

**Tests: Yamaha's Hot New 650 Four  
Suzuki PE400 and GS450S**

**Four Water Cooled Motocrossers**

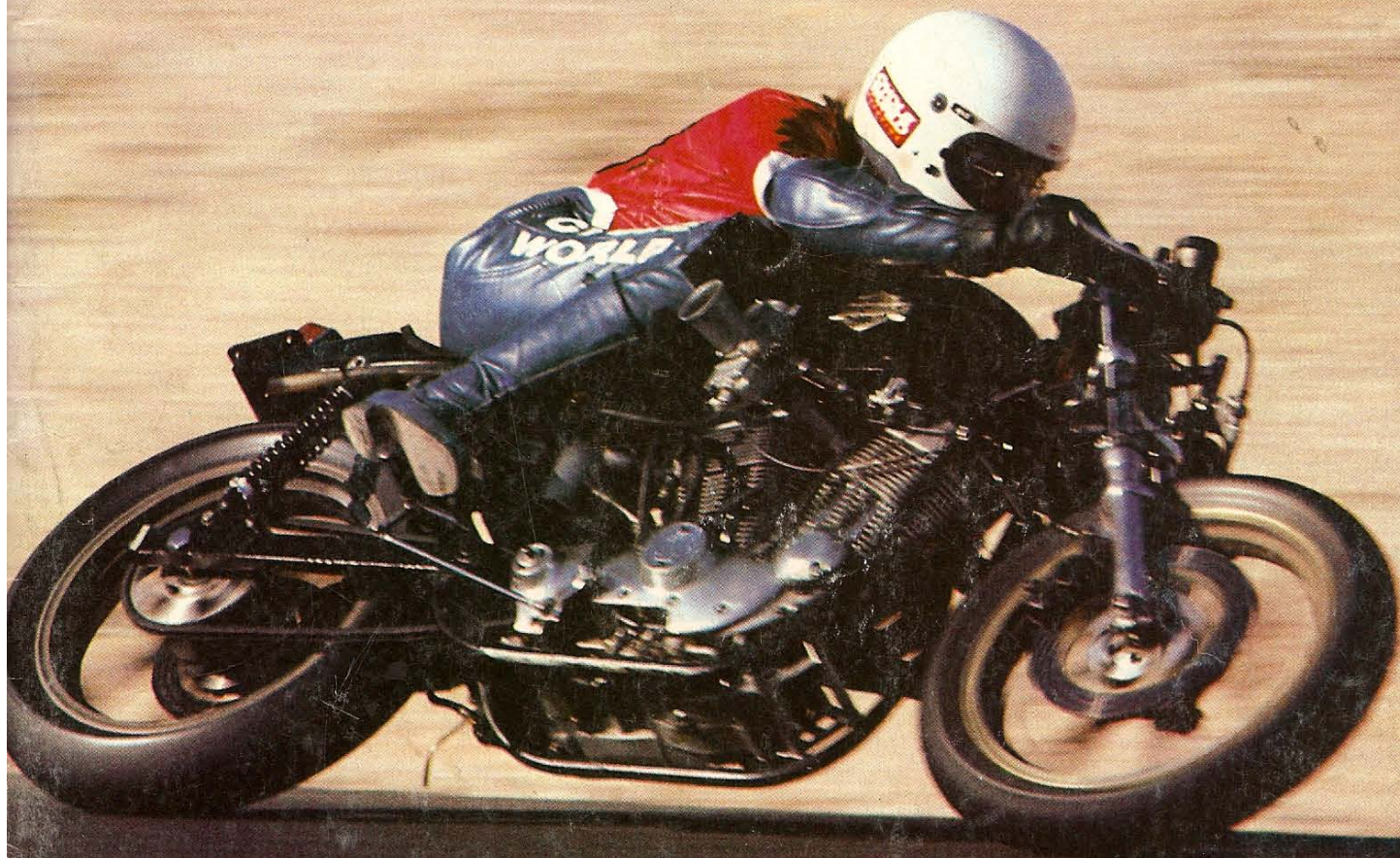
# **CYCLE WORLD**

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*America's  
Leading  
Motorcycle  
Enthusiasts'  
Publication*

***Hundred Horse Harley—  
Street Legal and 150 mph Fast.***





# The Aluminum Steamroller

A Lean and Hungry Hawg

by Peter Egan

**H**arley Sportster engines are known for a lot of things. They are known for their spare, aggressive good looks, the deep, unrhythmic shuffle of the 45° V-Twin at idle, low-end grunt, and for inspiring admiration in those who like tradition and simplicity backed by years of refinement. They are famous for being as easy to repair as farm implements and providing all the power you will ever need on the highway. What they are not famous for is blowing away exotic, highly-tuned multicylinder Japanese superbikes on road racing circuits.

