PHOTO: SCOTT DAROUGH

RIDING SUIT: AEROSTICH HELMET: MARUSHIN/GERARD DESIGN GLOVES: THUNDERWEAR

BY JOE MINTON

HIGH-FLYING NIGHTHAWK

Honda's Nighthawk CB700S is a brilliant motorcycle. Its designers successfully addressed most of the needs of us who ride our motorcycles everyday everywhere. It is comfortable, even after hours in the saddle, accommodating the needs of both sport and touring riders. At cruise, the tall sixth gear makes the engine seem more like an electric motor than a high-speed, high-performance sport engine. With an advanced four-valve design, hydraulic tappets, shaft drive and electronic ignition, the 'Hawk's power train is almost maintenance-free. Its handling is superior and the brakes superb.

As good as it is, though, the Nighthawk also has an important flaw: the engine is a bit peaky for real-world use. There is little power available at mid-rpm (below 5000), and acceleration can be positively lethargic in that range. We set out to correct that shortcoming and also to see if we could improve the 'Hawk's ride and road manners in the bargain.

THE ENGINE

We made two basic alterations to the Nighthawk engine. We altered cam timing to add power in the lower half of the rpm range, and we made changes in the intake and exhaust systems to allow more air to pass through the engine.

CAMS

The stock cams have extraordinarily long duration. Both intake and exhaust valves remain open for 276 crankshaft degrees when measured from .040 inch off their seats until .040 inch from closing. Cams with 260 degrees of duration would give a wider powerband. But since no aftermarket cams are available, we did not have the option of milder cam action, so we retimed the stock cams.

Honda closes the Nighthawk's intake valves late and opens the exhaust valves early, which favors high-rpm breathing efficiency and power. Our par-

ticular engine's cam-lobe centers were 120 degrees for the intake valves and 118 degrees for the exhausts—the highest numbers of any stock engine I have measured. The cams' timing and duration largely account for the Nighthawk's low-rpm lethargy.

Engine tuners use the concept of lobe centers to compare cams with differing durations. In general, any engine design runs best with its cams set within a particular range of lobe centers. The actual duration of any one set of cams has little effect on the lobe centers that work best on an engine design.

To find a cam's lobe center, follow these steps. Measure its opening and closing positions and calculate its duration in degrees. Then, in the case of the intake cam, subtract the number of degrees before top dead center (TDC) that the intake valve opens from one-half the total duration number. For example, the total duration of the Nighthawk intake cam is 276 degrees. The valve opens 18 degrees before TDC. Subtract 18 from 138. The lobe center is 120 degrees.

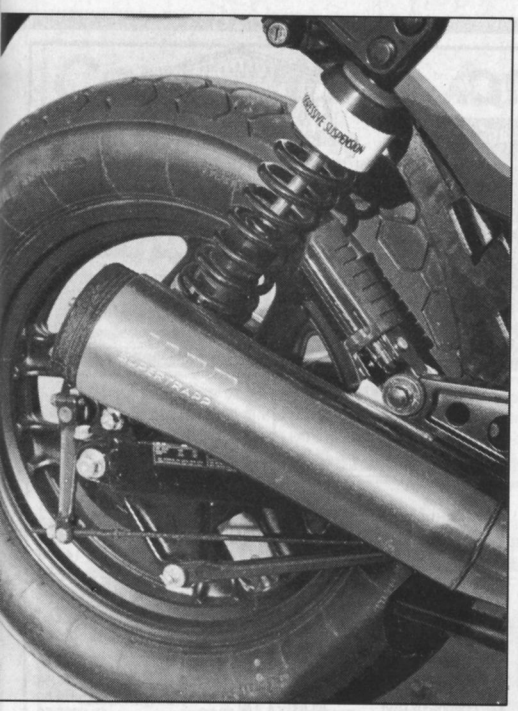
An exhaust cam's lobe center is found by subtracting its closing angle after bottom dead center (BDC) from one-half the total duration. The Nighthawk's exhaust cam has a total duration of 276 degrees. Its valve closes 20 degrees after BDC. Subtracting 20 from 138 equals 118; that's the exhaust's lobe center.

With an advanced, four-valve design, hydraulic tappets, shaft drive and electronic ignition, the 'Hawk's drivetrain is almost maintenance-free.

To set our Nighthawk's lobe centers where I wanted them, I had to elongate the holes in the cam sprockets in order to change the position of the cams in relation to the crankshaft. The cam sprockets were case-hardened and could only be ground with tiny grinding stones. I used a Dremel tool and stones available from the local hobby shop.

