Cycle®

JUNE 1982 • $1.25

Honda's New 500 Roadster

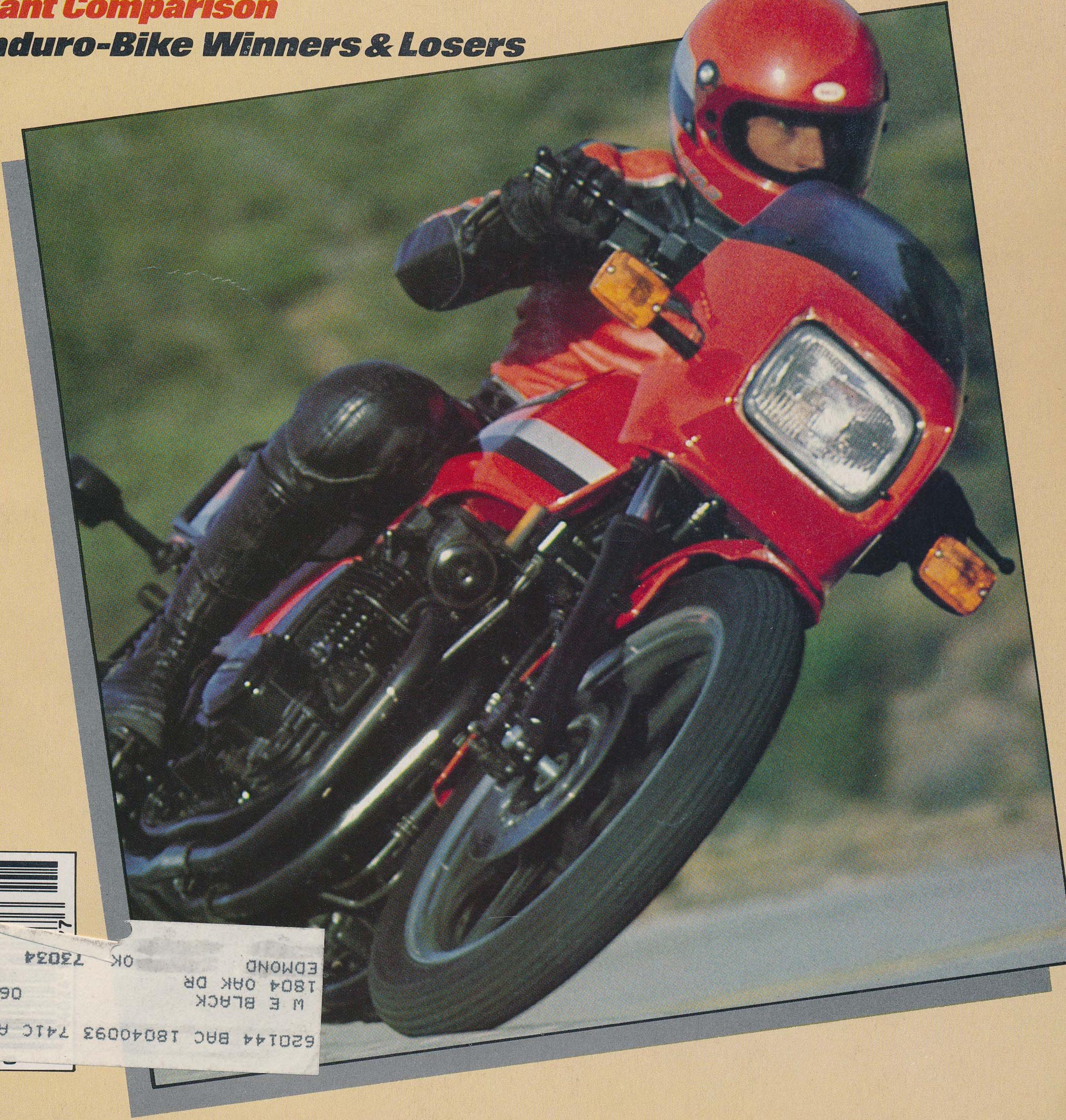
Multi-Million-Dollar Daytona Spendathon

Kawasaki GPz750

Purebred Sports Bike Supreme

Giant Comparison

Enduro-Bike Winners & Losers



Cycle

June 1982 Volume XXXIII No. 6

pg.58

pg.30

This Month's Cover: See here, Zăpūdō, we said to the AD, we want this GPz750 to *pop* off the cover. No problem, he replied, we'll put this jump-out square-lens on Robin Riggs' cardboard camera, and it'll be dramatic. It was. So is the bike: best 750 sports bike in red or any other color. The test begins on page 30.

Road Tests

Special Features

Technical

Competition

Departments

CYCLE (ISSN 0574-8135), published monthly at One Park Avenue, New York, NY 10016, by Ziff-Davis Publishing Company—Richard P. Friese, President; Selwyn Taubman, Treasurer; Bertram A. Abrams, Secretary. Second-class postage paid at New York, NY 10016 and at additional mailing offices. Authorized as second-class mail by the Post Office Department, Ottawa, Canada, and for payment of postage in cash. One-year subscription rate for U.S. and possessions $13.98, Canada $18.98, all other countries $21.98. POSTMASTER send address change to *Cycle*, Circulation Department, P.O. Box 2776, Boulder, Colorado 80302. Please allow at least eight weeks for change of address. Include your old address, as well as new—enclosing, if possible, an address label from a recent issue.