So when a Harley race bike showed up for the AFM season opener at Ontario this spring we didn't get too excited. Roadracers and fans learn early in life to reserve

judgement on motorcycles seen in the paddock. All too often the bike with expensive paint goes onto the track and wobbles into last place. The engine that shakes the earth with its shattering exhaust note during warmup sometimes blows up in the pit lane. Off-brand, oddball motorcycles that gladden your heart just because somebody was crazy enough to race them are often a disappointment. They end up on the trailer after first practice, while corner workers mop oil and the engine parts. Bikes are best judged after a race, when success or failure put them in perspective.

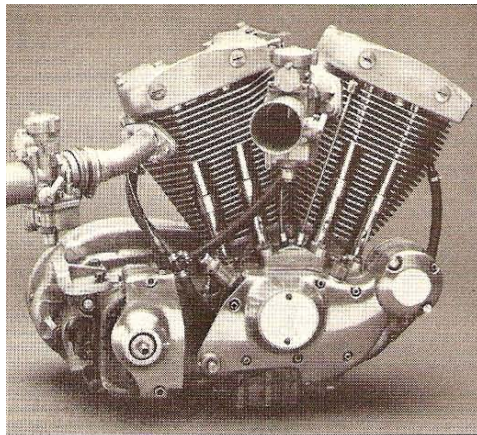
Case in point, that Sunday morning at Ontario. John Ulrich and I were waiting in the slow-moving tech line, sitting astride a couple of Oriental box stockers, when

some kind of Harley-Davidson rolled into the line beside us. The bike was pushed by Vance Breese, a veteran roadracer from Redwood City, California.

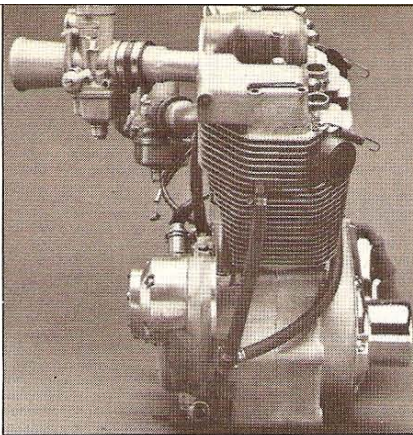
At first glance the bike appeared to be an XLCR set up for Superstreet competition. The tank, at least, was XLCR and the motorcycle was black. Then I noticed a pair of big Dell'Orto carb throats aimed out and rearward in threatening fashion. There was something different about the heads and cylinders, and the 2-into-1 exhaust system swept up and around the left side of the motor. The scale of the bike was wrong, too. It was all engine, like an old Vincent, with a short and compact frame. Mean and businesslike. Not the sort of Harley available in stores. I dismissed it as >



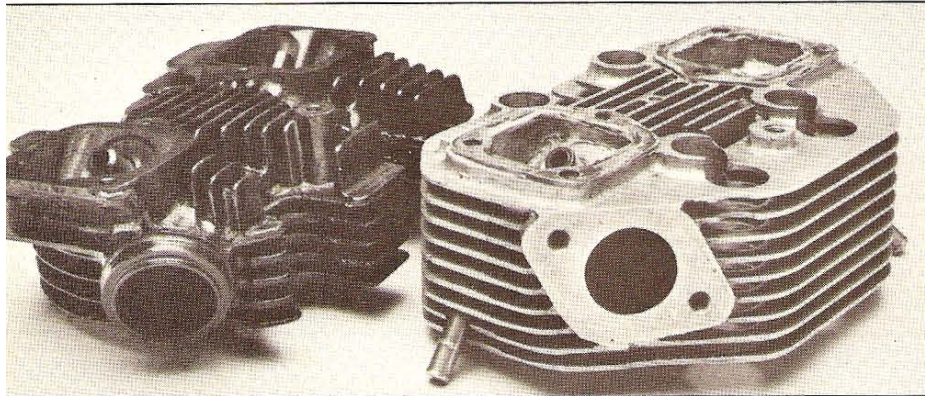




The complete 166 lb. motorcycle engine. Sputhe aluminum barrels and heads make this a very light 100-hp-plus package.



Narrow engine with low cg contributes to nimble handling and exceptional ground clearance on Breese Harley.



Sputhe head next to stock Sportster item (left). Sputhe design offers low weight, increased finning, and lower valve angle for better flow from twin-carb setup. Intake ports are 36 mm.

another one of those noble experiments where a brand fanatic (usually British) tries an underdog assault on the usual lineup of Japanese hyperbikes. A campaign doomed, no doubt, to frustration and failure.

Right.

Two hours later the Harley was out on the track, challenging Pat Eagan's Moriwaki Kawasaki for second place in Open GP, turning short-course 1:43's and applying heavy pressure on a bike and rider that would finish fifth at Daytona two weeks later. In the Open Superstreet race later that afternoon, Eagan and Breese battled wheel to wheel the entire race, Eagan holding a slight edge until the last lap, when he took a wide line (i.e. straight off the track) in the last corner and Breese blasted his Harley across the finish line to victory. The crowd loved it.