Once the holes were lengthened and the sprockets reinstalled, the cam-timing procedure went rapidly. This job is much easier than it seems. I make a careful guess as to where the cam bolt ought to be in the slotted sprocket and snug it down. Then I check the opening or closing angle of the valve, depending on whether it is an intake or exhaust cam. It usually takes a couple of tries to position the cam within the range I have chosen.

It isn't necessary to recalculate the lobe-center number every time you change the sprocket position. For instance, I calculated the 'Hawk's intake lobe center and learned that it was opening its valves about 15 degrees later than I wanted. I merely added 15 to the actual opening number to get my new desired intake-valve opening angle of 33 degrees.



Less weight, more power, more traction, better control and longer life: Progressive Suspension shocks last longer than stock units and give better control when the going is fast. The SuperTrapp exhaust helps make the fast even faster.

My first sprocket-positioning guess opened the valve at 33.5 degrees, plenty close enough. I got the exhaust to close its valve at 32 degrees after BDC on the second try. The end result: 104.5 degrees on the intake and 106 on the exhaust, within my goal of 104 to 106 degrees.

Don't let this lobe-center business intimidate you. It is easier to do than to read or talk about. You need a degree wheel. Vance & Hines Racing has one as does S&S Cycle. I prefer the S&S because of its machined steel center and somewhat greater durability.

Although you can use a dial indicator to measure valve openings, you can get equally accurate results by introducing about half a millimeter of valve clearance. The idea is to get past the rather gradual opening ramps that make it difficult to decide just when the valve is really opening. When all the valve clearance is taken up, you read the degree wheel. Continue to turn the crank and take another reading when the valve clearance reappears.

Our Nighthawk ran much better below 7000 rpm with its retimed cams. It is especially good below 5000, where the engine spends most of its running time. It is more responsive and makes more power over a wider rpm range. However, peak power rpm has been lowered slightly. Our Nighthawk now peaks at about 10,000 rpm instead of 11,000.

Since the stock cams have such radical timing, I consider the lobe-center alteration to be an important and unavoidable step in making the Nighthawk engine more suitable to the average American riding style.

INTAKE

Like most recent motorcycles, the Nighthawk has a restrictive intake system. The inlet horn to the airbox limits airflow at high rpm and full throttle. There is power to be had by removing this restriction. The answer isn't as simple as removing the horn or airbox lid. The fuel-air mixture is already achingly lean, and this modification will only make matters worse if it is not accompanied by carburetor recalibration.

K&N Engineering makes a filter and carburetor recalibration kit for the Nighthawk, which includes a large replacement filter and a carb-recalibration kit from the Dynojet company. Dynojet's kit consists of a new set of adjustable needles, two sizes of main jet, a drill bit and a set of instructions. The drill is used to open up the vacuum-sensor hole in the carburetor slides.

The size of the hole in a slide determines how fast the slide raises in response to opening the throttle. If the hole is on the small side, the slide raises slowly and keeps the mixture lean. However, if the hole is made too large, the slide raises too rapidly and the mixture will also be too lean. Don't try to second-guess what Dynojet has done; its drill size is not arbitrary.

Dynojet's adjustable needles have a more rapid taper and enrichen the mixture over the stock needles. Neither of the two main-jet sizes were correct for our engine, but that isn't the fault of either Dynojet or K&N. The K&N kit has been calibrated for use with the stock exhaust system, and our SuperTrapp simply needed slightly different jetting. I found that number 125 main jets were correct for the K&N kit and the SuperTrapp exhaust. You can get the jets from your Honda dealer.

The most difficult single task of the entire project was getting the carburetors off and back on the bike. Our machine is a California model with a maze of hoses, valves, hose clips and mounting brackets, all hidden under the tank. When I saw all that for the first time, I remembered why I liked singles.

Even without the emissions-related paraphernalia, the Nighthawk's carbs are difficult to remove. A can of WD-40 helps. I sprayed it on the rubber manifolds and both ends of the carbs to lubricate them. Remove all the metal hose clamps that hold the carbs in place before you pull them out. If you don't, the clamps will likely get bent and scratched. The factory shop manual's instructions were useful, accurate and clear.