PHOTOGRAPHY: PATRICK BEHAR

DAYTONA 82

SUPERBIKES

One-Liter High Tide

This was the last Daytona for one-liter four-cylinder Superbikes. Here's how the factory war-bikes developed over four short years.
By Kevin Cameron

The final season of Superbike as a 1025cc class has begun; in 1983 the class will drop to a 750/four-cylinder, 1025/twin-cylinder formula. What will this mean? For the factories, very little. For them, the major expense has been the development of concepts and methods. Giving those ideas metallic form, no matter what the displacement, is now relatively trivial. Under the big formula, chassis, brakes, powerbands and reliable components have been developed. Will power and speed drop with displacement? It's doubtful. If Honda succeeds in getting its V45 water-cooled 750 homologated with a chain drive, the bike will produce 125 bhp without new technology. It will be a fast motorcycle.

For the privateer, hardware is everything. He has put all the money he can muster into a particular gusseted frame, a particular braced swing arm, a particular modified engine. Now he will have to put lights on his creation, go peddle it to the street cowboys for whatever he can get, and begin again.

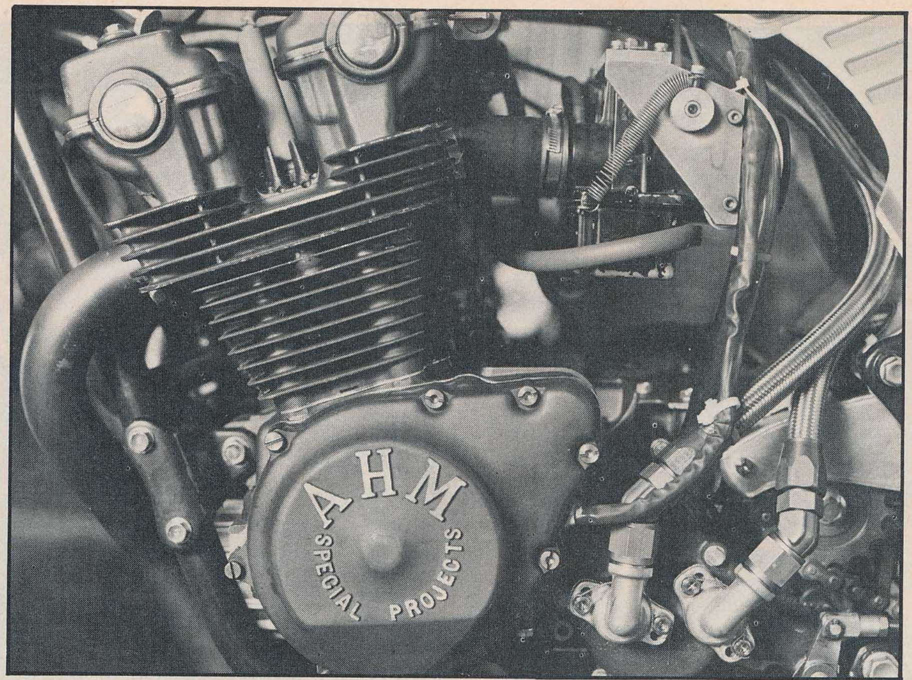
Why the displacement change? Several reasons. First, the 1025 machines have become even more powerful than the TZ750 Yamaha F1s the AMA decided to muzzle back in 1978 because they were tearing up their tires. Second, much of the best engineering is now going into middle-displacement street machines. Third, under the straight 1025cc formula it has been impossible to give the twins the displacement break they need to make competitive power. Their lower ends and cases simply won't tolerate enlargement to 1200 or 1300cc. Of course, even this won't make twins competitive. The fastest of them, the Leoni Ducati ridden by Adamo, laps Daytona more than 10 seconds slower than the fastest 1025cc four. Cutting the fours back to 750cc will help, but it won't turn their present 2:05s into 2:16s.

The 1025cc Superbike road-racing class, with its rules requiring near-stock appearance, upright ride position and high minimum weight, might seem handicapped in comparison with the GP class, which features sleek, gorgeous, lightweight machines. Indeed, only five years ago Superbikes were slower than 250s. Now, however, the big factory four-strokes challenge the lap times of the fastest F-750/Formula One two-strokes. Factory Superbikes now have true racing chassis, though based on production parts; they're short, steep, fast-turning and carry their weight well forward. The engine builders have dipped deep into existing four-stroke technology to produce big, broad powerbands. Factory riders are well-paid professionals, the mechanics are veteran career specialists, and the team managers actually manage. Every one of these factors has been essential to the drop in lap times.

Inklings of the factory era came when Kawasaki hired young Mike Baldwin to ride in the 1979 season. At a January Daytona tire test he took a big slice out of the Superbike lap record on an old practice hack. Maybe there was something to this pro-rider idea. Previously, Superbike riders had been mainly older men or inexperienced amateurs. After Baldwin's Loudon injury, Kawasaki put Freddie Spencer on one of its machines for Sears Point and Laguna; he won both races, pulling away from opposition formerly considered unbeatable.

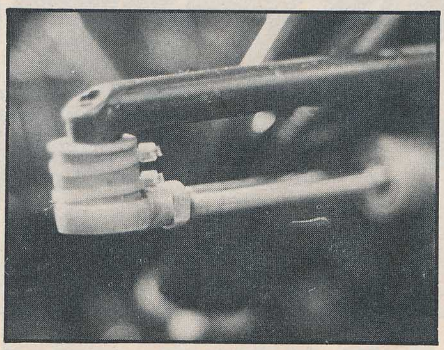
Big changes came to Superbike with top riders like Baldwin and Spencer. These riders were unwilling to accept anything but true race-bike handling—no compromises. They knew equally good jobs were waiting for them in European racing, so they had nothing to lose by being frank. "Fix that pile or I'm not riding."

Now with most of the elements in place, the battle could begin—*if* the corporate planners would initial the budget requests. Kawasaki had gambled little so far but had won big. Honda was on the point of re-entering European GP racing; why not join the United States scene as well? Suzuki had benefited so much from Yoshimura's successes that they could refuse him little.