No ordinary Harley, indeed. Breese was apparently riding something more than a breathed-on XLCR or an old Sportster with a sleek tank and clip-ons. After the race speculation filled the paddock. There were rumors of 1400cc barrels, and of funny fuel that evaporated before it hit the ground, burned smoldering holes in the pavement, or when touched caused the fingers to shrivel and fall off. The only thing anyone knew for sure was that the bike was very fast and had a lot of power. Obviously a motorcycle worth looking into.

Intrigued by the bike, we invited Breese and the man who designed and built the Harley's barrels and cylinder heads, Alan Sputhe, for a tear-down session and a day at Orange County Drag Strip.

"This is really just my street bike," Breese explained as he and Sputhe rolled the bike down a ramp from the back of a Datsun pickup. "I use it for riding on the weekends in northern California. I love to ride in the rain, which is good, because it's always raining up there. For that kind of riding I prefer light bikes, because I think heavy bikes like the Japanese multis are dangerous in the rain. Once you start to lose them, it's all over." Sputhe steadied the bike as Breese slid a center-stand under the frame. "So we built this as a street bike," he continued. "If we built a real race bike it would be a lot more radical than this."

Sputhe nodded his agreement. "The secret of the bike's performance is in the upper end. People think we're running fuel or real high compression, but we're not. The compression ratio is 9:1 and we use pump gas. The fuel rumors come from the smell of Castrol R in the exhaust. The bottom end is stock Sportster, from a '72 engine, with S&S rods, pistons and bearings. The barrels and heads are my own design."

Displacement?

"Twelve hundred and ninety cc's."

Sputhe and Breese checked tire pres-

sures, tightened bolts and poured gas into the tank, while John Ulrich donned his leathers. Breese trotted the bike across the warm-up area, hopped onto the saddle, and the big Twin fired. There is no starter, kick or electric. He handed the bike over, with advice to go with a 6500 rpm redline and second gear out of the hole. First wouldn't stand up under a really hard drop of the clutch, and it wasn't needed anyway.

Ulrich made a couple of easy trial runs in the mid-elevens, then got down to business. A 10.95; 10.94, and then a 10.86 at 131.3 mph. He came in and parked the bike.

"This is the hardest bike to ride I've ever been on," he said, flexing his hands in front of his face, checking to see if they still worked. "The vibration pumps my hands up so much I can't tell if I'm really hanging on to the bars or if my hands are going to slide right off the grips. Also, it goes into a tank-slapper at the end of every run. It's scary."

Sputhe and Breese looked at the bike and frowned. Tony Williams, their pipemaker from Williams Pipes who had come along to help with the drag strip tuning, got down on one knee and began to examine the bike. "It shouldn't be vibrating at all," Sputhe said. "It's balanced to smooth out as the revs climb toward redline."