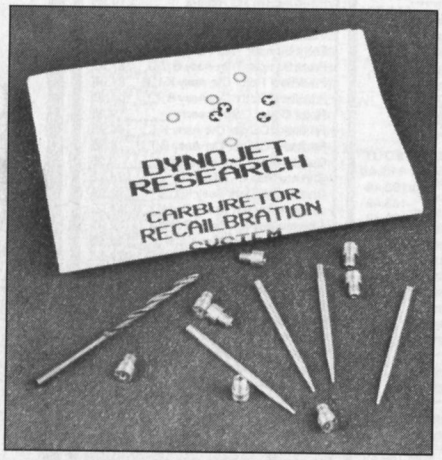
Dynojet's kit performs as it should. The specified needle position worked with the SuperTrapp pipe. Our bike only needed the larger 125 main jets and two turns out on the mixture screws instead of the suggested two and a half. This kit vastly improves throttle response, and I strongly recommend it.

PHOTOS: SCOTT DAROUGH

Be sure to balance the carburetors after you finish installation of the filter and jetting kit. Even a slight imbalance affects engine smoothness and response at low throttle settings.

EXHAUST

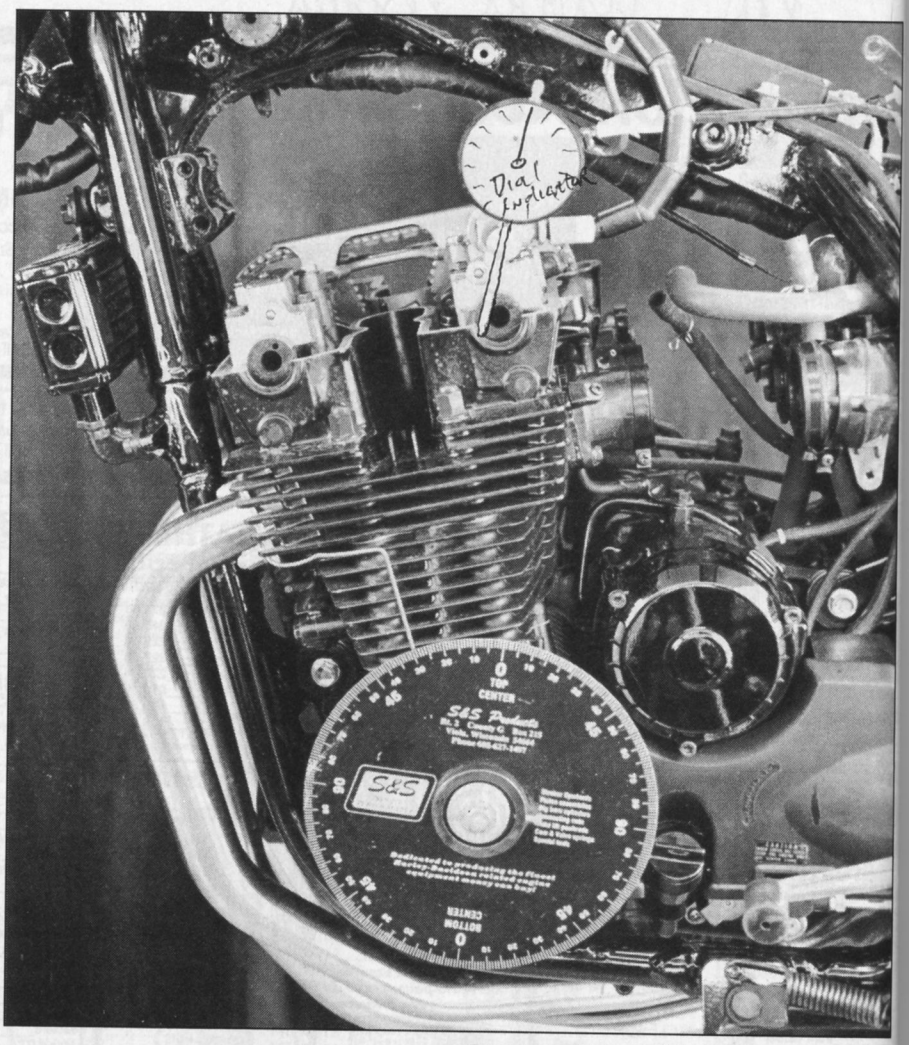
We had several reasons for using a SuperTrapp stainless-steel exhaust system on our Nighthawk. The owner of the bike, Dr. Harry Hurt (yes, *that* Harry Hurt), preferred the SuperTrapp because of its appearance. SuperTrapp's Nighthawk pipe has a reputation for superior performance. Since we were not going to do time-consuming development work on this engine, it was important that we get as much tunability as possible out of the parts selected. SuperTrapp's variable-restriction muffler design gave us a measure of control that no other system can match. I knew that a certain amount of sound level and engine tuning would be available to me via the variable number of plates that could be fitted to the muffler.