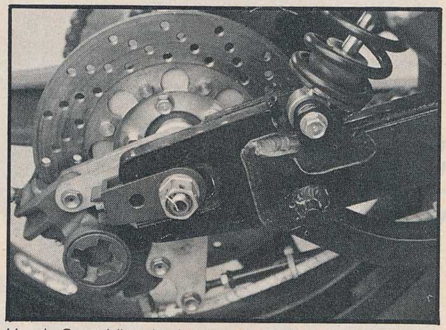


Here's the basic Honda dry-sump endurance/Superbike engine. Trick cover comes from Gardena-based American Honda Motor special project team. This engine has the Edmonston "old" El-type carburetors. Titanium fasteners abound.

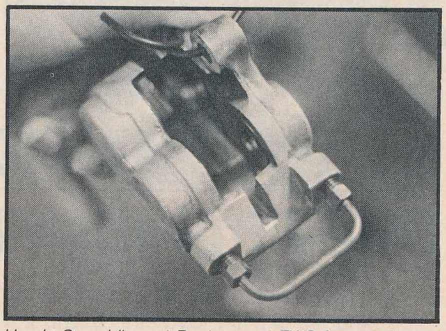
The Honda Superbike onslaught at Daytona should be seen as a culmination: putting together the technical knowledge and know-how gained in the last two years and uniting that with a team organization that could get straight to winning times.



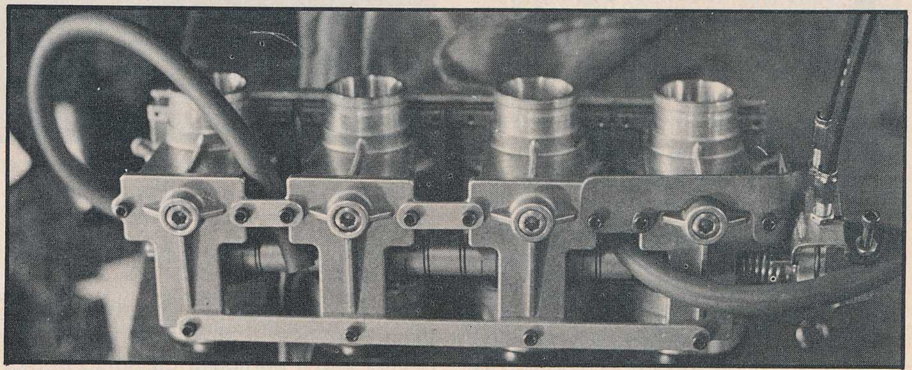
Transversely disposed steering damper can be adjusted enroute at speed; this view shows the right side.



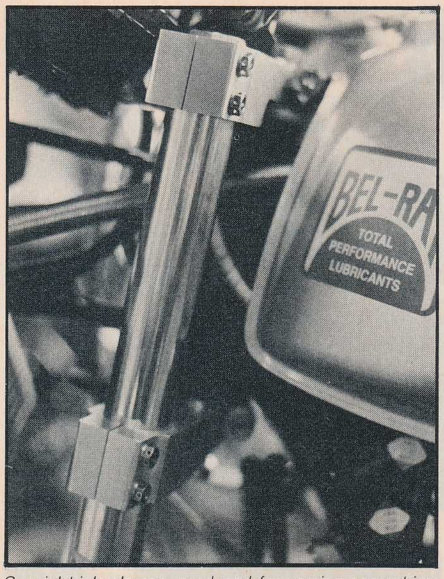
Honda Superbikes had new underbridge aluminum swing arms. Holes and light metal pieces are everywhere.



Honda Superbikes at Daytona got FWS front ends with four-piston calipers; this one is shown sans pucks.



Honda employs Pappy Edmonston as a consultant; here's his latest Superbike carburetors as fitted to Spencer's bike. These rod-metering instruments are far more integrated and sophisticated than Edmonston's earlier devices.



Special triple-clamps, produced for varying geometries, are machined alloy with much relieving on undersides.

In 1980 they all took the plunge. Countless engines were blown up, vast budgets were spent, staffs came and went, but the factories learned an enormous amount. For the first time, Superbike vied successfully for the limelight with F-750; and at Laguna, Spencer's Honda was actually faster than the 750s. Later, at Pocono, Eddie Lawson's team Kawasaki Superbike was entered in the F-750/F1 event, won its heat, and then came in a close third behind the Yamahas of Singleton and Schlachter. These were becoming serious racing motorcycles now, even if they were still often unreliable and handled far from perfectly. The broad four-stroke powerband could pull a heavy Superbike out of a turn far harder than could any two-stroke, even though GP-style machines still had a top-end advantage.

The last race of the 1980 Superbike series, in October at Daytona, underlined the handling troubles that still plagued the class. The AMA rule that prohibited the complete removal of any frame tube made it almost impossible to lay down the rear shocks to get long wheel travel. The stiff springs necessary to prevent bottoming with short travel were transmitting excessive loads to the rear frame sections, causing flex and wobbling at speed. In an effort to deal with this, the Yoshimura team appeared with the top-ends of their seat tubes moved forward to permit the laid-down dampers. The Kawasaki team, hardly without blame itself, objected, and there was a sharp exchange of protest and counter-protest, culminating in the AMA's relaxing the rules. For 1981 it became legal to make any change behind the swing-arm pivot except to the number of shocks. It also became legal to relocate and re-angle the steering head.