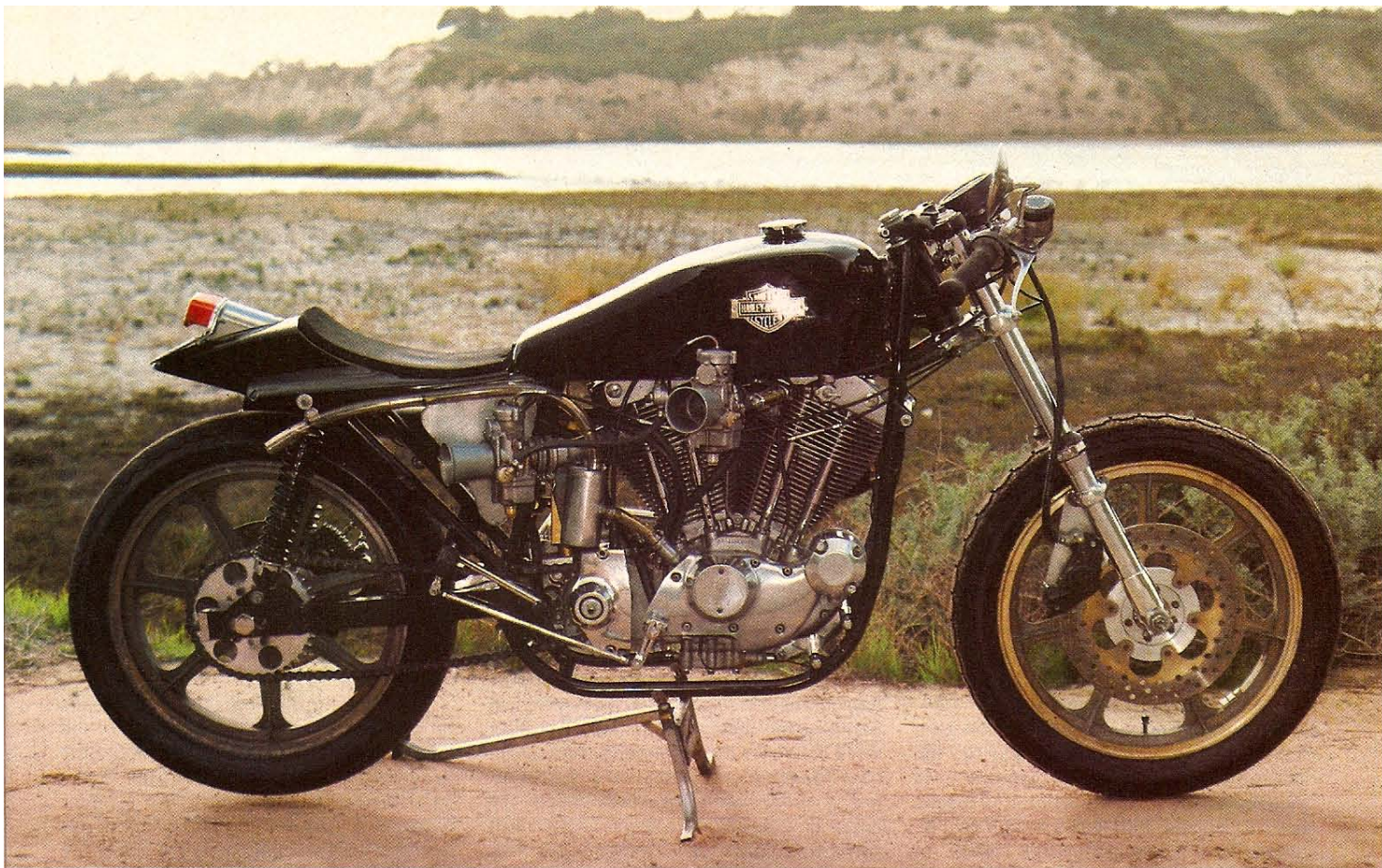
"It shouldn't wobble, either," Breese added. "Even at Ontario it felt nice and stable on the banking." They checked the bike over and found a loose motor mount and a slight rear wheel misalignment. Breese backed one alignment bolt off two flats. Ulrich made another test run and reported the bike smoother and better handling. Not exactly a detuned Gold Wing, but improved.

Sputhe explained that the frame is an old Mert Lawwill dirt track frame which Breese bought for only \$300 because it was bent in a crash. "We've straightened it—twice," he said. "But chrome-moly steel has sort of a memory."

Ulrich made another practice run and pulled in with an oil-soaked rear tire. The primary cover had loosened. "Sympathetic vibration," Sputhe said. "Harleys have a lot of it." Breese and Williams tightened the cover, ran a plug check and decided to lean out the Dell'Ortos. Williams added some discs to the Super Trapp muffler on the end of the pipes. The rear brake and tire were cleaned with solvent and Ulrich gave it another try.

The drag strip by mid-morning was becoming a dangerous place. The California Highway Patrol had set up a pursuit slalom course at the end of the strip and were careening in and out of orange pylons with Dodge Coronets. Ulrich had about half of the usual shutoff room, so every run ended in a cloud of brake dust and tire smoke as he hauled it down to a rapid stop. On the fourth run the throttle grip rotated on the bars and prevented the front brake lever from moving. Ulrich cleared the traps at





130 and ran straight through the cones, flying past speeding police cars, sliding the rear tire and downshifting. Unnerving, but a rare opportunity. I asked him if the police said anything and he said he didn't wait around to see.

When he came back there was more oil on the rear tire. The timing plug had fallen out on the strip. More sympathetic vibration. A replacement was borrowed from a full-dress FLT (hail interchangeability) being tested by another magazine, and a final jetting change was made. Tony

Williams removed the muffler from the exhaust header. Breese discovered an oil leak into the clutch, which is a dry stock unit off an early Sportster, and replaced the plates and cover gasket.

Williams checked a barometer in the truck and pointed to some storm clouds over the Santa Ana Mountains. He said the air density, which had been dropping off all morning, was improving because of the nearby storm. A good time for a run.

Ulrich went out and turned two more times in the high tens. On the third try the

Harley stopped the clocks at 10.554 seconds and 130.24 mph.

That made the Harley the quickest bike this magazine has ever tested. Quicker than the Yoshimura Suzuki GS1000 Superbike, which ran a 10.66 at a slightly faster 132.74 mph; faster and quicker than either the Yosh Z-1R (10.80 at 124.13) or the RC GS1000EC (10.73 at 128.57) we tested in our Taking it to the Tens report in November of 1978; and nearly a second quicker and 10 mph faster than the BAE/Magnum Turbo GS1000 we ran in January this year.

We set up our radar at the end of the strip (the cops had gone home or behind billboards or wherever it is they go) and the bike ran through the half-mile at 149 mph, still gaining speed as it ran out of drag strip. Another test record.

