getting back on the throttle smoothly after ripping a few downshifts into a corner incredibly easy, and changed the whole character of the bike. After all the tweaking, with both setups, the bike ran so ridiculously well, so sweetly, so perfectly, it was almost painful to have to ride it in stock trim.

So bust out that laptop and get tuning. And when you're done, be sure to wipe the drool off the tank. 



IT'S NO ACCIDENT THAT ALL STATES REQUIRE ONE.

Stupid hurts

OVER ONE THIRD OF ALL MOTORCYCLE ACCIDENTS INVOLVE UNLICENSED RIDERS. THAT'S WHY ALL 50 STATES NOW REQUIRE A RIDING TEST TO QUALIFY FOR A LICENSE. IT'S A LAW THAT PROTECTS YOU AND EVERYONE ELSE ON THE ROAD. AND IF YOU THINK THAT YOU'RE AN EXCEPTION, REMEMBER, EVEN THE WORST LICENSE PHOTO IS BETTER THAN A MUG SHOT.

 **HONDA**

PLAY IT SAFE, READ YOUR OWNER'S MANUAL, AND NEVER MIX ALCOHOL OR DRUGS WITH MOTORCYCLING. Stupid hurts is a registered trademark of Honda Motor Co., Ltd. ©2001 American Honda Motor Co., Inc. (11/01)

K&N

PERFORMANCE FILTERS

Performance out of the box!

K&N Oil Filters



- * Superior oil filtration.
- * Warranty approved.
- * Extended service intervals.
- * Designed for today's synthetic oils.
- * Hex nut for easy service.
- * Ready drilled for safety wiring.
- * Black or polished chrome finish.



Del Mar, Oct. 5-6 2002

Call for product brochure and location of nearest dealer:

800-357-7422 access code 47108

www.KNpowersports.com

K&N Engineering, Inc., P.O. Box 1329
Riverside, CA 92502, USA