By rider demand, all builders radically shortened their chassis to get quick turn-in. Kawasaki's 1981 wheelbase came

THE HONDA BLAST

Maybe Udo Gietl worried about the outcome of the Superbike race because The Man Responsible For The Team Winning is also The Man Responsible For The Team Losing. Still, how could Honda miss? Eddie Lawson's Kawasaki was, on a comparative basis, slow against the Hondas, and it had been that way all week. Wes Cooley had suffered with the 16-valve Suzukis early in the week; there were distressing battlefield sounds coming from the engine cases where there should have been the efficient, undisturbed whirr of comfortably running parts. Wes was back to the old eight-valve model, more than 10 horsepower away from even terms. The only threat privateers posed was to one another, and the self-inflicted sort.

So there was Honda, with Freddie Spencer, re-emergent Mike Baldwin, now-racer-for-real Roberto Pietri, and Steve Wise, that crossover motocrosser who, before his talents are fully probed, may turn out to be America's premier trials rider, too. Honda had the fastest bikes, a super-strong pilot roster, and a practice week of not-much-trouble. Gietl should have been wearing his Alfred E. Neuman "What, Me Worry?" T-shirt, but Gietl had been around racing too long to take anything for granted.

The race began as a total Honda parade of Spencer, Baldwin, Pietri, and Wise. Then came Cooley and Lawson. On lap three Spencer cut a quick 2:04.9 in pulling steadily away from Baldwin. Lawson was left to draft his way among Honda's second pair of riders. By lap 10, Spencer led by 10 seconds from Baldwin, and Lawson had worked up into third. Pietri, in his considerable efforts to stay hooked up with the leaders, had his machine wobbling, grounding and sparking spectacularly, but Lawson forced past him anyway.

As the Honda men prepared to pit for gas, Spencer had 27 seconds on Lawson and would still be leading after his stop even if Lawson kept going. Baldwin's advantage over the Kawasaki rider was only 10 seconds, and, sure enough, when the stops were finished, the order was Spencer, Lawson, Baldwin. When was Lawson going to come in? Spencer's cushion over Lawson was now down to only nine seconds, but this meant little because Spencer's laps were quicker.

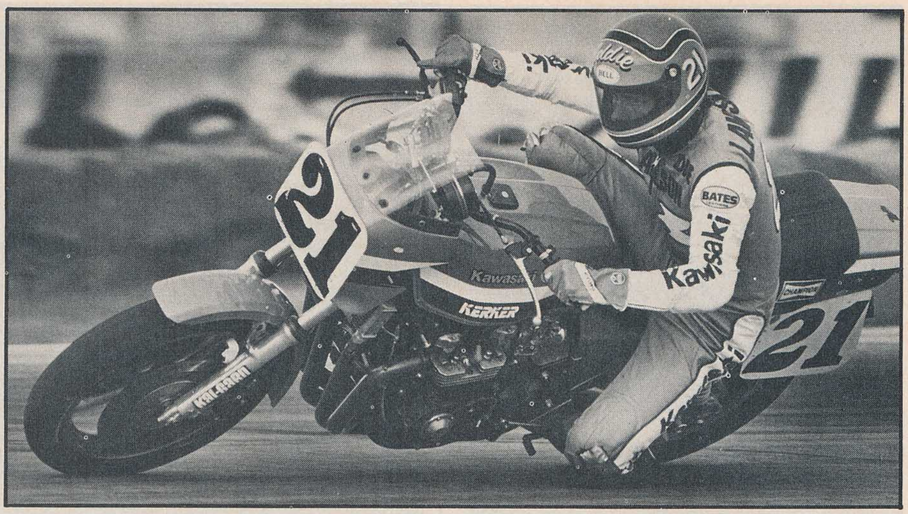
Superbikes moving through the chicane seem like sailing ships maddeningly speeded up, with the jutting bars, elbows, seats and knees taking the role of standing rigging, the whole affair tilted over at 45 degrees in obvious defiance of good sense. The fast men in Superbike do indeed seem to be hurling themselves into harm's way.

As the miles passed, everyone began to stare at Lawson; was he going the 100 miles nonstop? This model of Kawasaki is supposed to hold some 5.7 gallons, and a hundred miles on that would require 17.5 mpg, a lot more than some teams are known to get. Such a figure would require the engine to be far at the most efficient end of what is possible in specific fuel consumption. Could it happen?

It was now cooler, with a wind coming up. The relative humidity began to deposit moisture on any cool surface. By lap 21, Baldwin was within four seconds of Lawson, who was an unbridgeable 20 seconds out of first. Spencer cruised in the mid-sevens, having no earthly need to go any faster now. The second- and third-place men even made some ground on him in the final laps, but

PHOTOGRAPHY: DAVE HAWKINS, JOHN OWENS

DAYTONA 82 SUPERBIKES



down nearly two inches; Suzuki's an inch and a half.

With rear shocks laid down, the long-travel suspension, not the frame, did the flexing, and tires were saved from peak loads. Modern gas-pressurized dampers, whose performance remained stable race-long, controlled wheel movement.

Builders set front ends right back against the engine's exhaust pipes, concentrating weight over the front wheel. The older machines, with less front-end weight, had understeered, or "pushed," when power was applied exiting a turn. This had seriously limited acceleration, cutting straightaway speed as well. When you have the bars turned all the way and your thumb is on the tank, you can't turn it on any harder.

With chassis flex under better control through long travel and extensive bracing, it once more became possible to tolerate steep front-end geometry. Superbike angle came into line with GP practice, and steering became light.