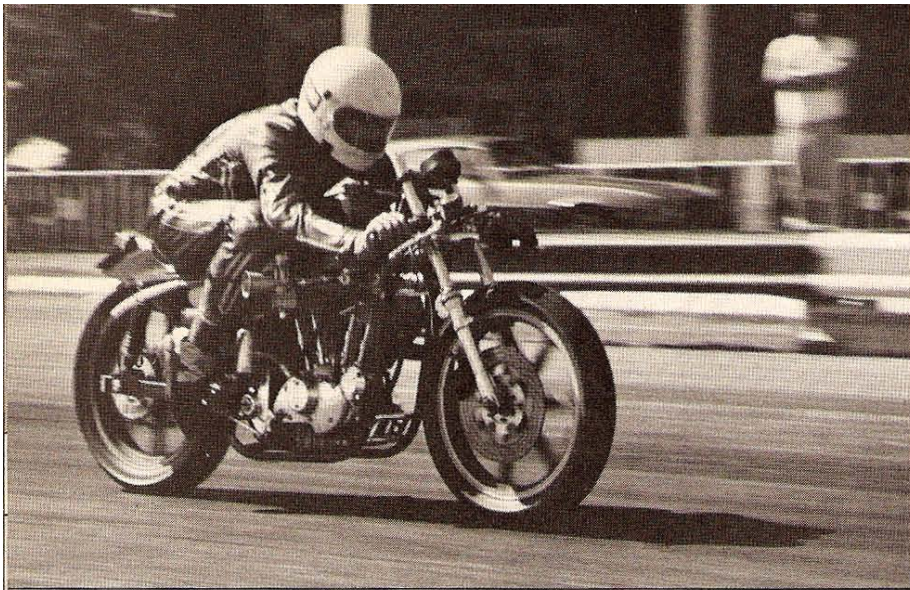
"It'll go faster than that on the top end," Breese said, "if it has more space. That's the trouble; its speed and acceleration really expand the room you need to play in. This bike can get you into deep trouble so fast . . ."

Sputhe suggested they regear the bike for a faster top end run, and possibly a faster quarter mile, but Ulrich said that was fast enough. The brakes wouldn't stop the bike in the short remaining runoff space if it went any faster. "This bike needs another disc on the front for racing," he said.

"This is just my street bike," Breese said. "If I built a race bike I'd probably put another disc on it."







Hard launches without wheelies or rear tire pyrotechnics were made possible by good weight distribution and tractable low-end power.



Ulrich gets the good news from Vance Breese; a 10.554 at 130.24, quickest time ever through the quarter mile for Cycle World.

Sputhe shook his head. "Then you'd have to put decals on it."

Back to the shop for teardown.

Weight and measurement time. With a half tank of gas (2 gal.) the Harley tips the scales at 347 lb. Weight distribution is 48 percent on the front wheel and 52 on the rear. Rake and trail are 27° and 3.9 in. respectively. The wheelbase is 55.5 in. In other words, the bike is about half an inch longer than a 400 Hawk but weighs 51 lb. less. It also has more horsepower.

"There are two approaches to horsepower," Breese said. "There's the electric high-speed machining method, and then there's the big cannon. This is a big cannon. A big engine doesn't have to work so hard to produce power, and it's usually simpler and lighter."

The Harley has been on a rear wheel dyno only once, Sputhe said. The dyno had trouble with the Harley's irregular power pulses and allowed the rear tire to slip and smoke in the rollers. They came up with corrected figures of 108 bhp at 7000 rpm and just over 100 lb.-ft. of torque, peaking at 3800 rpm. Breese thinks actual horsepower may be closer to 120, according to his speed and gearing calculations, though he hesitates to make concrete claims because of the many imaginative and inconsistent ways horsepower is measured. Like Rolls-Royce, Breese and Sputhe could probably say the Harley's horsepower is "adequate".

The bike's 290cc of extra displacement over the stock Sportster is gained by a bore increase from 3.18 in. to 3.6 in. Stroke is stock, at 3.8 in. Sputhe says most speed tuners of Harley-Davidsons have increased power and displacement by lengthening stroke, but this limits rpm because of dangerous piston speed. The Harley needs better breathing and carburetion, he says, not a longer stroke. Enter the Sputhe heads and barrels.