These tiny parts from K&N and Dynojet do much to improve the engine's response at part throttle. The kit parts are easy to install, but getting the carbs off is a pain.

I settled on 10 plates as being a good compromise between peak power output and sound. Initial testing was done with 12 plates, but that configuration was too loud. There was no noticeable loss of power with 10 plates, which is the number I recommend. Eight plates further silence the exhaust note but begin to eat into top-end power.

Even if the exhaust had only matched the stock system in power output, it would have increased our Nighthawk's performance, since there's nearly a 20-pound difference between the two. Certainly, the SuperTrapp gave us a substantial power increase and reduced weight significantly.



A reasonably careful mechanic can alter cam timing. By opening the intake earlier and the exhaust later on our bike, we improved power at low- and midrange rpm.

THE CHASSIS

TIRES

Nighthawks have 16-inch front wheels, making them more sensitive to the quality of the front tire. The OEM tire at the front wore well but slid before the rear. That, friend, is scary. When close to its limits of traction, the stock tire squirmed and made the steering feel rather vague. It had to go.

We fitted a set of Metzelers. Since we were unhappy with the 'Hawk's front-wheel tracking, we wanted a tire that would give us an extra measure of directional stability. Metzeler's Laser front tires are exceptional in that regard. The Laser made an even bigger improvement than I expected.

SUSPENSION

The Nighthawk has one of the finest street suspensions in motorcycling. It gives a superb ride and good control when pushed. There is no harshness in spite of the small front-tire diameter and rather heavy rear-wheel assembly. There are enough adjustments to allow the rider to customize the ride to his or her particular needs. We found only a couple of reasons for altering the stock suspension: wear and weight.

Although the 'Hawk's rear dampers perform well, they have short lives. In 4,000 to 10,000 miles, depending on how hard they are used, they lose a substantial amount of their control, and the rear begins to feel vague. We chose a set of Progressive Suspension's spring and damper assemblies for several reasons.

Progressive Suspension dampers give a smooth ride, and we didn't want to take away any of the day-to-day ride quality of the Nighthawk. Part of the good ride is due to the two-rate springs Progressive uses. The lower rate gives a smooth ride, and the other adds control when riding double or fast on a bumpy road.

If you weigh more than 175 pounds, you might want to install Progressive Suspension's fork springs. Those below 175 will probably be happy with the stock springs. I like the heavier Progressive springs, though Nick, who is lighter and rides faster, prefers the stock ones.

There are two adjustments to fine-tune the fork: you can play with air pressure, or you can add spring preload. An increase in air pressure has its largest effect when the fork is in its last third of travel before bottoming. You should increase fork pressure to limit braking dive or to limit fork travel over severe bumps. I prefer 16 psi for my weight and for the way I ride the Nighthawk.

If you find yourself adding more than 20 pounds of pressure in an effort to raise the front of the bike, you're doing the wrong thing. What you need to do is add spacers under the fork caps to increase spring preload. A .5- to 1-inch set of spacers should give you what you need. If you raise the front with excessive air pressure, the result is a harsh ride during the last half of fork travel.

BRAKES

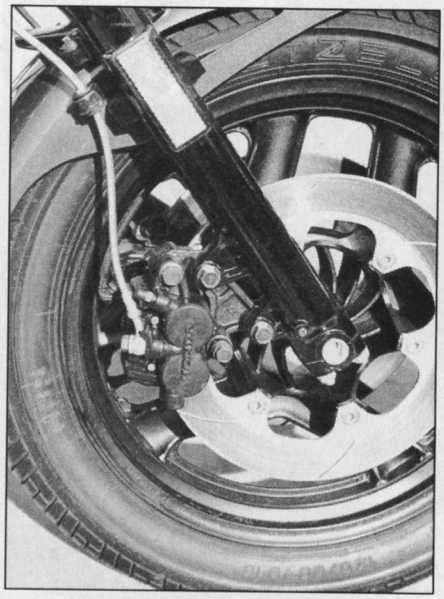
Stock Nighthawk brakes are powerful, won't fade and have a good feel. However, they can be made more powerful and their feedback improved.

As I always do, I fitted a set of Russell Motorcycle Products brake lines. And, as always, they fit perfectly. The lines improve the feel of the brake. The stiff Teflon tubing that lies under the braided-stainless-steel wire cover expands much less under pressure than the stock reinforced rubber hoses. I also installed soft-compound Ferodo pads, another reflex action for me.