Now that the handling is improved, what about horsepower? Superbikes have always had plenty of power, but the big numbers have had less to do with the recent drop in lap times than have powerband refinements. All these engines have five-speed gearboxes, and while the ratios for racing can be spaced more closely than for the street, they can't be so close that first is too high for starting and fifth is so low that the engine is wound out halfway down the shortest straight. Such a gearbox really demands a powerband of 7000–10,500 rpm, while the engine and its intake and exhaust system give generously only between 8000 and 10,000 rpm. If you tune for peak power, every upshift can leave you hanging in powerband-limbo for precious seconds while the engine struggles up into its real power range. If you go for wider power and succeed in making it work across the five speeds, you may very well have a combination that is two seconds faster per lap than with the more powerful engine.

The powerbands are really very good now, with torque usually reaching a maximum around 8000 rpm, then falling off in proportion to rising rpm so horsepower is nearly constant right across the band up to 10,500. This is still far from the constant torque of certain Formula One car engines, with horsepower rising in proportion to rpm; but without the F1 car's water-cooling and fuel injection, and its racing-only intent, the Superbike engines can certainly be praised for their achievements in this area.

While Honda attacked Superbike racing with special this-and-that, the Kawasaki team based their efforts on four Replica Racers and built their way up to competitive speed. Almost.

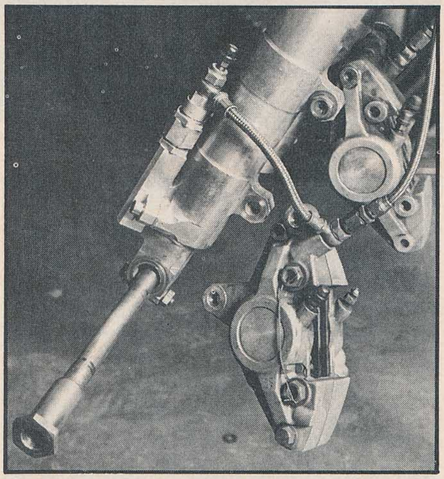
What determines the four-stroke powerband? The obvious upper limit is mechanical: rods and bearings can take only so much for so long. Gas flow too cannot keep up with limitless rpm within its limited flow area.

With only five speeds, it is the lower edge of the powerband that needs extending. In any engine that uses exhaust pressure waves to assist in cylinder charging at high rpm it is inevitable that at some lower rpm the waves will arrive back at the exhaust port at exactly the *wrong* time. This produces the big flat spot that sets the lower limit of the powerband; exhaust gas is blown into the cylinder during overlap when both valves are slightly open, and it's blown back out through the carburetor, upsetting fuel delivery and causing the engine to gargle and run roughly.

How is this tackled? The tuning rpm of the pipe can be moved downward with some loss of top-end. Intake length can be adjusted to counter the exhaust pressure wave with an intake wave. The cam timing can be juggled to throttle the flow path from exhaust to inlet during overlap. Certain types of carburetors work better than others in these transition regions.

In general, it's safe to say that horsepower has hovered near the 140 mark for the last three or four years, and maximum BMEP (Brake Mean Effective Pressure) has probably surpassed the "magic" 200 psi figure at the torque peak. With power somewhat constant, lap times have clearly responded to something else.

Both Kawasaki and Honda are using carburetors designed by Bill Edmonston, the man who designed the Lectron, the EI, and the Blue Magnum. Kawasaki is using the S&W version; Honda has hired Edmonston himself to further refine his work for Honda's special use. The Yoshimura Suzukis are using the latest Keihins in a larger 33 millimeter size, sleeved back as all Superbike carburetors must be to 31mm by a downstream restrictor. Kawasaki people disclaim any knowledge of ongoing work with racing fuel injection; but with electronic injection on their street bikes, can they resist?



Here's the Suzuki version of Superbike retardation and anti-dive; F1 and Superbike hardware draw closer.

Ignitions have come and gone; all companies have experimented with retard ignitions that match spark lead to the flame speed in the combustion chamber at each rpm. Although the potential gains with such systems are large, the reliability standards of some Japanese ignition electronics are far from military. Honda's system was battery powered, making success a hostage to the integrity of fiber grids packed with lead paste, dangling in a sulfuric acid solution: horrible storage batteries. On top of this, the spark wasn't all that hot at the best of times. Honda is now using the German-made Kröber magneto-CDI; it generates its own power, has a fast rise time, and has been

PHOTOGRAPHY: TOM RILES, DAVE HAWKINS, JOHN OWENS

refined since 1970. Even without the retard feature, it's nice to have sparks.

Kawasaki's system has also evolved: Tech chief Rob Muzzy now makes his own selection from among a variety of electronic components to get apparently very good results.

All three engines operate at high piston speeds near the current limits of technology. To keep them together up there, conventional materials and methods are insufficient. Certainly Honda and Kawasaki have had special titanium connecting rods made to push up the compromise on rod weight, strength and bearing load. Titanium lies beyond steel; it can provide necessary bulk at lower weight, but the material is $40 a pound, and the machining techniques are somewhat specialized.

Back in 1979 Yoshimura bikes were stopping with rod and bearing failures and twisted cranks. Now even production cranks from Suzuki and Kawasaki are assembled at the factory with Loctite-type anaerobic resin in their pressed joints to prevent twisting. Juggling crankpin sizes, rod designs, and bearing details is fairly easy at the factory, and eventually results in reliable performance.