The heads are cast from 356-T6 alumi-

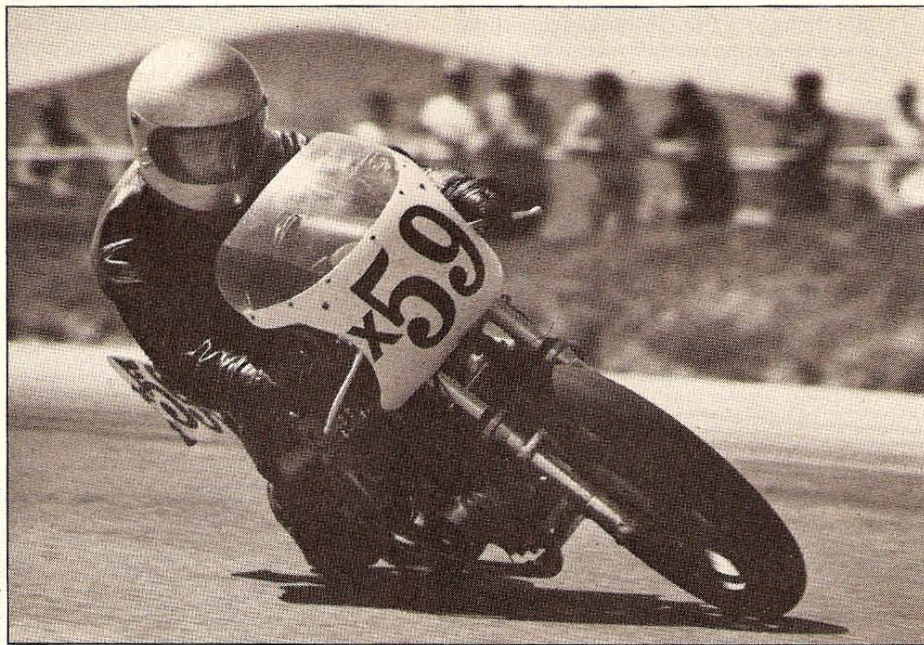
num and have stellite valve seats shrunk in. Chambers are shaped into what Sputhe half-jokingly refers to as a "polyspherical bathtub chamber". The intake valves have stock Sportster head diameter, 1.9 in., but have longer shovelhead-style stems to allow a more laid-down valve angle for better flow through the ports. The exhaust valve, at 1.75 in., is 0.115 in. larger than stock. Valve springs are from Jerry Branch.

The barrels are of the same aluminum as the heads, with manganese iron liners. The aluminum is cast around the liners and then heat-treated to assure proper bonding and good heat transfer. Sputhe has spent considerable time experimenting with cooling fin shapes and numbers to arrive at the correct operating temperature for the Harley. He says the engine never has over-

heating problems; after the Ontario race the oil temp was 150° F.

The aluminum barrels and heads provide less weight and a lower cg for the bike, as well as more horsepower. A Sputhe head on our scales weighs 8.75 lb. versus 14.5 lb. for the stock part; the cylinder barrel 8.75 instead of 12.5 lb. Taken together, a weight saving of 19 lb. The entire engine, complete with carbs, weighs only 166 lb.

Four long studs of 4130 centerless-ground steel extend from the cases up through each cylinder and head, holding it all together. Threads are rolled on, rather than cut, for improved strength. Sputhe explains that strong studs are critical because a high performance Harley with stock base bolts can—and will—blow the



Vance Breese in Turn Four at Willow; the Harley's high lean angle is well suited to Breese' tucked-in riding style.



entire cylinder off the cases, endangering bystanders and causing the rider to lose his concentration.

Tapered pushrods, made of aluminum to match the coefficient of expansion in the cylinders and heads, ride on stock Harley roller tappets. Rocker boxes are also stock Sportster, with rocker arms lightly radiused to prevent cracking. The valve train is moved by Andrews DX drag racing cams. Jim Belland, who built the bottom end and did much of the advisory work on the project, reworked the cams. He cut and rewelded the cam gears to change the lobe centers from 105° to 101° for more bottom end power. Lift on all four cams is 0.560 in.

Crank and cases are stock '72 Sportster. Breese says the '72 is not the best foundation for a performance engine because the tach drive on that model creates a weak spot in the transmission case. He used the '72 because it was available in blown-up form for \$500, and says a '73 through '76 would be more desirable. Those models have a stronger transmission case and will still accept the early dry clutch, which Breese says is stronger than the later wet clutch. Power arrives at the countershaft sprocket via a standard Harley C-type close ratio gearset.

Rods, pistons and bearings are off-the-shelf S&S parts. The oil pump is a competition unit from Mark Brelsford's old racebike, Goliath, which Breese bought and subsequently crashed in a big way at Sears Point when it threw a rod through the cases. Carbs are two Dell'Orto PHM 40's from a Moto Guzzi Le Mans. Accelerator pumps are blocked off "for better gas mileage." Breese and Sputhe made their own intake pipes. The exhaust system is a 2-into-1 Tony Williams design with 1.875 in. headpipes going into a 2 in. diameter collector. A muffler containing Super Trapp discs is detachable when top-end rather than mid-range is needed. Harley points and coil fire the plugs; ignition is total loss.

The bike itself is a fairly harmonious collection of odd bits and pieces Breese and friends had sitting around their garages. The wheels are Morris Mags, 3 in. front and 5 in. rear, from a '72 Harley roadracer. Forks and triple clamps are Ceriani roadrace with slider assemblies off the old Goliath (whose stanchion tubes were bent). Kosman discs are used front and rear, with a Brembo caliper at the rear and Grimeca caliper in front. S&W shocks with 90 lb. springs control the swing arm; 28 lb. springs are installed in the Cerianis. The frame is early Mert Lawwill dirt track, largely restraightened.