MISCELLANEOUS

We fitted a Corbin Gunfighter saddle to our Nighthawk for the same reasons most people might: it looks good and gives the hard charger a better place to sit. The pocket formed by the Corbin seat makes it easier for a rider to move from side to side. The bike's lower center of mass helps too, although long-legged types might find the reduced distance between the Corbin seat and the footpegs a bit cramped.

Every motorcycle should be fitted to its rider. When you bought your Nighthawk, its controls were in a standard position. Chances are that standard setup isn't quite right for you. Experiment with control positions. Raise or lower the brake pedal. Rotate the levers on the handlebar assembly, as well as the bar itself. It won't take much fiddling to get things right. A word of caution: Refer to the shop manual when you make control adjustments. For instance, when you lower the rear-brake pedal on the Nighthawk, you must also check and possibly alter the position of the brake-light switch; otherwise, the brake light might burn all the time.



Although mechanically complicated, Honda's anti-dive system is effective. Russell's rigid brake hoses substantially improve brake feel and rider control.

Go over your bike's controls and put a little oil on things that move against one another. Lube the cables, fuel valve, folding footpegs, control levers and any items that seem to need it. I use WD-40 for cables and Kal-Gard 30/30 for everything else.

If you do a lot of riding at night, install a 55/100-watt bulb. You won't normally need more than 55 watts on low beam, but the 100 sure is nice on dark and empty roads. Custom Chrome, Inc., sells a high-wattage taillight bulb that substantially increases rear visibility.

LAST WORDS

We believe the moderate changes made to our Nighthawk were successful. Our goal was to improve the midrange performance without losing top-end power. While we might have lost some very-high-rpm performance by reducing the cam-lobe centers, any such loss was more than compensated for by the improved breathing that resulted from installing the K&N intake kit and the SuperTrapp exhaust.

Our modified Nighthawk certainly runs better in the rpm range where most of us spend our time. There was a big improvement in throttle response and performance below 5000 rpm, and the bike is much more pleasant to ride through slow traffic. The power surge that used to occur at 9000 rpm now starts at 7000. High-rpm power now ends at a little over 10,000 rpm instead of 11,000. The peak power width is now 3000-rpm wide instead of 2000. The bike is much faster than it was and also much easier to ride at all engine speeds.

All the tuning in the world, though, will not compensate for cubic inches. My ideal Nighthawk would weigh the same as it does but have an engine with twice the displacement. I wouldn't want any more peak power, but it would be nice to have twice as much at 4 grand.

Many of us waited for Honda to introduce the inevitable larger version of the Nighthawk. Instead, it dropped the bike. Too bad. I believe that was a mistake. A larger Nighthawk could be the best UJM ever built. Why it hasn't been built is a puzzle. **M**

SUPPLIERS LIST

CORBIN SADDLE
123 C Lee Rd.
Watsonville, CA 95077-1562
(800)538-7035 (U.S.)
(800)662-6296 (California)
Supplied: Gunfighter seat, part No. H7N, $169

K&N ENGINEERING
561 Iowa Ave.
Riverside, CA 92502
(714)684-9762
Supplied: jetting kit, part No. 239048, $137.36

METZELER MOTORCYCLE TIRE
4520 107th St.
Everett, WA 98204
(206)348-4000
Supplied: tires—front, 120/80V16TL ME33 Laser, $98.50; rear, 140/90V16TL ME99A Perfect, $114.50

PROGRESSIVE SUSPENSION
11129 G Ave.
Hesperia, CA 92345
(619)948-4012
Supplied: rear shocks, part No. 1240B, $161.20; fork-spring kit, part No. 1124, $55.95

RUSSELL MOTORCYCLE PRODUCTS
20420 S. Susana Rd.
Carson, CA 90745
(213)602-1202
Supplied: Front-brake hoses, part No. 09267, $88.12; clutch hose, part No. 09608, $39.24

SUPERTRAPP
3910 Seaport Blvd.
W. Sacramento, CA 95691
(916)372-5000
Supplied: exhaust system—front, part No. 4MSH30700SS, $190.00; rear, part No. 4MSL30700SS, $159.95

VAN LEEUWEN ENTERPRISES
13275 Paxton Ave.
Arleta, CA 91331
(818)896-2200
Supplied: Ferodo brake pads, part No. 370244, $24.95 per set