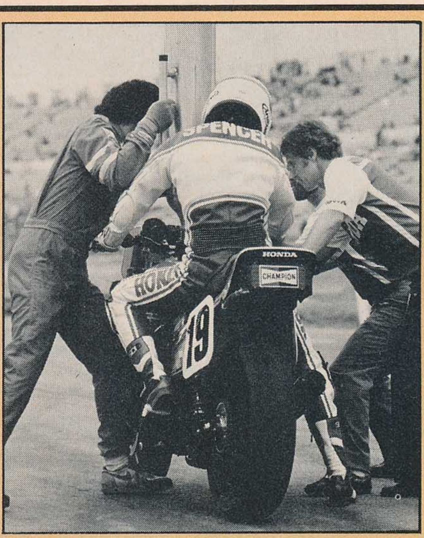
Forged aluminum pistons are standard for high-rpm four-stroke racing engines. When the upper limits are pushed, a lot of the horsepower gained up there goes directly into internal friction, much of which distorts moving parts and castings. Pistons suffer especially from this, and the denser, more ductile material of a forging is more resistant to it than the brittle, inclusion-ridden cast metal. Cast pistons still have appeal in hot-running air-cooled engines because the higher hot-hardness of high-silicon aluminum resists the up-and-down pounding of the piston rings in their grooves better than forged metal can. With rpm creeping up and up, and stress being proportional to its square, piston bending is now considerable. Only a forging will do, and even Yoshimura, the last bastion of the cast piston in Superbike, has begun to work with forgings.

Titanium valves, which are light and conduct heat far better than do the stainless steel parts they replace, are attractive because they can reduce the possibility of hot valve pre-ignition and because they somewhat raise the rpm of incipient valve float. Such valves are now a catalog item—they're expensive, but hardly unusual.

Kawasaki's engine presented special problems because its cylinder head had been designed for a smaller displacement than Superbike's 1025cc. This meant that the two valves in each chamber were much closer to each other than was necessary or desirable. When larger valves were fitted, it was hard to have both open very far (as they must be during overlap) without hitting each other. In a well-designed racing engine, the overlap period is an essential part of cylinder charging. Suction generated in the exhaust system first draws out the burned gases remaining in the combustion space, while the piston is essentially motionless during the "dead" forty-odd degrees of crank rotation near top center. Then the exhaust suction continues its work by initiating the flow of fresh mixture from the carburetor, even before the piston has begun to move down on its suction stroke. This highly desirable sequence of events depends on how much lift can be provided during overlap; there can be no flow without area.

Without this overlap scavenging, the burned gases in the chamber will remain to dilute the intake charge some eight percent, causing a large power loss. If exhaust suction doesn't begin to acceler-

(Continued on page 117)



THE HONDA BLAST

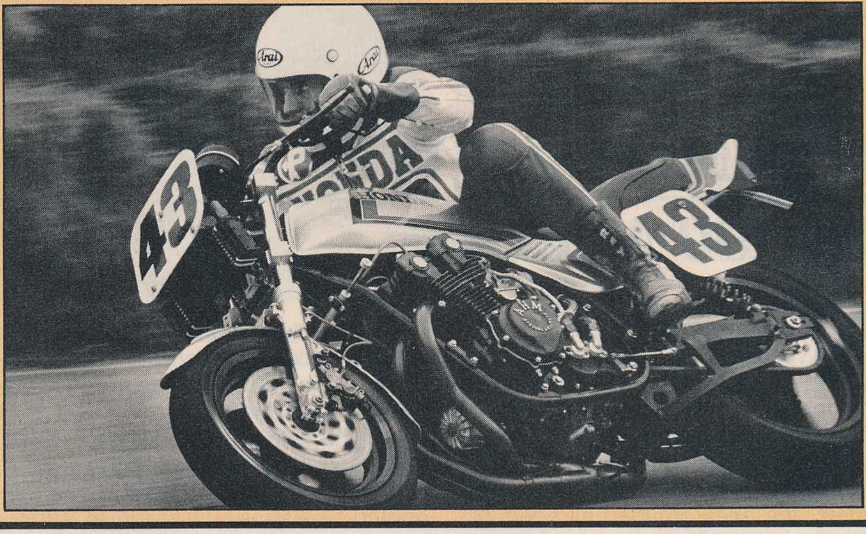
he was where he needed to be—out front with enough cushion to ensure against the little mishaps that can afflict a hard-worked machine in the final laps.

The signals to Lawson were vigorous, but he paid them no heed. He would gamble his second place against nothing rather than accept the certainty of a 15-second loss in a gas stop. On lap 25 he suddenly lost a second and a half to Baldwin; was his engine cutting out? On the last lap, entering turn two with three miles to go, his engine stopped completely. The gamble had failed.

The final order was Spencer, Baldwin and Pietri for a total Honda sweep, with the persistent Cooley salvaging a few points back in fourth. Fifth was filled by Kawasaki's road-race aspirant, Wayne Rainey, on one of the new Replica Racers. In sixth was the gambler Lawson, having summoned up a few precious ounces of fuel and fumes to carry him stuttering to the finish. Thad Wolff was the first privateer home, in seventh.

The lesson? Don't be caught with even a tiny hole in your technology, for with the top factory riders being broadly equal, it is machinery that makes the difference. Honda is on top now, just as was Kawasaki only months ago. Don't relax, though. It's far from over.

—Kevin Cameron



Superbikes *Continued from page 113*

ate the mixture in the intake pipe, the entire intake process will be delayed and will deliver less total mixture to the cylinder, producing another hefty power drop.

Even were decent lift somehow possible, the closer the valve heads are to each other, the greater the chance of fresh charge scooting out the exhaust before it can swirl around the chamber and chase out the burned gases.

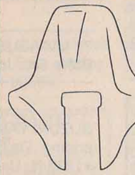
Standard airflow methods have done a lot for two-valve-per-cylinder engines; the core of these methods is reducing flow resistance without making the ports large. The larger the port, the lower the flow velocity; and the lower the velocity, the less ram effect there will be. Ramming is the process by which the fast-moving intake flow continues to pour into the cylinder even though the piston has stopped at bottom center or started back up on compression. Because the pressure gained in the cylinder this way depends on the square of the intake velocity, even a small velocity drop can reduce the ram effect a lot.