Breese uses different tires for varied purposes. Street riding on northern California's mountain roads he uses Dunlop Isle of Man racing rains, a 3.25/4.50-18 front and a 3.50/6.00-18 rear. Dunlop slicks of the same dimensions go on the bike for roadracing.

Vance Breese has had plenty of time to



Breese performs last-minute jetting change on highly-accessible Dell'Ortos. Accelerator pumps are removed "for good gas mileage."

accumulate used racing parts. He has a long history of racing slightly offbeat motorcycles and doing quite well. Beginning with a Bultaco TSS in 1965, he has since raced such machines as a 305 Superhawk, a Norton Dominator 99, Manx, and 750 production racer; a Matchless 650, a Norton and a Trident. He won the '75 AFM 500 GP championship on a BSA 500MX, the '76 500 GP title on an Eso, and in '77 placed second in Open Production points on a Guzzi Le Mans. He won the '79 sidecar title with a TZ750 engine in a homemade frame.

Breese once ran a motorcycle repair shop, but sold the business. "Working on other people's bikes made me not want to work on mine," he says. He now runs a carpet cleaning business and a telephone answering service and works on motorcycles as a hobby. The Harley idea came along when friend Jim Nezgoda urged him to take a test ride on Mark Brelsford's old Harley racer, Goliath. "I couldn't believe how nice it was," Breese says. "It felt like a 650 Triumph with 82 rear wheel horsepower. I knew then I had to have a Harley." He then bought Goliath from Nezgoda and raced it until he wrote the bike off at Sears Point by looping it at 125 mph. His current Harley is a descendent, in spirit and leftover parts, to the original Goliath.

"There's a real community of Harley high performance people," says Breese, "more than you'd think. Everyone is willing to help out when you've got a project going. The people at Belmont Harley-Davidson, for instance, helped us out with parts and gave us hours of free tuning help just because they liked the bike. Sportsters of San Jose did all kinds of plating for us . . . the list goes on and on."

Alan Sputhe is another member of that community, and says that he and Breese were bound to run into each other, even though they live a few hundred miles apart, because they were both Harley high

performance men. Sputhe has a long background in manufacturing motorcycle parts. He worked for 10 years as a pattern and die-maker for Bob Corey at R&S Patterns before branching off into his own business and becoming Sputhe Engineering. His interest in the Harley engine comes from a respect for its basic concept.

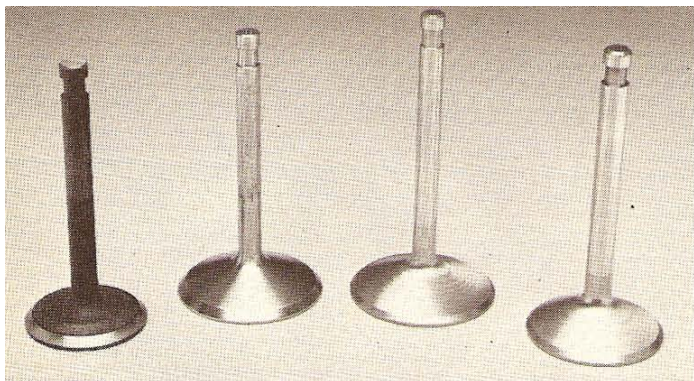
"When Harley decided to build a motorcycle engine," he explains, "they went about it the same way airplane engine designers would. They figured out how much power a motorcycle needed to work properly, then built the slowest turning, lightest, most reliable engine they could to provide that power. Displacement didn't matter, as long as it was enough." To Sputhe there is nothing immoral about enough displacement, as long as the engine—and the motorcycle—are compact and light in weight. He views the usual displacement classes, 500, 750 and so on, as artificial divisions created by traditional roadracing classes; divisions which have little meaning where road bikes are concerned. He sees no reason why motorcycles of adequate displacement and power should have to be heavy and cumbersome, or wide. He shares with Breese a high regard for efficiency and simplicity. Their 166 lb. engine, with 108 hp and 35 mpg on the race track, is a fair measure of that regard.

The engine went back into the frame and out to Willow Springs Raceway for the season's first AFM roadrace on that desert circuit (the track has no willows and no apparent springs; a good track though, with clear desert air and a lot of sunshine).

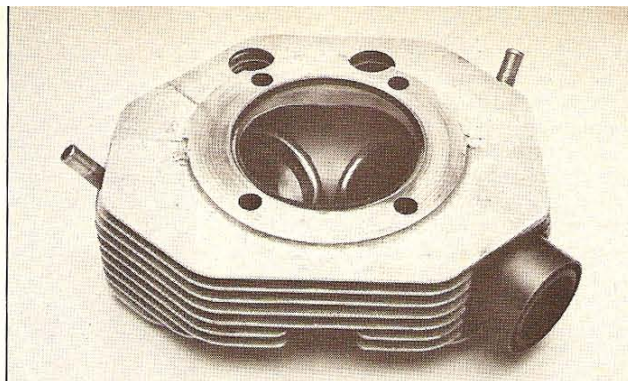
During one of the morning practice sessions Breese fired up the Harley and told us to take it out for a few laps. Ulrich went first. He did a couple of respectably fast laps and came in. "It's really wobbling in the fast corners," he said.

"You can't hang off at all with this bike," Breese told him. "You have to hug the >





Valves from Spathe head (right) are longer than stock Sportster valves because of lower valve angle, and are also lightened. Intake has same head diameter; exhaust is 0.115 wider than stock.



Spathe calls this his "polyspherical bathtub chamber design." Stellite valve seats are shrunk into aluminum heads. Spigots at side are for oil return lines.



Even with larger bore, replacement barrel (left) is nearly 4 lb. lighter than stock. Aluminum is cast around manganese iron liner.



Engine uses 0.42-over S&S pistons (left) and a 9:1 compression ratio. At right is stock Sportster piston.

tank. Even if you stick your knee out it'll wobble." Ulrich went out, tucked in, and got around faster. After five or six laps he came in and handed it over to me. As I climbed on the bike he lifted his face shield and shouted over the exhaust racket from the straight pipe, "Whatever you do, don't take your knees off the tank or you'll get into a terrible tank-slapper. Also there's some oil in Turn Four."

"And the bad news is we're out of holy water," I mumbled to myself, clicking into gear and heading out pit lane. The Harley moved smartly down the road. Right side shift. Up for slow, down for go. The rearsets, adjusted for Breese who is less long of leg, were an extremely tight fit. I assumed the classic racing position of an Aztec grinding corn meal and heeled carefully into Turn One.

There was no way to hug the tank with my knees; they stuck out too far. One side made contact with a hot exhaust pipe (delayed reaction there; odor of burning leather before the pain) and the other knee ran straight into the foremost Dell'Orto. Sliding back in the seat, I held on as well as the bike permitted.

Concentrating not to shift wrong, I tried to pick up some speed. Initial reaction to the Harley is one of mild disorientation. Fresh off an ordinary street bike, it's hard to get a clear sense of how fast the Harley is traveling. Below 5000 rpm all speeds feel the same because of the wide, loafing powerband. The rearsets and slicks and the bike's general narrowness add to the sensa-

tion because cornering clearance seems limitless. I'd pass a bike easily in one corner, then be surprised to have him scratch by in the next. Opening the throttle a little more caused him to float suddenly backwards, peacefully and easily, like a fish in an aquarium. Nothing sudden or flashy, just awesome, useable power. The Harley lacks the usual ratio of commotion to speed. The commotion is constant; the speed infinitely variable.

Until you start revving the engine. Then engine and road vibrations begin to pick up and the world becomes more hectic. Things get faster and meaner. Above 5000 rpm in top gear the motorcycle is going genuinely fast. Too fast, maybe, when you can't hug the tank with your knees.

Before I went out Breese was telling me the Harley turns only 2000 rpm at 55 mph in top gear, describing the bike as "extremely peaceful" to ride. Peaceful? Maybe. If you have the self restraint to let the bike loaf, it chuffs along fairly well at low rpm. But a 347 lb. motorcycle with clip-ons, rearsets, a solo seat with a quarter inch of padding and more horsepower than a good Formula Ford does not lend itself to peaceful riding. With the wick turned up, the Harley becomes the embodiment of spartan, borderline-violent performance. Above 5000 rpm in top gear it's about as peaceful as a wounded rhino at a Landrover convention.

I brought the bike in and gave it back to its master. Breese went out that afternoon and won Open Superbike even though he

had no front brakes because the pads somehow spit themselves out of the calipers. He stayed ahead of the second place full-house Kawasaki by pitching the Harley into corners and scrubbing off speed. Out on the track, the bike had that exaggerated time/distance look of a slot car on the wrong voltage. It reached a tremendous velocity down the main straight and always appeared to be going too fast to make the first corner. It would barely slow and then disappear around the turn, leaving only an exhaust note—which can be heard all the way around the track—as evidence it hadn't crashed into the mesquite and Joshua trees. In Open GP he finished second to Dave Emde, who was riding a TZ750.

After the race Breese looked at the Harley and told me, "We've really just started with this bike. There are a lot more things we could do to get real power out of it; hotter cams, high compression, and so on. But then it wouldn't be as much fun to ride on the street. The best thing about this bike is being able to pull up at a stoplight on a Harley and look CBX owners in the eye. I raced a guy with a turbo CBX up in northern California and it was just pitiful. He didn't have a chance."

Further information and pricing on the Spathe heads and cylinders is available from:

Spathe Engineering  
6852 St. Estaban St.  
Tujunga, Calif. 91042