Two valves, it must be remembered, can flow as much or more air than can the four smaller ones of the "more modern" layout. With only the two ports, there is much less wall friction and only one valve stem in the way of the intake flow. The Kawasaki (and Suzuki) two-valve designs are actually turning revs as high or higher than the Honda. How is this done? Much of the difficulty of controlling two large valves has been eliminated in recent years by the use of high-frequency valve springs. Recently a better solution has come to hand. The fewer coils a spring has, and the lighter it is, the higher its natural frequency. Early designers must be excused for using many coils, for this reduces stress in the spring wire, which is important with older materials. But by using new spring alloys that can live with extremely high stress, very light springs are now wound with far fewer coils to have a natural frequency so high as to be out of reach of excitation by engine operation. Older springs had eight or more turns of wire in them; the new ones may have fewer than four.

Even the most sophisticated airflow work couldn't get everything lurking in the Kawasaki castings because those valves were too close together. Therefore the engineers changed it. They swung the valve heads away from each other, pivoting around the centerlines of the two camshafts, moving the valve heads outward into the unoccupied real estate at the edges of the chamber. The machine work involved in this was obviously beyond what evening adult-education courses teach. The overlap lift compromise was eliminated and the track results surprised even the staff themselves. A nice piece of work.

The two-valve engines still suffer from

(Continued on page 122)



Superbikes *Continued from page 117*
not having a central spark plug, which gives such a desirable short flame travel to the farthest parts of the chamber. Kawasaki has attacked this one in the same way Ferrari did back in its two-valve days—by using two plugs per cylinder.

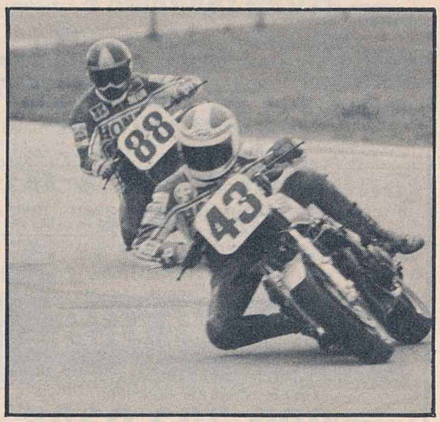
The Honda is a four-valve design, and the way Honda uses the four-valve concept in this rather old engine gives it no advantage over the two-valve designs. The Honda's bore and stroke are equal, so the stroke is very long at about 69mm. The con-rod stress—not valve float—resulting from this sets the upper limit to the Honda's rpm.

To get two big valves into a given chamber diameter, the valves have to be set at an angle to each other—the included angle. Otherwise the sum of the diameters of the two valves could not exceed the chamber diameter. The bigger the valves you want, the larger must be the included angle, and the deeper is the resulting combustion chamber. To achieve a high compression ratio, the piston must have a high dome that fits tightly up into this deep chamber, making the combustion space thin and its shape complicated. This slows combustion, requiring a very early spark timing to get complete burning. This long burn time pushes out a lot of heat through the chamber walls and piston crown, and that lost heat is lost power.

When four valves are used in a very oversquare engine (large bore, small stroke), plenty of valve area can be had with almost no included valve angle at all. This results in a flat, compact combustion chamber that gives rapid flame speed even at very high compression ratios. These are the advantages which the 16-valve Suzuki Katana 1000cc engine has—but not Honda. The Honda engine does not have a large bore and short stroke, so to get valve area, even with four valves, a large included angle is needed, and that makes performance unexceptional. In addition, motorcycle engines, being air-cooled, have trouble with narrow valve angles because of the difficulty of extracting the heat from the narrow hot zone between the valves and directly over the combustion chamber.

Honda must therefore soldier on with its 1960s-style four-valve engine in a world of high-rpm two-valve designs. To get power, they must rev it up, and with that long 69mm stroke, piston speed sails up toward the fantastic 5000-foot-per-minute mark at 11,000 rpm. No wonder their connecting rods grow old so quickly.

Honda has won its share of races. Its strengths include a good budget, a good staff and manager, and good riders. The basic engine may be old, but at least it has some maturity of development. From the endurance racing program have come the dry clutch and dry-sump oiling



system. Because Honda engineers use plain shell bearings on rods and mains, they can use a one-piece crank, very light and stiff, which helps acceleration. Although the four valves are no superweapon, their great perimeter (the sum of the circumferences) gives them a flow advantage at low lift, potentially permitting shorter cam timing to be used with some gain in powerband width. The team has done well to get as much as it has from the engine, although it has cost plenty of money.

Kawasaki's organization is small but it has achieved a lot. Racing policy at Kawasaki has been extremely mercurial in the past, budgets being turned on and off seemingly at random. With its present U.S. operation, Kawasaki is on to something good.

It has been agreeable to see Superbike lure three factories back into racing, but it is improper to hail the class as any kind of a favor to the privateer. The basic problem with Superbike is that it requires the private rider to be an entire engineering department. That's why so many classes of car racing prohibit engine modifications: even the wealthy lawyers and surgeons who support that branch of motor sport cannot afford no-holds-barred development programs.

Kawasaki has defined the bottom line, the price of admission, by offering for public sale a production-racer replica of their successful Superbike at $11,000 (see *Cycle*, May 1982). Here are the proven wheels, brakes, chassis modifications and engine developments you need to make a decent beginning in the class. Add to that the spares—the wheels, engines and other parts you may need—and you have a nice little program. Serious privateers will see that it represents value for money, and maybe other makers will soon offer similar machinery.

Factory Superbikes ridden by factory riders are very little slower than F1 machines under the same riders—only about three seconds at Daytona. Why?

Both types have enough surplus horsepower that neither has any advantage coming out of slower corners. Through the corners themselves the F1s may be a couple of tenths better here and there, but not much. Although it might seem that the tall Superbikes would have all sorts of brake trouble—lifting their back ends—they don't have to brake as much in the first place. First, they aren't going in as fast by about 10 percent (maximum of about 158 mph vs. 175 mph for the good F1s) so their brakes have less actual work to do. Second, their aerodynamically "dirty" shape and larger frontal area put the wind to work in getting them stopped. The F1s gain little there. Only top speed is left. Both classes spend less than 20 percent of each lap at or near maximum, so the 10 percent speed difference adds up to a little over a two-second advantage for the F1s. That, plus the odd tenth picked up in the corners, is the only real performance difference. The factories have done a magnificent job of making chassis and suspension apply all that power.

The Honda racing team made some major changes to their chassis over the winter of 1981–82. First, they fitted the Superbikes with the excellent Showa anti-dive fork with its large, stiff tubes and effective damping system. Second, they abandoned Lockheed brake calipers in favor of the four-piston Nissin racing calipers developed for the NR500 and lately used on the FWS. These provide high brake torque but don't wither the rider's arm and fingers. Third, they gave up their stock-looking pipe swing arm and built proper racing parts with heavy triangulation beneath, like those used by Kawasaki. Fourth, they constructed a new chassis with an even steeper fork angle of some 25 degrees to lighten steering made heavier by the necessary forward engine placement. This chassis, tested at Daytona in January, was received enthusiastically by the riders. When chassis flex is reduced, it makes a machine much easier to slide in a controlled fashion; the sliding is smooth rather than jerky.

Bill Edmonston's latest carburetors for Honda, as used on Spencer's machine, now have the machinery for pushing and pulling the slides enclosed. These carbs are said to confer a top-end advantage of some four to five horsepower, but Baldwin chose to use the venerable Keihin smooth bores instead, finding the new carburetors hard to get off-idle because of engine suction acting on the slides.

Bear in mind that while engine development must go on continuously, modern racing is really tire racing. More power is often less useful in improving lap times than is a more rigid chassis or a smoother fork. The improved Honda chassis makes the machine lap more quickly even though the engine is not greatly different from a year ago (except in reliability). Recall also that certain parties began to claim 150 bhp for their Superbikes as long ago as 1978. Although Honda still

(Continued on page 129)

Superbikes *Continued from page 122*
doesn't have that much power, their machines are almost 10 seconds a lap faster than any 1978 machine. The only real horsepower is the amount actually being transmitted to the ground, not the maximum your engine can, under lab conditions, yodel and shriek into a dyno. Make it possible for your rider to open the throttle farther and earlier in the turns and you have increased real-world horsepower without touching the engine.

Kawasaki offered no visible technology different from what had worked so well last year, but the new speed of the Hondas seemed to put Lawson's machine into the second-best category—a reversal of the position six months ago.

The AMA finally approved a 1025 version of Suzuki's new 1100 16-valve engine after that company built a thousand special 1000cc Katanas based on that powerplant. Although early development had netted Yoshimura 13 horsepower more than last season's best eight-valve units, there was a problem: the wristpins were seizing in both the pistons and in the unbushed, unplated con-rod small-ends. On the street engine, the pin is coated with the Parco-Lubrite process and works well; but under extra pressure, lubrication breaks down and local welding begins, leading to breakage of the pistons' skirts. Therefore, Cooley was demoted by this one fact to 1981 technology, some two seconds a lap down from the current art. The problem will be easy enough to fix, perhaps, but a new design always has its little surprises.

Suzuki's prospects are harder to read because of the difficulty of differentiating between Yoshimura's contribution and the company's. There are always rumors that Suzuki will soon have its own racing team, but past experience will tempt Suzuki to let Yoshimura continue to carry the flag. The Old Master's great advantage has always been that he is the engineer and the builder, not just someone hired on to do a job. Last year his innovations included a shortened chassis, a new intake length to lower the power, and Fujio Yoshimura's new rising-rate rear suspension, which he calls "Swing-Cross." The rear dampers are in their usual place, but their lower eyes, instead of being bolted directly to the swing arm, are attached to one end of short toggle arms whose other ends pivot on the swing arm. The motion of the toggles is controlled by bars which cross the swing arm to attach to the frame below it. As the rear wheel rises, the bars cause the toggles to swing upward, compressing the shocks faster and faster. Wes Cooley has been very optimistic about this device although they have just begun to work with it. Already it has permitted them to reduce initial spring rate by almost half, making the suspension much more supple without increasing the tendency to bottom under severe load.

Because Honda and Kawasaki are now spending a lot of money, it is a lot to expect even a prosperous aftermarket concern to match swords successfully with factories that have buildings crammed with dyno cells lined up in rows. With the factories escalating their efforts so far, it will only get harder. Will Suzuki step into the game or give direct support to Yoshimura?

All the people on the Yoshimura team are extremely hard-working and indeed it appears more like a family than a business. Is this a strength or a weakness? Don't count them out. Private racing teams often have more staying power than the factories.

So after three intense years, here's where we stand with one-liter four-cylinder Superbikes. They are factory-supported motorcycles, quick and fast enough to embarrass almost any Formula One machine that isn't on a factory life-support system too. These Superbikes are also outrageously expensive, totally beyond the resources of private teams, and the factory bikes are ridden by the best talent available. Superbikes benefit now from the best money can buy because Honda, Kawasaki and Suzuki believe that a Superbike winner has commercial value, and winning at this level is worth the cost. ◉